GOVERNMENT COLLEGE OF TECHNOLOGY

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

Curriculum and Syllabi for
B.TECH. INFORMATION TECHNOLOGY
(Full Time)

2018
Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS

GOVERNMENT COLLEGE OF TECHNOLOGY

THADAGAM ROAD, COIMBATORE – 641 013

PHONE 0422-2433355 FAX: +91 0422 – 243355

email: coegct@gmail.com

GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

Coimbatore-641 013

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.

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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

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

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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
GOVERNMENT COLLEGE OF TECHNOLOGY, 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.

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PROGRAMME SPECIFIC OUTCOMES

The Programme Specific Outcomes 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]

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013

B.TECH.INFORMATION TECHNOLOGY

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FIRST SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks
		Induction Programme	MC	0	0	0

Details of the Programme:

Number of Days: 21 Days

Day0: College Admission

Day1: Orientation Programme

Day2: Registration.

Day3 to Day 23 : Induction Programme

Activities:
Physical activity,
Playground Events,
Yoga Practices,
Literary, Proficiency modules,
Team Building,
Lectures by Eminent people,
Familiarization to department,
Branch oriented information,
Motivational speakers,
Talent exposure,
Quiz completion,
Visit to local areas….etc.

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013

B.TECH.INFORMATION TECHNOLOGY

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FIRST SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18IHS101	Communicative English	HS	50	50	100	2	1	0	3
2	18IBS102	Calculus	BS	50	50	100	3	1	0	4
3	18IBS103	Semiconductor Physics	BS	50	50	100	3	1	0	4
4	18IES104	Programming in C	ES	50	50	100	3	0	0	3
		PRACTICAL								
5	18IBS105	Physics Laboratory	BS	50	50	100	0	0	3	1.5
6	18IES106	Workshop Practice	ES	50	50	100	1	0	4	3
7	18IES107	Programming in C Laboratory	ES	50	50	100	0	0	3	1.5
		TOTAL		350	350	700	12	3	10	20

SECOND SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18IBS201	Applied Chemistry	BS	50	50	100	3	1	0	4
2	18IBS202	Differential Equations and Linear Algebra	BS	50	50	100	3	1	0	4
3	18IES203	Fundamentals of Electrical and Electronics Engineering	ES	50	50	100	3	0	0	3
		PRACTICAL								
4	18IBS204	Chemistry Laboratory	BS	50	50	100	0	0	3	1.5
5	18IES205	Fundamentals of Electrical and Electronics Engineering Laboratory	ES	50	50	100	0	0	3	1.5
6	18IES206	Engineering Graphics	ES	50	50	100	2	0	4	4
		TOTAL		300	300	600	11	2	10	18

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THIRD SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18IBS301	Probability Theory and Applied Statistics	BS	50	50	100	3	1	0	4
2	18IES302	Digital Logic Design	ES	50	50	100	3	0	0	3
3	18IES303	Elements of Communication Engineering	ES	50	50	100	3	0	0	3
4	18IES304	Basics of Microprocessors and Microcontroller	ES	50	50	100	3	0	2	4
5	18IPC305	Data Structures and Applications	PC	50	50	100	3	0	0	3
6	18IPC306	Object Oriented Programming	PC	50	50	100	3	0	0	3
7	18IMC3Z7	Environmental Sciences and Engineering	MC	50	50	100	3	0	0	0
		PRACTICAL								
8	18IES308	Digital Logic Design Laboratory	ES	50	50	100	0	0	3	1.5
9	18IPC309	Data Structures and Applications Laboratory	PC	50	50	100	0	0	3	1.5
		TOTAL		**450**	**450**	**900**	**21**	**1**	**8**	**23**

FOURTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18IHS401	Resource Management Techniques	HS	50	50	100	3	0	0	3
2	18IBS402	Elements of Discrete Structures	BS	50	50	100	3	0	0	3
3	18IPC403	Computer Organization and Architecture	PC	50	50	100	3	0	0	3
4	18IPC404	Database Design and Management	PC	50	50	100	3	0	0	3
5	18IPC405	Information Coding Techniques	PC	50	50	100	3	0	0	3
6	18IPC406	Operating Systems	PC	50	50	100	3	0	0	3
7	18IMC4Z7	Constitution of India	MC	50	50	100	3	0	0	0
		PRACTICAL								
8	18IPC408	Database Design and Management Laboratory	PC	50	50	100	0	0	3	1.5
9	18IPC409	Operating Systems Laboratory	PC	50	50	100	0	0	3	1.5
		TOTAL		**450**	**450**	**900**	**21**	**0**	**6**	**21**

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FIFTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18IHS501	Technology Management	HS	50	50	100	3	0	0	3
2	18IPC502	Web Technology	PC	50	50	100	3	0	0	3
3	18IPC503	Data Communication and Networking	PC	50	50	100	3	0	0	3
4	18IPC504	Analysis and Design of Algorithms	PC	50	50	100	3	0	0	3
5	18IPE5XX	Professional Elective I	PE	50	50	100	3	0	0	3
6	18#OE5XX	Open Elective I	OE	50	50	100	3	0	0	3
		PRACTICAL								
7	18IPC507	Data Communication and Networking Laboratory	PC	50	50	100	0	0	3	1.5
8	18IEE508	Web Technology and Application Development Laboratory	EEC	50	50	100	0	0	4	2
		TOTAL		**400**	**400**	**800**	**18**	**0**	**7**	**21.5**

SIXTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18IPC601	Fundamentals of Machine Learning	PC	50	50	100	3	0	0	3
2	18IPC602	Software Engineering	PC	50	50	100	3	0	0	3
3	18IPC603	Fundamentals of Digital Signal Processing	PC	50	50	100	3	0	0	3
4	18IPE6XX	Professional Elective-II	PE	50	50	100	3	0	0	3
5	18#OE6XX	Open Elective-II	OE	50	50	100	3	0	0	3
6	18#OE6XX	Open Elective-III	OE	50	50	100	3	0	0	3
		PRACTICAL								
7	18IVL607	Machine Learning Laboratory	PC	50	50	100	0	0	3	1.5
8	18IEE608	Open source and tools laboratory	EEC	50	50	100	0	0	3	1.5
		TOTAL		**400**	**400**	**800**	**18**	**0**	**6**	**21**

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SEVENTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18IHS701	Professional Ethics	HS	50	50	100	3	0	0	3
2	18IPC702	Cryptography and Network Security	PC	50	50	100	3	0	0	3
3	18IPC703	Internet of Things and its Applications	PC	50	50	100	3	0	0	3
4	18IPE7XX	Professional Elective -III	PE	50	50	100	3	0	0	3
5	18IPE7XX	Professional Elective -IV	PE	50	50	100	3	0	0	3
6	18#OE7XX	Open Elective – IV	OE	50	50	100	3	0	0	3
		PRACTICAL								
7	18IPC707	Internet of Things Laboratory	PC	50	50	100	0	0	3	1.5
8	18IEE708	Mini Project	EEC	50	50	100	0	0	8	4
		TOTAL		**400**	**400**	**800**	**18**	**0**	**11**	**23.5**

EIGHTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18IPE8XX	Professional Elective-V	PE	50	50	100	3	0	0	3
2	18IPE8XX	Professional Elective-VI	PE	50	50	100	3	0	0	3
		PRACTICAL								
3	18IEE801	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; MC- Mandatory Course

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18IHS101	Communicative English	HS	50	50	100	2	1	0	3
2	18IHS401	Resource Management Techniques	HS	50	50	100	3	0	0	3
3	18IHS501	Technology Management	HS	50	50	100	3	0	0	3
4	18IHS701	Professional Ethics	HS	50	50	100	3	0	0	3

BASIC SCIENCES (BS)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18IBS102	Calculus	BS	50	50	100	3	1	0	4
2	18IBS103	Semiconductor Physics	BS	50	50	100	3	1	0	4
3	18IBS105	Physics Laboratory	BS	50	50	100	0	0	3	1.5
4	18IBS201	Applied Chemistry	BS	50	50	100	3	1	0	4
5	18IBS202	Differential Equations and Linear Algebra	BS	50	50	100	3	1	0	4
6	18IBS204	Chemistry Laboratory	BS	50	50	100	0	0	3	1.5
7	18IBS301	Probability Theory and Applied Statistics	BS	50	50	100	3	1	0	4
8	18IBS402	Elements of Discrete Structures	BS	50	50	100	3	0	0	3

ENGINEERING SCIENCES (ES)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18IES104	Programming in C	ES	50	50	100	3	0	0	3
2	18IES106	Workshop Practice	ES	50	50	100	1	0	4	3
3	18IES107	Programming in C Laboratory	ES	50	50	100	0	0	3	1.5
4	18IES203	Fundamentals of Electrical and Electronics Engineering	ES	50	50	100	3	0	0	3
5	18IES205	Fundamentals of Electrical and Electronics Engineering Laboratory	ES	50	50	100	0	0	3	1.5
6	18IES206	Engineering Graphics	ES	50	50	100	2	0	4	4
7	18IES302	Digital Logic Design	ES	50	50	100	3	0	0	3
8	18IES303	Elements of Communication Engineering	ES	50	50	100	3	0	0	3
9	18IES304	Basics of Microprocessors and Microcontroller	ES	50	50	100	3	0	2	4
10	18IES308	Digital Logic Design Laboratory	ES	50	50	100	0	0	3	1.5

PROFESSIONAL CORE (PC)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week L	T	P	C
1	18IPC305	Data Structures and Applications	PC	50	50	100	3	0	0	3
2	18IPC306	Object Oriented Programming	PC	50	50	100	3	0	0	3
3	18IPC309	Data Structures and Applications Laboratory	PC	50	50	100	0	0	3	1.5
4	18IPC403	Computer Organization and Architecture	PC	50	50	100	3	0	0	3
5	18IPC404	Database Design and Management	PC	50	50	100	3	0	0	3
6	18IPC405	Information Coding Techniques	PC	50	50	100	3	0	0	3
7	18IPC406	Operating Systems	PC	50	50	100	3	0	0	3
8	18IPC408	Database Design and Management Laboratory	PC	50	50	100	0	0	3	1.5
9	18IPC409	Operating Systems Laboratory	PC	50	50	100	0	0	3	1.5
10	18IPC502	Web Technology	PC	50	50	100	3	0	0	3
11	18IPC503	Data Communication and Networking	PC	50	50	100	3	0	0	3
12	18IPC504	Analysis and Design of Algorithms	PC	50	50	100	3	0	0	3
13	18IPC507	Data Communication and Networking Laboratory	PC	50	50	100	0	0	3	1.5
14	18IPC601	Fundamentals of Machine Learning	PC	50	50	100	3	0	0	3
15	18IPC602	Software Engineering	PC	50	50	100	3	0	0	3
16	18IPC603	Fundamentals of Digital Signal Processing	PC	50	50	100	3	0	0	3
17	18IVL607	Machine Learning Laboratory	PC	50	50	100	0	0	3	1.5
18	18IPC702	Cryptography and Network Security	PC	50	50	100	3	0	0	3
19	18IPC703	Internet of Things and its Applications	PC	50	50	100	3	0	0	3
20	18IPC707	Internet of Things Laboratory	PC	50	50	100	0	0	3	1.5

PROFESSIONAL ELECTIVES (PE)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18IPE$01	Data Mining and Data Warehousing	PE	50	50	100	3	0	0	3
2	18IPE$02	Wireless Sensor Networks	PE	50	50	100	3	0	0	3
3	18IPE$03	Software Testing	PE	50	50	100	3	0	0	3
4	18IPE$04	Software Project Management	PE	50	50	100	3	0	0	3
5	18IPE$05	Software Quality Assurance	PE	50	50	100	3	0	0	3
6	18IPE$06	Enterprise Resource Planning	PE	50	50	100	3	0	0	3
7	18IPE$07	Intellectual Property Rights	PE	50	50	100	3	0	0	3
8	18IPE$08	Information Retrieval	PE	50	50	100	3	0	0	3
9	18IPE$09	Embedded System	PE	50	50	100	3	0	0	3
10	18IPE$10	Cloud Computing	PE	50	50	100	3	0	0	3
11	18IPE$11	Advanced Data Structures	PE	50	50	100	3	0	0	3
12	18IPE$12	Foundations of Information Security	PE	50	50	100	3	0	0	3
13	18IPE$13	Distributed Systems	PE	50	50	100	3	0	0	3
14	18IPE$14	Soft Computing	PE	50	50	100	3	0	0	3
15	18IPE$15	XML and Web Services	PE	50	50	100	3	0	0	3
16	18IPE$16	Semantic Web	PE	50	50	100	3	0	0	3
17	18IPE$17	Service Oriented Architecture	PE	50	50	100	3	0	0	3
18	18IPE$18	Virtualization Techniques	PE	50	50	100	3	0	0	3
19	18IPE$19	Fundamentals of Automata Theory	PE	50	50	100	3	0	0	3
20	18IPE$20	Virtual and Augmented Reality	PE	50	50	100	3	0	0	3
21	18IPE$21	Introduction to Natural Language Processing	PE	50	50	100	3	0	0	3
22	18IPE$22	Artificial Intelligence and Applications	PE	50	50	100	3	0	0	3
23	18IPE$23	Mobile Computing	PE	50	50	100	3	0	0	3
24	18IPE$24	Human Computer Interface	PE	50	50	100	3	0	0	3
25	18IPE$25	Social Network Analysis	PE	50	50	100	3	0	0	3
26	18IPE$26	Foundations of Image Processing	PE	50	50	100	3	0	0	3
27	18IPE$27	Pervasive Computing	PE	50	50	100	3	0	0	3
28	18IPE$28	Software Defined Networking	PE	50	50	100	3	0	0	3
29	18IPE$29	Computer Graphics	PE	50	50	100	3	0	0	3
30	18IPE$30	Data Analytics*	PE	50	50	100	3	0	0	3

OPEN ELECTIVES (O.E)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	18COE$01	Climate Change and Adaptation	OE	50	50	100	3	0	0	3
2.	18COE$02	Disaster Management and Mitigation	OE	50	50	100	3	0	0	3
3.	18COE$03	Energy Efficient Buildings	OE	50	50	100	3	0	0	3
4.	18MOE$04	Nanotechnology and Surface Engineering	OE	50	50	100	3	0	0	3
5.	18MOE$05	Mechatronics	OE	50	50	100	3	0	0	3
6.	18MOE$06	Renewable Energy Sources	OE	50	50	100	3	0	0	3
7.	18EOE$07	Renewable Power Generation Systems	OE	50	50	100	3	0	0	3
8.	18EOE$08	Electric Vehicles	OE	50	50	100	3	0	0	3
9.	18EOE$09	Smart Grid Systems	OE	50	50	100	3	0	0	3
10.	18LOE$10	Mobile Communication	OE	50	50	100	3	0	0	3
11.	18LOE$11	Introduction to VLSI System Design	OE	50	50	100	3	0	0	3
12.	18LOE$12	Microcontroller and Applications	OE	50	50	100	3	0	0	3
13.	18POE$13	Rapid Prototyping	OE	50	50	100	3	0	0	3
14.	18POE$14	Managerial Economics	OE	50	50	100	3	0	0	3
15.	18POE$15	Hydraulics and Pneumatics	OE	50	50	100	3	0	0	3
16.	18NOE$16	Measurement and Control	OE	50	50	100	3	0	0	3
17.	18NOE$17	Industrial Automation	OE	50	50	100	3	0	0	3
18.	18NOE$18	Virtual Instrumentation	OE	50	50	100	3	0	0	3
19.	18SOE$19	Programming in Java	OE	50	50	100	3	0	0	3
20.	18SOE$20	Cyber Security	OE	50	50	100	3	0	0	3
21.	18SOE$21	Network Essentials	OE	50	50	100	3	0	0	3
22.	18IOE$22	Programming in Python	OE	50	50	100	3	0	0	3
23.	18IOE$23	Big Data Science	OE	50	50	100	3	0	0	3
24.	18IOE$24	Object Oriented Programming Using C++	OE	50	50	100	3	0	0	3
25.	18BOE$25	Computational Biology	OE	50	50	100	3	0	0	3
26.	18BOE$26	Fundamental Concepts of Biology for Engineers	OE	50	50	100	3	0	0	3
27	18BOE$27	Fundamentals of Bioengineering	OE	50	50	100	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18IEE508	Web Technology and Application Development Laboratory	EEC	50	50	100	0	0	4	2
2	18IEE608	Open source and tools laboratory	EEC	50	50	100	0	0	3	1.5
3	18IEE708	Mini Project	EEC	50	50	100	0	0	8	4
4	18IEE801	Project Work	EEC	50	50	100	0	0	16	8

MANDATORY COURSES (MC) (NO CREDIT)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18IMC3Z7	Environmental Sciences and Engineering	MC	50	50	100	3	0	0	0
2	18IMC4Z7	Constitution of India	MC	50	50	100	3	0	0	0

VALUE ADDED COURSES (VA) (ONE CREDIT)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18IVA$01	R Programming	VA	100	-	100	1	0	0	1
2	18IVA$02	Ethical Hacking	VA	100	-	100	0	0	2	1
3	18IVA$03	.NET Framework	VA	100	-	100	1	0	0	1
4	18IVA$04	Automated Testing	VA	100	-	100	1	0	0	1
5	18IVA$05	User Interface Technologies	VA	100	-	100	0	0	2	1
6	18IVA$06	Unified Modelling Language	VA	100	-	100	0	0	2	1
7	18IVA$07	Hardware Troubleshooting Techniques	VA	100	-	100	0	0	2	1
8	18IVA$08	Electronic circuits	VA	100	-	100	1	0	0	1
9	18IVA$09*	Android Malware Analysis	VA	100	-	100	0	0	2	1
10	18IVA$10	Aptitude I	VA	100	-	100	1	0	0	1
11	18IVA$11	Aptitude II	VA	100	-	100	1	0	0	1
12	18IVA$12	Aptitude III	VA	100	-	100	1	0	0	1

* - Industry Offered Course

CURRICULAM DESIGN FOR CBCS 2018 REGULATIONS

FULL TIME B.E INFORMATION TECHNOLOGY ENGINEERING(U.G)

SUMMARY

S.No	Category	Credits Per Semester								Total Credits	AICTE Suggested Credits.
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	3			3	3		3		**12**	**12**
2	**BS**	9.5	9.5	4	3					**26**	**25**
3	**ES**	7.5	8.5	11.5						**27.5**	**24**
4	**PC**			7.5	15	10.5	10.5	7.5		**51**	**48**
5	**PE**					3	3	6	6	**18**	**18**
6	**OE**					3	6	3		**12**	**18**
7	**EEC**					2	1.5	4	8	**15.5**	**15**
8	**MC**	0		0	0					**0**	**0**
Total		**20**	**18**	**23**	**21**	**21.5**	**21**	**23.5**	**14**	**162**	**160**

HS	Humanities and Social Sciences including Management
BS	Basic Sciences
ES	Engineering Sciences
PC	Professional Core
PE	Professional Elective
OE	Open Elective
EEC	Employability Enhancement Courses
MC	Mandatory Course
VA	Value Added Course

18IHS101	**COMMUNICATIVE ENGLISH** *(Common to All Branches)*	**SEMESTER I**

Category : HS

PRE-REQUISTE: NIL

L	**T**	**P**	**C**
2	**1**	**0**	**3**

COURSE OBJECTIVES:

The course is intended to

- Make learners listen to audio files and replicate in speaking contexts
- Make learners read widely and practice it in writing
- Make learners develop vocabulary and strengthen grammatical understanding

UNIT-I : LISTENING	**(6+3 Periods)**
Listening Comprehension, Pronunciation, Intonation, Stress, Pause, Rhythm, Listening to Short & Long Conversations/Monologues - Note-Taking.	
UNIT-II : SPEAKING	**(6+3 Periods)**
Self Introduction, Making Oral & Formal Presentation, Communication at Work Place, Mock Interviews, Role Play Activities, Group Discussions, Debates, Delivering Welcome Address, Proposing Vote of Thanks, Introducing the Chief Guest at a function.	
UNIT-III : READING	**(6+3 Periods)**
Reading Comprehension, Speed Reading, Interpreting Visual Materials (Signs, Post Cards Pictures, Labels Etc.), Reading for Specific Information-Reading to identify Stylistic Features (Syntax, Lexis, Sentence Structures)-Cloze Test.	
UNIT-IV : WRITING	**(6+3 Periods)**
Phrase, Clause And Sentence Structures, Punctuation, Discourse Markers, Coherence, Precision in Writing, Graph & Process Description-Definition, Writing Email-Paraphrasing, Note making, Job Application With Resume, Writing Review of a Book / Movie, Creative Writing.	
UNIT-V : GRAMMAR AND VOCABULARY	**(6+3 Periods)**
Word Formation with Prefix and Suffix, Synonyms and Antonyms, Tenses, Parts of Speech, Common Errors in English (Subject –Verb Agreement, Noun-Pronoun Agreement, Prepositions, Articles, Conditional statements, Redundancies, Clichés etc), Voices.	

Contact periods:			
Lecture: 30 Periods	**Tutorial:15 Periods**	**Practical: 0 Periods**	**Total: 45 Periods**

TEXT BOOKS:

1. ***Board of Editors, Using English***, Orient Black Swan, 2015.

REFERENCE BOOKS:

1. ***Practical English Usage***, Michael Swan. OUP 1995.
2. ***Cambridge BEC Vantage* -** Practice Tests, Self-study Edition, CUP, 2002
3. ***Exercises in Spoken English***.Parts. I –III. EFLU,Hyderabad, OUP, 2014
4. ***Indlish***. Jyothi Sanyal, Viva Books,2006
5. ***Communicative English***. J.Anbazhagan Vijay, Global Publishers, Chennai. 2018

WEB REFERENCES

1. *www.cambridgeenglish.org/exams/business.../business-preliminary/*
2. *http://www.examenglish.com/BEC/BEC_Vantage.html*
3. *www.splendid-speaking.com/exams/**bec**_speaking.htmlhtml*

COURSE OUTCOMES:

At the end of the course, the learners will be able to

1. CO1: Enhance their listening capacity through various accents and discourse
2. CO2: Communicate better at various public meeting and work place environments
3. CO3: Read and strengthen their interpretive and linguistic skills
4. CO4: Write appropriately on technical, business and general contexts.
5. CO5: Understand the usage of grammar and vocabulary

COURSE ARTICULATION MATRIX

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	--	--	--	M	H	L	M	--	H	H	M	H	M	M
CO2	--	--	--	H	H	L	M	M	H	H	M	L	M	M
CO3	--	--	--	H	H	L	M	M	--	H	M	H	M	M
CO4	--	--	--	H	H	L	M	M	--	H	M	L	M	M
CO5	--	--	--	L	H	L	--	--	--	H	M	H	M	M
18IHS101	--	--	--	H	H	L	M	M	L	H	M	M	M	M

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

18IBS102	**CALCULUS** *(Common to CSE & TT Branches)*	**SEMESTER I**

Category : BS

PRE-REQUISTE: NIL

L	**T**	**P**	**C**
3	**1**	**0**	**4**

COURSE OBJECTIVES:

- To be familiarize with differentiation of single variable and its applications.
- To obtain the knowledge of integration and its applications.
- To acquire knowledge of testing convergence of sequences and series.
- To acquire knowledge of differentiation for more than one variable and vector differentiation.
- To gain the knowledge of multiple integration and related applications and vector integration including theorems.

UNIT-I: Differential Calculus	**(9+3 Periods)**
Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders, Indeterminate forms and L'Hospital's rule, Maxima and minima, Evolute of a curve.	
UNIT-II: Integral Calculus	**(9+3 Periods)**
Evaluation of definite and improper integrals, Beta and Gamma functions and their properties, Applications of definite integrals to evaluate surface areas andvolume of revolution.	
UNIT-III: Sequences and series	**(9+3 Periods)**
Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.	
UNIT-IV: Multivariable Calculus (Differentiation)	**(9+3 Periods)**
Limits, continuity and partial derivatives, total derivativeJacobians, Maxima, minima and saddle points, Method of Lagrange multipliers, Gradient, curl and divergence.	
UNIT-V: Multivariable Calculus (Integration)	**(9+3 Periods)**
Multiple integration - Double integrals, change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), Change of variables (Cartesian to spherical polar). Theorems of Green, Gauss and Stokes, Simple applications involving cubes, sphere and rectangular parallelepipeds.	
Contact periods:	

Lecture: 45 Periods	**Tutorial:15 Periods**	**Practical: 0 Periods**	**Total: 60 Periods**

TEXT BOOKS:

1. *Sivaramakrishnadas.P, Rukmangadachari.E,* ***Engineering Mathematics,*** *Pearson, Chennai & Delhi, 2nd Edition 2013.*
2. *Srimanta Pal and suboth.C.Bhunia,* ***Engineering Mathematics****, Oxford University Press, New Delhi, 2015.*

REFERENCE BOOKS:

1. *B.S.Grewal,* ***Higher Engineering Mathematics****, Khanna Publishers, 43rd Edition,2010.*
2. *Erwinkreyszig,* ***Advanced Engineering Mathematics****,9th Edition, John Wiley&Sons, 2006.*
3. *N.P. Bali and Manish Goyal,* ***A text book of Engineering Mathematics****, Laxmi Publications, Reprint, 2008.*

4. *James Stewart, **Essential Calculus**, Cengage Learning, Delhi, 2nd Edition, 2013.*
5. *Howard Anton, IRL Bivens, Stephen Davis, **Calculus,** Wiley, New Delhi, 10th Edition, 2013.*

COURSE OUTCOMES:

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

CO1: Understand the standard theorems and applications like maxima and minima, evolute of a curve using principles of differentiation.

CO2: Acquire fluency in integration for one variable for definite and improper integrals like beta and gamma functions and also applications of area and volumes.

CO3: Understand the convergence and divergence of sequences and series.

CO4: Understand the techniques of partial differentiation and vector differentiation.

CO5: Understand multiple integration for finding area, surface and volume and applications to Green's, Stoke's and Gauss theorems on Vector Calculus.

COURSE ARTICULATION MATRIX

PO **CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	H	L	L	-	-	-	-	-	-	-	-	M	L	-
CO2	H	L	L	-	-	-	-	-	-	-	-	M	L	-
CO3	H	L	L	-	-	-	-	-	-	-	-	M	L	-
CO4	H	L	L	-	-	-	-	-	-	-	-	M	L	-
CO5	H	L	L	-	-	-	-	-	-	-	-	M	L	-
18IBS102	H	L	L	-	-	-	-	-	-	-	-	M	L	-

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

18IBS103	**SEMICONDUCTOR PHYSICS** *(Common to CSE & TT Branches)*	**SEMESTER I**

Category : BS

PRE-REQUISTE: NIL

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

To enhance the fundamental knowledge in Semiconductor 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 electronic materials.
- The properties and applications of semiconductors.
- The application of magnetic and super conducting materials.
- Measurement of various parameters related to semiconductors.
- Applications and properties of engineered semiconductor materials.
- Nano materials and its properties.

<table>
<tr><td colspan="3"><b>UNIT-I : ELECTRONIC MATERIALS</b></td><td><b>(9+3 Periods)</b></td></tr>
<tr><td colspan="4">Classical Free electron theory of metals – Postulates – Electrical and Thermal conductivity of metals –Derivation of Wiedeman – Franz law – Lorentz number – Drawbacks of Classical theory - Occupation probability – Effect of temperature – Density of energy states in metals (derivation) – Carrier concentration in metals - Calculation of Fermi energy at 0 K - Types of electronic materials: metals, semiconductors, and insulators.</td></tr>
<tr><td colspan="3"><b>UNIT-II : SEMICONDUCTORS</b></td><td><b>(9+3 Periods)</b></td></tr>
<tr><td colspan="4">Properties of semiconductors – elemental and compound semiconductors - Direct and indirect band gaps - Intrinsic and extrinsic semiconductors - Fermi level - Carrier concentration in intrinsic semiconductor - Dependence of Fermi level on temperature – Electrical conductivity – band gap determination – extrinsic semiconductors – Carrier concentration in P- type and N-type semiconductors - Dependence of Fermi level on impurity concentration and temperature for P-type and N-type semiconductors.</td></tr>
<tr><td colspan="3"><b>UNIT-III : MAGNETIC AND SUPER CONDUCTING MATERIALS</b></td><td><b>(9+3 Periods)</b></td></tr>
<tr><td colspan="4">Origin of magnetic moment - Bohr magneton - Dia, Para, and Ferro magnetic materials - Domain theory of ferromagnetism - Hysteresis - Hard and Soft magnetic materials. Superconductivity - Types of superconductors - BCS theory of superconductivity (qualitative) - properties- -Meissner effect, effect of magnetic field and heavy current- Applications of superconductors: Cryotron, Magnetic levitation.</td></tr>
<tr><td colspan="3"><b>UNIT-IV : MEASUREMENTS</b></td><td><b>(9+3 Periods)</b></td></tr>
<tr><td colspan="4">Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility - Hot-point probe measurement - capacitance-voltage measurements - parameter extraction from diode I-V characteristics - DLTS – Determination of band gap by UV-Vis spectroscopy - absorption/transmission.</td></tr>
<tr><td colspan="3"><b>UNIT-V : ENGINEERED SEMICONDUCTOR MATERIALS</b></td><td><b>(9+3 Periods)</b></td></tr>
<tr><td colspan="4">Density of states in 2D, 1D and 0D (qualitatively) - Practical examples of low-dimensional systems such as quantum wells, wires, and dots – Nanomaterials – Properties – Methods of synthesize – Top-down & Bottom-up Approach – Ball Milling – Chemical vapour deposition – Applications of Nanomaterials.</td></tr>
<tr><td colspan="4"><b>Contact periods:</b></td></tr>
<tr><td><b>Lecture: 45 Periods</b></td><td><b>Tutorial:15 Periods</b></td><td><b>Practical: 0 Periods</b></td><td><b>Total: 60 Periods</b></td></tr>
</table>

TEXT BOOKS:

1. *Dr. V.Rajendran*, "***Material Science"***, *Tata McGraw-Hill Publications, NewDelhi, (2011)*
2. *Dr.Jayakumar .S*, **"*Materials* science"** , *R.K.publishers, (2008)*

REFERENCE BOOKS:

1. *William D Callister and David G. Rithwish , "**Materials science & Engineering : An introduction"** ; 9th edition , Wiley (2013)*
2. *S. M. Sze, "**Semiconductor Devices: Physics and Technology"**, Wiley (2008).*
3. *P. Bhattacharya*, "***Semiconductor Optoelectronic Devices"***, *Prentice Hall of India (1997).*
4. *J.Singh*, "***Semiconductor Optoelectronics: Physics and Technology"***, *McGraw-Hill Inc. (1995)*

COURSE OUTCOMES:

Upon completion of the course, the student 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: Interpret the various measuring instruments related to semiconductor parameters.

CO5: List the properties and applications of engineered semiconducting materials. [Familiarity& Application]

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	M	--	--	--	--	--	--	--	--	M	L
CO2	H	M	L	--	--	--	M	--	--	--	--	--	M	--
CO3	H	M	M	--	M	M	--	--	--	--	--	--	M	--
CO4	H	H	M	L	M	--	--	--	--	--	--	--	M	--
CO5	H	H	M	M	L	L	L	--	--	--	--	--	L	--
18IBS103	H	M	M	M	M	M	M	--	--	--	--	--	M	L

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

18IES104	**PROGRAMMING IN C** *(Common to All Branches Except MECH & PRODN Branches)*	**SEMESTER I**

Category :ES

PRE-REQUISTE: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- The Computer and Programming fundamentals
- Data types in C and Flow control statements
- Functions, Arrays, Pointers And Strings
- Bitwise Operators, Preprocessor Directives, Structures and Unions
- Structures, List Processing, Input And Output

UNIT-I : COMPUTER AND PROGRAMMING FUNDAMENTALS	**(9 Periods)**
Computer fundamentals – Evolution, classification, Anatomy of a computer: CPU, Memory, I/O – Introduction to software – Generation and classification of programming languages – Compiling – Linking and loading a program – Translator – loader – linker – develop a program – software development – Introduction to OS –Types of OS – Algorithms – Structured programming concept.	
UNIT-II : DATA TYPES AND FLOW OF CONTROL	**(9 Periods)**
An overview of C – Programming and Preparation – Program Output – Variables – Expressions, and Assignment, The use of #include, printf(), scanf() – Lexical elements, operators and the C systems – The fundamental data types – Flow of control	
UNIT-III : FUNCTIONS, ARRAYS, POINTERS AND STRINGS	**(9 Periods)**
Functions and storage classes - 1D Arrays – Pointers – Call by reference – Relationship between Arrays and Pointers – Pointer arithmetic and element size – Arrays as function argument – Dynamic memory allocation – Strings – String handing functions – Multidimensional Arrays.	
UNIT-IV : ARRAY OF POINTERS, BITWISE OPERATORS, 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:

1. *Pradip Dey, Manas Ghosh, “**Computer Fundamentals and Programming in C**”, Second Edition, Oxford University Press, 2013.*
2. *Al Kelley, Ira Pohl, “A Book on C-Programming in C”, Fourth Edition, Addison Wesley, 2001.*

REFERENCE BOOKS:

1. *Stephen G. Kochan, "**Programming in C-A complete introduction to the C programming language**", Third Edition, Sams Publication, 2004.*
2. *Yashavant P. Kanetkar, "**Let Us C**", 13th edition, BPB Publications, 2013.*
3. *Brian W. Kernighan and Dennis Ritchie, "**The C Programming Language**", Second Edition, Prentice Hall Software Series, 1988.*
4. *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 statements [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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	M	H	H	--	M	M	M	M	L	M	M	--
CO2	H	H	M	H	H	--	--	M	M	M	L	M	H	M
CO3	H	H	M	H	H	--	--	M	M	M	L	M	H	M
CO4	H	H	M	H	H	--	--	M	M	M	L	M	M	--
CO5	H	H	M	H	H	--	--	M	M	M	L	M	M	--
CO6	H	H	M	H	H	--	--	M	M	M	L	M	M	--
18IES104	H	H	M	H	H	--	M	M	M	M	L	M	M	M

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

18IBS105	**PHYSICS LABORATORY** *(Common to All Branches)*	**SEMESTER I**

Category : BS

PRE-REQUISTE: NIL

L	**T**	**P**	**C**
0	**0**	**3**	**1.5**

COURSE OBJECTIVES:

To improve the basic 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:

- To have a practical knowledge about the concepts of physics and its applications in the emerging fields of engineering and technology

LABORATORY EXPERIMENTS	
1.	Spectrometer - Diffraction Grating Normal Incidence Method
2	Air Wedge –Determination 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.	Determination of Bandgap Energy of Semiconductor
7.	Ultrasonic Interferometer - Velocity of sound & Compressibility of liquids.
8.	Torsional pendulum –Determination of Rigidity Modulus & Moment of Inertia

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

COURSE OUTCOMES:

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

CO1: Determine all physical properties of any matter,

CO2: Calibrate electrical measuring instruments and thereby effectively using it for particular application

CO3: Understand principle of Laser diffraction and its application in particle size determination

CO4: Understand the concept of light propagation through optical fibers and determination of its parameters

CO5: Determine the Intrinsic characteristic features of electronic devices for electrical and electronic applications.

CO6: Understand the ultrasonic wave propagation in liquids and the determination of compressibility of liquids for engineering applications.

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	M	M	M	--	--	--	--	--	--	M	M
CO2	H	H	L	M	L	--	--	--	--	--	--	--	M	M
CO3	M	M	M	--	--	--	--	--	--	--	--	--	L	--
CO4	H	M	M	L	M	--	--	--	--	--	--	--	--	M
CO5	H	M	M	M	M	--	--	--	--	--	--	--	M	M
CO6	H	M	H	M	L	L	--	--	--	--	--	--	M	M
18IBS105	H	M	M	M	M	M	--	--	--	--	--	--	M	M

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

18IES106	**WORKSHOP PRACTICE** *(Common to All Branches)*	**SEMESTER I**

Category : ES

PRE-REQUISTE: NIL

L	T	P	C
1	0	4	3

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
9. CNC Machines demonstration and lecture on working principle.
10. Additive manufacturing demonstration and lecture on working principle.

Contact periods:

Lecture: 15 Periods	**Tutorial: 0 Periods**	**Practical: 60 Periods**	**Total: 75 Periods**

COURSE OUTCOMES:

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

CO 1: Safely Use tools and equipment's used in Carpentry, Welding, Foundry and Sheet metal to create basic joints.

CO 2: Prepare sand mold for various basic pattern shapes.

CO 3: Fabricate parts like tray, frustum of cone and square box in sheet metal.

CO 4: Carry out minor works/repair related to electrical wiring and plumbing.

CO 5: Demonstrate the working of CNC machines and additive manufacturing**.**

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	--	L	--	--	--	L	--	--	--	L	--
CO2	H	--	L	--	L	--	--	--	L	--	--	--	L	--
CO3	H	--	L	--	L	--	--	--	L	--	--	--	L	--
CO4	H	--	L	--	M	--	--	--	L	--	--	--	L	--
CO5	H	--	L	--	H	--	--	--	L	--	--	--	L	--
18IES106	H	--	L	--	M	--	--	--	L	--	--	--	L	--

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

18IES107	**PROGRAMMING IN C LABORATORY** *(Common to All Branches Except MECH & PRODN Branches)*	**SEMESTER I**

Category : ES

PRE-REQUISTE: NIL

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

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

- 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

COURSE OUTCOMES:

Upon completion of this course, 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	PSO1	PSO2
CO1	H	H	M	H	H	--	--	M	M	M	L	M	H	H
CO2	H	H	M	H	H	--	--	M	M	M	L	M	M	M
CO3	H	H	M	H	H	--	--	M	M	M	L	M	M	M
CO4	H	H	M	H	H	--	--	M	M	M	L	M	M	H
CO5	H	H	M	H	H	--	--	M	M	M	H	H	M	M
CO6	H	H	M	H	H	--	--	M	M	M	M	M	H	H
18IES107	H	H	M	H	H	--	--	M	M	M	M	M	M	M

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

18IBS201	**APPLIED CHEMISTRY** *(Common to EEE, ECE, EIE, CSE & IT Branches)*	**SEMESTER II**

Category : BS

PRE-REQUISITE: NIL

L	T	P	C
3	1	0	4

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+3 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 - pH measurement using glass electrode and fluoride measurement by ISE.	
UNIT-II : BATTERIES	**(9+3 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+3 Periods)**
Corrosion- Spontaneity - Chemical corrosion- mechanism, nature of oxides – PilliingBedworth rule- electrochemical corrosion- mechanism-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 galvanizing – Organic coating- paints - constituents and functions.	
UNIT-IV : SPECTROSCOPIC TECHNIQUES AND APPLICATIONS	**(9+3 Periods)**
Beer Lambert's law -UV visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only)- Flame photometry- principle – instrumentation (block diagram only)- estimation of sodium by flame photometry- Atomic absorption spectroscopy – principles – instrumentation(block diagram only) – estimation of nickel by atomic absorption spectroscopy.	
UNIT-V : SILICON WAFER TECHNOLOGY	**(9+3 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.	

Contact periods:			
Lecture: 45 Periods	**Tutorial:15 Periods**	**Practical: 0 Periods**	**Total: 60 Periods**

TEXT BOOKS:

1. *Jain. P.C. and Monica Jain*, ***"Engineering Chemistry",*** *Dhanpat Rai Publications Pvt. Ltd, New Delhi, 16th Edition, 2017.*
2. *Vairam. S, Subha Ramesh*, ***"Engineering Chemistry"***, *Wiley India, 2015.*

REFERENCE BOOKS:

1. *Dara. S.S, Umarae*, "***Text book of Engineering Chemistry",*** *S. Chand Publications, 2013.*
2. *M.S.Tyagi,* ***"Introduction to semiconductor materials and devices",*** *Wiley India, 2012.*
3. *Y R Sharma ,* ***"Elementary Organic Spectroscopy",*** *S. Chand Publications, 2013.*
4. *B.R. Puri, L.R. Sharma & M. S. Pathania*, "***Principles of Physical Chemistry***", *S. Nagin Chand and Co., 2017*

COURSE OUTCOMES:

Upon completion of the course, the student 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 spectroscopic techniques and 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:

PO 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	--	--	L	--	--	--	--	--	--	--	L	L
CO2	L	M	L	--	--	--	--	--	--	--	--	--	--	M
CO3	--	L	L	--	--	--	--	--	L	--	--	--	L	--
CO4	M	L	--	L	L	--	--	--	--	--	--	--	--	--
CO5	L	H	--	--	M	--	--	--	--	--	--	L	M	--
18IBS201	M	M	L	L	L	--	--	--	L	--	--	L	L	L

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

18IBS202	**DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA** *(Common to CSE & IT Branches)*	**SEMESTER II**

Category: BS

PRE-REQUISTE: NIL

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To know about matrix theory used to find inversion and to solve linear system.
- To be familiar with the methods to solve different types of first order differential equations.
- To gain methods to solve second order differential equations with constant and variable coefficients.
- To gain the concepts of vector spaces and linear transformations.
- To obtain the knowledge of eigenvalues and diagonalisation of a matrix.

UNIT-I: Matrices			**(9+3 Periods)**
Matrices, Linear systems of equations, linear Independence, rank of a matrix, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.			
UNIT-II: First order ordinary differential equations			**(9+3 Periods)**
Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.			
UNIT-III: Ordinary differential equations of higher order			**(9+3 Periods)**
Second order linear differential equations with constant and variable coefficients: Cauchy-Euler equation, Cauchy-Legendre equation. Method of variation of parameters, Power series solutions of Bessel and Legendre equations.			
UNIT-IV :Vector spaces I			**(9+3 Periods)**
Vector Space, linear dependence of vectors, basis, dimension, Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.			
UNIT-V : Vector spaces II			**(9+3 Periods)**
Eigenvalues, eigenvectors, symmetric, skew-symmetric and orthogonal Matrices, Eigen bases, Diagonalization, Inner product spaces, Gram-Schmidt orthogonalization.			
Contact periods:			
Lecture: 45 Periods	**Tutorial: 15 Periods**	**Practical: 0 Periods**	**Total: 60 Periods**

TEXT BOOKS:

1. *B.S.Grewal,* ***Higher Engineering Mathematics****, Khanna Publishers, 43rd Edition,2015.*
2. *Howard Anton, Chris Rorres,* ***Elements of Linear Algebra with Applications****,Wiley, New Delhi, 2nd Edition, 2015*

REFERENCE BOOKS:

1. *E. A. Coddington,* ***An Introduction to Ordinary Differential Equations****, Prentice Hall India, 1995.*
2. *G.F. Simmons and S.G. Krantz,* ***Differential Equations****, Tata McGraw Hill, 2007.*
3. *Srimanta Pal and suboth.C.Bhunia,* ***Engineering Mathematics****, Oxford university publications, New Delhi, 2015.*
4. *Gilbert Strang,* ***Linear Algebra and its Applications****, Cengage Learning, Delhi, 4th Edition, 2006.*
5. *D.Poole,* ***Linear Algebra: A Modern Introduction****,2nd Edition,Brooks/Cole,2005.*

6. *V. Krishnamurthy, V.P. Mainra and J.L. Arora,* ***An introduction to Linear Algebra****, Affiliated East–West press, Reprint 2005.*

COURSE OUTCOMES:

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

CO1: Solve the linear system of equations by rank of a matrix and matrix inversion.

CO2: Acquire fluency in solving different types of first order differential equations.

CO3: Understand the general solutions to higher order differential equations and power series solutions to second order differential equations leading to Bessel and Legendre functions.

CO4: Understand the concepts of vector spaces and linear transformation orientation with matrices.

CO5: Solve to find eigenvalues of a matrix and understand the process of diagonalization by similarity and orthogonal transformation including Inner product spaces.

COURSE ARTICULATION MATRIX

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	H	L	L	-	-	-	-	-	-	-	-	M	L	-
CO2	H	L	L	-	-	-	-	-	-	-	-	M	L	-
CO3	H	L	L	-	-	-	-	-	-	-	-	M	L	-
CO4	H	L	L	-	-	-	-	-	-	-	-	M	L	-
CO5	H	L	L	-	-	-	-	-	-	-	-	M	L	-
18IBS202	H	L	L	-	-	-	-	-	-	-	-	M	L	-

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

18IES203	**FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING** *(Common to CSE & IT Branches)*	**SEMESTER II**

Category : ES

PRE-REQUISTE: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand and analyze basic electric circuits
- To Study the working principles of Electrical Machines and Transformers
- To study the working of basic electronics system
- To understand the functioning of power electronic circuits and it applications.

UNIT-I : DC CIRCUITS	**(9 Periods)**
Electrical Circuit Elements – Voltage and Current Sources– Source transformation techniques – Ohms law, Kirchhoff's laws –Analysis of simple circuits with DC excitation – Superposition, Thevenin and Norton's theorem. Star and Delta transformation.	
UNIT-II : AC CIRCUITS	**(9 Periods)**
Representation of Sinusoidal waveforms, peak, rms and average value. Real power, reactive power, apparent power and power factor. Analysis of single phase AC circuits consisting of R,L, C, RL, RC, RLC combinations (Series and Parallel) – Resonance in series Circuits (Study of phenomenon). Three phase circuits – relation between voltage and current in star and delta connections – Three phase balanced circuits.	
UNIT-III : ELECTRICAL MACHINES AND TRANSFORMERS	**(9 Periods)**
Working and construction of Single phase transformer – EMF equation – Equivalent circuit - Regulation and Efficiency. Construction and Principle of operation of: Three phase induction motor and Singlephase induction motor – Synchronous generators - Regulation and efficiency – Construction and Operation of DC generator and DC motor – Load test on DC motor and Swinburne's test – DC generator emf equation – Applications of all machines.	
UNIT-IV: BASIC ELECTRONIC SYSTEMS	**(9 Periods)**
Semiconductor materials – Operation and characteristics of BJT, JFET, MOSFET, UJT and SCR. Amplifier circuits – Operational Amplifiers and its characteristics – Inverting – Non Inverting – Summing – Differential amplifiers. Linear IC applications: Voltage regulators– 555 Timer and Phase locked loops.	
UNIT-V : ENERGY, POWER ELECTRONICS AND MEASUREMENTS	**(9 Periods)**
Three phase Converter and Inverter Circuit Operation – UPS – SMPS – Batteries and Types – Design of battery for backup – Measuring Instruments: Digital voltmeter – Digital Storage Oscilloscope – Energy Consumption Calculation – Power factor improvement – Harmonics and its mitigation methods.	

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

TEXT BOOKS:

1. *D.P.Kothari, I.J.Nagrath,, **"Basic Electrical Engineering"**, Tata McGraw Hill, 2010.*
2. *P. S. Bimbhra, "**Electrical Machinery**", Khanna Publishers, 2011.*
3. *M. H. Rashid, "**Power electronics: circuits, devices, and applications**", Pearson Education India, 2009.*
4. *R.S.Sedha, **"A Textbook of Applied Electronics"**, S.Chand and Company Limited, 2016*

REFERENCE BOOKS:

1. *Nagsarkar T K and Sukhija M S, **"Basic Electrical Engineering"**, Oxford Press (2005).*
2. *I. J. Nagrath and D. P. Kothari, "**Electric Machines**", McGraw Hill Education, 2010.*
3. *E.Hughes, **" Electrical and Electronics Technology"**, Pearson, 2010.*
4. *Mahmood Nahvi and Joseph A. Edminister, **"Electric Circuits"**, Schaum Outline Series, McGraw Hill, Sixth edition (2014).*

COURSE OUTCOMES:

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

CO1: Verify Ohm's law, Kirchoff's laws and theorems for simple electrical circuits.
CO2: Solve problems on AC circuits and analyze three phase AC circuits.
CO3: Understand the performance of AC, DC machines and transformers.
CO4: Studying of analog electronic devices and Operational Amplifier applications.
CO5: Understanding of power electronic circuits and their application

COURSE ARTICULATION MATRIX:

PO 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	--
CO2	H	M	L	--	--	--	--	--	--	--	--	L	L	--
CO3	H	M	--	H	--	--	--	--	--	--	--	L	L	--
CO4	H	M	H	H	L	--	L	--	--	--	--	L	M	L
CO5	H	M	H		L	--	L	--	--	--	--	L	M	L
18IES203	H	M	M	L	L	--	L	--	--	--	--	L	L	L

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

18IBS204	**CHEMISTRY LABORATORY** *(Common to All Branches)*	**SEMESTER II**

Category : BS

PRE-REQUISTE: NIL

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To have a practical knowledge about the concepts of physics and its applications in the emerging fields of engineering and technology

LIST OF EXPERIMENTS	
1.	Estimation of hardness by EDTA method.
2.	Estimation of chloride by Argentometric method.
3.	Conductometric titration of mixture of strong acid and weak acid using strong base.
4.	Potentiometric titration of ferrous iron by dichromate.
5.	Determination of Saponification value of an oil.
6.	Estimation of Iron by Spectrophotometry.
7.	Estimation of HCl by pH titration.
8.	Determination of the rate constant of reaction.
9.	Estimation of Dissolved Oxygen.

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

REFERENCE BOOKS:

1. *A.O. Thomas, “**Practical Chemistry**”, Scientific Book Centre, Cannanore, 2003.*
2. *Vogel’s “**Text book of Quantitative Analysis**”, Jeffery G H, Basset J. Menthom J, Denney R.C., 6th Edition, EBS, 2009.*

COURSE OUTCOMES:

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

CO1: Understand the nature of hardness using EDTA Complex

CO2 : Iron present in water can be estimated and chloride level, pollution level using dissolved oxygen content.

CO3: Apply the EMF and conductometric measurements in quantitative analysis of Substances.

CO4: pH of the liquid sample will be analysed and hence strength of the sample can be estimated using pH Meter

COURSE ARTICULATION MATRIX:

PO 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	--	--	--	--	--	--	--	--	--
CO2	L	L	L	--	--	--	--	--	--	--	--	--	L	--
CO3	--	L	L	--	--	--	--	--	L	--	--	--	L	--
CO4	--	M	--	L	L	--	--	--	--	--	--	--	--	--
18IBS204	L	M	L	L	L		--	--	L	--	--	--	L	--

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

18IES205	**FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY** *(Common to CSE & IT Branches)*	**SEMESTER II**

Category : ES

PRE-REQUISTE: NIL

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To familiarize with basic electrical wiring and measurements
- To provide basic laboratory experience on electronic circuits, DC machines, AC machines and Transformer
- To demonstrate internal cut-section view of machines and other advanced measurement devices

LIST OF EXPERIMENTS			
1.	Introductions to measuring instruments – voltmeter, ammeter, wattmeter, multimeter and Digital Storage Oscilloscope.		
2	Resonance in RLC circuits, verification of laws in electrical circuits.		
3.	Measurement of phase difference between voltage and current.		
4.	Voltage Current relations in three phase circuit and three phase power measurement.		
5.	Op Amp and its applications in simple circuits.		
6.	Demonstration of cut out section of machines.		
7.	No load test on single phase transformer and equivalent test.		
8.	Load Test on single phase transformer.		
9.	Swinburne's Test, Speed Control and Load test on DC motor.		
10.	Direction change and load test on three phase induction motor.		
11.	Alternator load test and regulation test.		
12.	Demonstration of Power Quality Analyzer, AC and DC drives.		
Contact periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

COURSE OUTCOMES:

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

CO1: Making electrical connections by wires of appropriate wires [Usage]

CO2: Acquire exposure to common electrical components and measuring instruments [Familiarity]

CO3: Verify Simple laws using electrical circuits [Usage]

CO4: Do experiment to understand the characteristics of transformers and Electrical machines [Usage]

CO5: Understand the working of Low Tension Switch gear components, AC and DC drives. [Assessment]

COURSE ARTICULATION MATRIX:

PO 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
CO2	H	H	H	H	M	--	--	--	--	--	--	--	M	--
CO3	H	H	H	H	M	--	--	--	--	--	--	--	M	--
CO4	H	H	H	H	--	--	--	--	--	--	--	--	M	--
CO5	H	H	H	H	--	--	L	L	--	H	H	--	M	L
18IES205	H	H	H	M	L	--				L	L	--	M	L

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

18IES206	**ENGINEERING GRAPHICS** *(Common to All Branches)*	**SEMESTER II**

Category : ES

PRE-REQUISTE: NIL

L	T	P	C
2	0	4	4

COURSE OBJECTIVES:

- Geometrical constructions
- Orthographic projections.
- Performing section of solids and development of the same.
- Pictorial view of solids
- Familiarization of CAD packages.

UNIT-I : GEOMETRICAL CONSTRUCTIONS	**(6+12 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.	
UNIT-II : ORTHOGRAPHIC PROJECTIONS	**(6+12 Periods)**
Introduction to Orthographic Projection-Projection of points-Projection of straight lines with traces - Conversion of pictorial views to orthographic views-Projection of solids	
UNIT-III : SECTION OF SOLIDS AND DEVELOPMENT	**(6+12 Periods)**
Section of solids- Development of surfaces	
UNIT-IV : PICTORIAL VIEWS	**(6+12 Periods)**
Isometric projections - Conversion of orthographic views to pictorial views (simple objects).	
UNIT-V : COMPUTER AIDED DRAFTING	**(6+12 Periods)**
Introduction to computer aided drafting package to make 2-D Drawings. OBJECT CONSTRUCTION – page layout – Layers and Line type – Creating, Editing and selecting the Geometric Objects MECHANICS – Viewing, Annotating, Hatching and Dimensioning the drawing – Creating Blocks and Attributes, DRAFTING – Create 2D drawing. A number of chosen problems will be solved to illustrate the concepts clearly. (Demonstration purpose only, not be included in examinations)	

Contact periods:			
Lecture: 30 Periods	**Tutorial: 0 Periods**	**Practical: 60 Periods**	**Total: 90 Periods**

TEXT BOOKS:

1. *K.Venugopal,* ***"Engineering Graphics"****, New Age International (P) Limited, 2015.*
2. *K.L.Narayana and P.Kannaiah,* ***"Text book on Engineering Drawing,"*** *2nd Edition, SciTech Publications (India) Pvt. Ltd, Chennai, 2009.*

REFERENCE BOOKS:

1. *Dhananjay.A.Jolhe,* ***"Engineering Drawing"****, Tata McGraw Hill Publishing Co., 2007.*
2. *K.V.Nataraajan,* ***"A text book of Engineering Graphics"****, Dhanalakashmi Publishers, Chennai, 2006.*
3. *M.B.Shah and B.C. Rana,* ***"Engineering Drawing"****, Pearson Education, 2005.*
4. *Luzadder and Duff,* ***"Fundamentals of Engineering Drawing"****, Prentice Hall of India Pvt Ltd, XIth Edition, 2001.*
5. *Alan Kalameja, "****AutoCAD 2008: A tutor for Engineering Graphics",*** *Auto Desk Press 2007*
6. *CAD Software manuals of latest version.*

COURSE OUTCOMES:

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

CO1: Construct basic geometric shapes and dimension the drawing as per standards.

CO2: Project points, lines and solids in various positions, and convert 2D projections to pictorial projections.

CO3: Generate sectional views of solids and construct development drawings.

CO4: Generate and interrupt pictorial views.

CO5: Use AutoCAD to create simple Engineering Drawings.

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	--	M	L	--	--	M	M	L	--	L	--
CO2	--	--	L	--	M	L	--	--	M	M	L	--	L	--
CO3	--	--	L	--	H	L	--	--	M	M	L	--	L	--
CO4	--	--	L	--	H	L	--	--	M	M	L	--	L	--
CO5	--	--	L	--	H	L	--	--	M	M	L	--	L	--
18IES206	--	--	L	--	H	L	--	--	M	M	L	--	L	--

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

18IBS301	**PROBABILITY THEORY AND APPLIED STATISTICS** *(Common to CSE & IT)*	**SEMESTER: III**

PRE-REQUISITES: **Category: BS**

NIL

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

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

- To gain the knowledge of basic probability concepts
- To understand the statistical distributions both discrete and continuous cases
- To be familiar with statistical averages regarding one or more random variables
- To acquire knowledge of Random process and Markov chains.
- To acquire knowledge of queueing models with finite/infinite capacity in single/multi servers.

UNIT – I : PROBABILITY AND RANDOM VARIABLES	**(9+3 Periods)**
Sample spaces – Events - Probability Axioms – Conditional Probability – Independent Events – Baye’s Theorem. Random Variables: Distribution Functions – Expectation – Moments - Moment Generating Functions.	
UNIT – II : PROBABILITY DISTRIBUTIONS	**(9+3 Periods)**
Binomial, Poisson, Geometric, Uniform, Exponential, Normal, Gamma, Weibull (Mean, Variance and Simple problems). Functions of random variables.	
UNIT – III : TWO DIMENSIONAL RANDOM VARIABLES	**(9+3 Periods)**
Joint distributions – Marginal Distributions – Conditional distributions – Covariance – Correlation and Regression – Transformation of random variables – Central Limit Theorem.	
UNIT – IV : RANDOM PROCESSES	**(9+3 Periods)**
Definition and Examples - first and Second order, Strict sense stationary, Wide sense stationary and ergodic processes- Markov processes – Poisson processes - Birth and Death processes - Markov chains -Transition probabilities - Limiting distributions.	
UNIT – V : QUEUEING THEORY	**(9+3 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: 15 Periods** **Practical: 0 Periods** **Total: 60 Periods**

TEXT BOOKS:

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

REFERENCE BOOKS:

1. *Gupta S.C and Kapoor V.K.,* ***"Fundamentals of Mathematical Statistics",*** *Sultan Chand & Sons, New Delhi, 2015.*
2. *Gupta S.P,* ***"Statistical Methods",*** *Sultan Chand & Sons, New Delhi, 2015.*
3. *Trivedi K.S,* ***"Probability and Statistics with Reliability, Queuing and Computer Science Applications",*** *Prentice Hall of India, New Delhi.*
4. *Hwei Hsu,* ***"Schaum's outline series of Theory and Problems of Probability and Random Process",*** *Tata McGraw Hill Publishing Co., New Delhi, 2015.*
5. *Kandasamy, Thilagavathy and Gunavathy,* ***"Probability and Random Process",*** *S.Chand & Co, Ramnagar, New Delhi, Reprint 2013.*

COURSE OUTCOMES:

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

CO1: Understand probability axioms and calculate expected values through moment generating Function. **[Understand]**

CO2: Identify various probability distributions of discrete and continuous random variables. **[Analyze]**

CO3: Understand the concept of two dimensional random variables. **[Understand]**

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

CO5: Utilize queuing models in engineering problems. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	M	H	M	M	H	M	M	L	M	M	H	M
CO2	H	H	M	H	M	M	M	M	M	L	M	M	H	M
CO3	H	H	M	M	M	M	M	M	M	L	M	M	M	M
CO4	H	H	H	H	H	L	H	M	H	M	M	H	H	M
CO5	H	H	H	H	H	L	H	M	H	M	M	H	H	M
18IBS 301	H	H	M	H	M	M	H	M	M	M	M	M	H	M

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

18IES302	**DIGITAL LOGIC DESIGN**	**SEMESTER: III**

PRE-REQUISITES: **Category: ES**

NIL

L	T	P	C
3	0	0	3

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:

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, Larry L.kinney ***"Fundamentals of Logic Design",*** *7th Edition, Jaico Publishing House, 2013.*

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 the course, the student will be able to,

CO1: Perform number conversions and binary arithmetic for signed 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	M	L			L					M	L
CO2	H	M	M	M	L			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
18IES 302	H	H	H	H	M			L					H	L

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

18IES303	**ELEMENTS OF COMMUNICATION ENGINEERING** *(Qualitative Treatment only)*	**SEMESTER: III**

PRE-REQUISITES: **Category: ES**

NIL

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

COURSE OBJECTIVES:

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

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

UNIT – I : FUNDAMENTALS OF ANALOG COMMUNICATION	**(9 Periods)**
Principles of amplitude modulation-AM envelope- Frequency spectrum-Bandwidth-Modulation Index-Percent modulation-Voltage and power distribution-AM generation and detection-Angle modulation-FM and PM waveforms-Phase deviation and modulation index-Frequency deviation and percent modulation-Frequency analysis of angle modulated waves-Bandwidth requirements for angle modulated waves-Direct method and Armstrong method of FM generation-Phase discriminator.	
UNIT – II : DIGITAL COMMUNICATION	**(9 Periods)**
Introduction-Shannon limit for information capacity –ASK transmitter, receiver and bandwidth-FSK transmitter, receiver and bandwidth-BPSK transmitter, receiver and bandwidth-QPSK transmitter, receiver and bandwidth-Quadrature amplitude modulation Transmitter, receiver and bandwidth-Bandwidth efficiency Carrier recovery-Squaring loop, Costas loop-DPSK Transmitter and receiver	
UNIT – III : DIGITAL TRANSMISSION	**(9 Periods)**
Sampling theorem-Pulse modulation-PCM-Quantization-Signal to quantization noise ratio-Companding-Delta modulation-Transmitter and receiver-Adaptive delta modulation-Differential pulse code modulation Transmitter and receiver-Intersymbol interference-Nyquist criteria for distortionless transmission.	
UNIT – IV : SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES	**(9 Periods)**
Pseudo-Noise sequence-Direct sequence spread spectrum with coherent binary PSK, Frequency-Hop spread spectrum-Slow and fast hopping multiple access techniques: FDMATDMA-CDMA-SDMA-Wireless communication-Frequency reuse and cell splitting, TDMA and CDMA in wireless communication systems.	
UNIT – V : MICROWAVE AND OPTICAL COMMUNICATION	**(9 Periods)**
UHF and microwave antennas-Parabolic and conical horn antenna-Frequency modulated microwave radio system-Transmitter, receiver and repeater-Line of sight path characteristics. Optical fiber communication system: Light propagation in fiber- optical fiber classification-Losses in optical fibers Sources and Detectors.	

Contact Periods:

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

TEXT BOOKS:

1. *Wayne Tomasi,* ***"Electronic Communication Systems: Fundamentals Through Advanced",*** *Pearson Education, Fifth Edition, 2004.*
2. *G Kennedy, B Davis and S R M prasanna,* ***"Electronic Communication Systems",*** *Tata Mc-Graw Hill Education Pvt Limited, Fifth Edition 2011.*

REFERENCE BOOKS:

1. *B.P.Lathi,* ***"Modern Analog and Digital communication Systems",*** *4/e, Oxford University Press, 2009*
2. *Simon Haykin,* ***"Communication Systems",*** *4th Edition, John Wiley & sons, Third edition, 2004.*
3. *Martin S.Roden.,* ***"Analog and Digital Communication systems",*** *5rd Edition, Shroff publishers & Distributors Pvt.Ltd, 2005.*
4. *B.Sklar,* ***"Digital communication Fundamentals and Applications",*** *2/e Pearson Education, 2001.*
5. *Louis E.Frenzel,* ***"Principles of Electronic Communication Systems",*** *3rd Edition, Tata MC graw Hill Education Pvt Ltd, 2008.*

COURSE OUTCOMES:

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

CO1: Explain the principles of Amplitude modulation, Frequency modulation and phase modulation. **[Familiarize]**

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

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

CO4: Differentiate multiple access techniques like FDMA, TDMA, CDMA and SDMA. **[Analyze]**

CO5: Explain the working principles of microwave antennas and optical fiber communication system. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	M									H	M	L
CO2	M	M	M									H	M	L
CO3	M	M	M									H	M	L
CO4	M	M	M									H	M	L
CO5	M	M	M									H	M	L
18IES 303	M	M	M									H	M	L

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

18IES304	BASICS OF MICROPROCESSORS AND MICROCONTROLLER	SEMESTER: III

PRE-REQUISITES: **Category: ES**

NIL

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

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

- To understand the Architecture of 8086 microprocessor
- To learn the design aspects of I/O and Memory Interfacing circuits
- To interface microprocessors with supporting chips
- To study the Architecture of 8051 microcontroller
- To design a microcontroller based system

UNIT – I : THE 8086 MICROPROCESSOR	**(9 Periods)**
Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.	
UNIT – II : 8086 SYSTEM BUS STRUCTURE	**(9 Periods)**
8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.	
UNIT – III : I/O INTERFACING	**(9 Periods)**
Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.	
UNIT – IV : MICROCONTROLLER	**(9 Periods)**
Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.	
UNIT – V : INTERFACING MICROCONTROLLER	**(9 Periods)**
Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.	
LIST OF EXPERIMENTS	**(30 Periods)**

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching

Peripherals and Interfacing Experiments

5. Traffic light controller
6. Digital clock
7. Key board and Display
8. Printer status
9. Serial interface and Parallel interface

8051 Experiments using kits

10. Basic arithmetic and Logical operations

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

TEXT BOOKS:

1. *Yu-Cheng Liu, Glenn A.Gibson,* ***"Microcomputer Systems: The 8086 / 8088 Family - Architecture",*** *Programming and Design‖, Second Edition, Prentice Hall of India, 2007. (UNIT I-III).*
2. *Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay,* ***"The 8051 Microcontroller and Embedded Systems: Using Assembly and C",*** *Second Edition, Pearson education, 2011. (UNIT IV-V).*

REFERENCE BOOKS:

1.Doughlas V.Hall, ***"Microprocessors and Interfacing, Programming and Hardware",*** *TMH,2012.*

2.A.K.Ray,K.M.Bhurchandi, ***"Advanced Microprocessors and Peripherals",*** *3rd edition, Tata McGrawHill, 2012.*

3.Krishna Kanth, ***"Microprocessor and Microcontroller Architecture,Programming and System Design using 8085,8086,8051",*** *Prentice Hall of India,2011.*

4.Kenneth J.Ayala, ***"The 8051 Microcontroller",*** *3rd edition,Thompson Delmar Learning,2007,NewDelhi.*

COURSE OUTCOMES:

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

CO1: Understand and execute programs based on 8086 microprocessor. **[Understand]**
CO2: Design Memory Interfacing circuits. **[Analyze]**
CO3: Design and interface I/O circuits. **[Analyze]**
CO4: Design and implement 8051 microcontroller based systems. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H	M	L	H		H	L		H	H	L
CO2	H	H	H	H	M	L	H		H	L		H	H	L
CO3	H	H	H	H	M	L	H		H	L		H	H	L
CO4	H	H	H	H	M	L	H		H	L		H	H	L
18IES 304	H	H	H	H	M	L	H		H	L		H	H	L

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

18IPC305	DATA STRUCTURES AND APPLICATIONS	SEMESTER:III

PRE-REQUISITES: **Category: PC**

18IES104 Programming in C

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Sorting and Searching algorithm.
- 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.
- Shortest path algorithm and Hashing techniques.

UNIT – I : LINEAR DATA STRUCTURES	**(9 Periods)**
Abstract Data Types (ADTs) – List ADT – array implementation – linked list implementation— singly linked lists - circularly linked lists - doubly - linked lists - All operation (Insertion- Deletion-Find) - Stack ADT – stack applications - Queue ADT – Queue applications.	
UNIT – II : SORTING AND SEARCHING	**(9 Periods)**
Sorting algorithms- Insertion sort - Selection sort - Shell sort - Bubble sort - Quick sort - Merge sort - Radix sort .Linear search – Binary Search.	
UNIT – III : NON - LINEAR DATA STRUCTURES – TREES, HEAPS	**(9 Periods)**
Binary Search trees-insertion-deletion-find -Traversal - AVL trees – Red -Black trees –Splay trees - Heaps - Heap creation – Heap sort.	
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 algorithm.	
UNIT – V : HASHING TECHNIQUES	**(9 Periods)**
Hashing - Hash Functions – Separate Chaining – Open Addressing– Rehashing – Extendible Hashing Methods – search, insert, delete.	

Contact Periods:

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

TEXT BOOKS:

1. *Robert Kruse, C.L.Tondo, Bruce Leung, ShashiMogella, " **Data Structures and program design in c**", Prentice Hall of India Pvt. Ltd., Second edition, 1997.*
2. *Mark Allen Weiss,**"Data Structures and Algorithm Analysis in C",** Pearson Education, 2nd Edition, 2011.*

REFERENCE BOOKS:

1. *Jean-Paul Tremblay & Paul G.Sorenson, **"An Introduction to Data Structures with Applications",** Tata McGraw Hill Publishing Book Company, 1991.*
2. *Dinesh P.Mehta,SartajSahni, **"Handbook of Data structures and applications",** Chapman & Hall/CRC Press, 2005.*

COURSE OUTCOMES:

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

CO1: Analyze different sorting searching algorithms. **[Analyze]**

CO2: Analyze the arrangement of data elements in list stack and queue and study its applications. **[Analyze]**

CO3: Use binary tree, binary search tree and AVL tree. **[Understand]**

CO4: Apply graph algorithms. **[Understand]**

CO5: Identify different hashing techniques. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L	M	L	L					L	L	M	L
CO2	M	M	L	M	L	L					M	L	M	L
CO3	M	M	M	M	M	M					H	L	M	L
CO4	M	M	M	M	M	M					H	L	M	L
CO5	M	M	M	M	M	M					H	L	M	L
18IPC 305	M	M	M	M	M	M					H	L	M	L

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

18IPC306	**OBJECT ORIENTED PROGRAMMING**	**SEMESTER: III**

PRE-REQUISITES: **Category: PC**

NIL

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

COURSE OBJECTIVES:

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

- Basic concepts of object oriented programming and its programming constructs.
- Features of object oriented programming.
- The working of streams and files.
- The working of templates and exception handling.
- Standard template library containers and algorithms

UNIT – I : INTRODUCTION	**(9 Periods)**
Need of Object-Oriented Programming - Comparison of procedural programming and Object-Oriented Programming - Characteristics of Object-Oriented Languages - C++ Programming Basics: Basic Program Construction - Data Types, Variables, Constants - Type Conversion, Operators, Library Functions - Loops and Decisions, Structures - Functions : Simple Functions, Passing arguments, Returning values, Reference Arguments. - Recursion, Inline Functions, Default Arguments - Storage Classes - Arrays, Strings.	
UNIT – II : FEATURES OF OBJECT ORIENTED PROGRAMMING	**(9 Periods)**
Introduction to Classes and Objects Constructors and its types, Destructors - Passing Objects as Function arguments and Returning Objects from Functions - Operator Overloading Inheritance - Overloading Member Functions Pointers - Virtual Functions – Friend Functions, Static Functions.	
UNIT – III : STREAMS AND FILES	**(9 Periods)**
Streams: Classes and Errors, Disk File I/O with Streams - - Files: File Pointers - Error handling in File I/O - File I/O with member Functions - Overloading the extraction and Insertion Operators - Multi File Programs.	
UNIT – IV : TEMPLATES AND EXCEPTION	**(9 Periods)**
Templates : Function templates, Class templates - Exceptions: Need of Exceptions, keywords, Simple and Multiple Exceptions - Re-throwing Exception and Exception Specifications, Custom Exception.	
UNIT – V : STANDARD TEMPLATE LIBRARY	**(9 Periods)**
Introduction to STL: Containers, Algorithms, iterators - potential problems with STL - Algorithms: find(), count(), sort(), search(), merge() - Function Objects: for_each(), transform() - Sequence Containers: vectors, Lists, Dequeues - Iterators and specialized iterators.	

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

TEXT BOOKS:

1. *Robert lafford, **"Object Oriented Programming using C++",** Sams publishing, 4th edition, 2002.*

REFERENCE BOOKS:

1. *Bjarne Stroustrup, **"Programming: Principles and Practice Using C++",** Addison Wesley, 2nd edition, 2014*
2. *Stanley B Lippman, **"The C++ Primer",** Addison Wesley, 4th edition, 2005.*
3. *Robert Sedgewick, **"Algorithms in C++ Fundamentals, Data Structures, Sorting, Searching",** Pearson India 3rd edition, 2001.*

COURSE OUTCOMES:

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

CO1: Explain the concepts of Object Oriented Program, data types, variables, functions and structures. **[Understand]**

CO2: Analyze the object passing, overloading and inheritance **[Analyze]**

CO3: Realize the working of streams and files. **[Understand]**

CO4: Analyze the working of templates and exceptions. **[Familiarity]**

CO5: Explain the containers and algorithms of Standard template library. **[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	L					L	M	L
CO2	H	H	H	L	M							L	H	L
CO3	H	M	M		M		L					L	L	L
CO4	H	M	M		M	L	L					L	M	L
CO5	H	M	H	L	M	L	L					L	M	L
18IPC 306	H	L	M	L	M	L	L					L	M	L

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

18IMC3Z7	**ENVIRONMENTAL SCIENCES AND ENGINEERING** *(Common to all Branches)*	**SEMESTER III**

Category : MC

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

L	T	P	C
3	0	0	0

- 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_2, 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:

1. Sharma J.P., “Environmental Studies”, 3rd Edition, University Science Press, New Delhi 2009.
2. Anubha Kaushik and C.P.Kaushik, “Environmental Science and Engineering”, 3rd Edition, New age International Publishers, New Delhi, 2008.

REFERENCE BOOKS:

1. *R.K.Trivedi, "Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards", Vol.I&II, Environ Media, 2006.*
2. *G.TylerMiller, JR, "Environmental Science", Tenth Edition, Thomson BROOKS / COLE Publishing, 2004.*
3. *Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2004.*

COURSE OUTCOMES:

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

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

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

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

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

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

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L	H	L	M	M	M	M	M	M	L	L	L	L	M
CO2	M	L	L	L	L	L	L	L	L	L	L	L	M	L	L
CO3	L	L	H	L	L	L	M	M	L	M	L	L	L	L	L
CO4	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L
CO5	M	L	H	L	L	L	H	H	L	M	L	L	M	L	M
18IMC 3Z7	M	L	H	L	L	L	M	M	L	M	L	L	L	L	L

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

18IES308	**DIGITAL LOGIC DESIGN LABORATORY**	**SEMESTER: III**

PRE-REQUISITES: **Category: ES**

NIL

L	T	P	C
0	0	3	1.5

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: 45 Periods** **Total: 45 Periods**

COURSE OUTCOMES:

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

CO1: 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 counter **[Analyze]**

CO5: Implement combinational/sequential circuits using HDL **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	M	L			L	M				M	L
CO2	H	M	M	M	L				M				M	L
CO3	H	H	H	H	M			L	H				H	L
CO4	H	H	H	H	M			L	H				H	L
CO5	H	H	H	H	M			L	H				H	L
18IES 308	**H**	**H**	**H**	**H**	**M**			**L**	**H**				**H**	**L**

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

18IPC309	**DATA STRUCTURES AND APPLICATIONS LABORATORY**	**SEMESTER: III**

PRE-REQUISITES: **Category: PC**

18IES107 Programming in C Lab

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

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

- Sorting and searching techniques.
- The operations of linear and non-linear data structures.
- 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 Sorting and searching techniques
4. Implementation of Binary tree operations
5. Implementation of Heaps
6. Implementation of Graph traversal algorithms
7. Implementation of Topological sorting
8. Implementation of Minimum Spanning Tree
9. Implementation of Shortest Path Algorithms
10. Implementation of Hashing techniques
11. Mini Projects/ Implementation using HackerRank website

Contact Periods:

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

COURSE OUTCOMES:

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

CO1: Sort an array’s elements using suitable sorting algorithms. **[Analyze]**

CO2: Search an element in an array using linear and binary search algorithms**. [Analyze]**

CO3: Analyse linear data structures like stack, queue, linked list and its operations. **[Analyze]**

CO4: Analyse non-linear data structures tree, heaps and graph and its operations. **[Analyze]**

CO5: Apply different hashing techniques and shortest path 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	M	M	M	M		L		M	L	M	M
CO2	H	H	M	M	M	M	M		L		M	L	M	M
CO3	H	H	M	M	M	M	M		L		M	L	M	M
CO4	H	H	M	M	M	M	M		L		M	L	M	M
CO5	H	H	M	M	M	M	M		L		M	L	M	M
18IPC 309	H	H	M	M	M	M	M		L		M	L	M	M

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

18IHS401	**RESOURCE MANAGEMENT TECHNIQUES**	**SEMESTER:IV**

PRE-REQUISITES: **Category: HS**

NIL

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

COURSE OBJECTIVES:

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

- Classification and formulation of real-life problem for modeling, solving and applying for decision making
- Various methods of solutions for linear programming, transportation, assignment, CPM and PERT problems
- Solving problems using dynamic programming method

UNIT – I : LINEAR PROGRAMMING	**(9 Periods)**
Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method-Primal Dual problems.	
UNIT – II : TRANSPORTATION AND ASSIGNMENT MODELS	**(9 Periods)**
Dual theory and Sensitivity analysis-Transportation models definition – Nontraditional transportation models – The transportation algorithm – The assignment model – The transshipment model.	
UNIT – III : NETWORK MODELS	**(9 Periods)**
CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations-example-Sequencing problems.	
UNIT – IV : INVENTORY MODELS	**(9 Periods)**
Replacement problems-Capital equipment- Discounting costs- Group replacement – Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models-Single period inventory models with shortage cost.	
UNIT – V : DYNAMIC PROGRAMMING	**(9 Periods)**
Dynamic programming-Formulation-Invest problem-General allocation problem-Stage coach problem-Production Scheduling.	

Contact Periods:

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

TEXT BOOKS:

1. *H. A. Taha,* ***"Operations Research - An introduction",*** *10th edition, Prentice Hall, Macmillan, 2017*

REFERENCE BOOKS:

1. *P. Sankara Iyer,* ***"Operations Research",*** *Tata McGraw-Hill, 2008.*
2. *A.M. Natarajan, P. Balasubramani, A. Tamilarasi,* ***"Operations Research",*** *Pearson Education, 2005.*
3. *F. S. Hiller and G. J. Liebermann,* ***"Introduction to operational research",*** *8th edition, McGraw-Hil, 2005.*
4. *B. E. Gillet,* ***"Introduction to operational research-A computer oriented algorithmic approach",*** *McGraw Hill, 1989.*
5. *H. M. Wagner, Principles of operational research with applications to managerial decisions, PH, Inc, 1975.*

COURSE OUTCOMES:

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

CO1: Solve Problems using Linear Programming. **[Analyze]**

CO2: Formulate and solve real problems using Transportation and assignment models. **[Analyze]**

CO3: Utilize PERT and CPM in project management. **[Analyze]**

CO4: Determine the optimum level of **inventories** that should be maintained in a production process. **[Understand]**

CO5: Find optimized solution using dynamic programming. **[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	L	L		L	L	L	M	L	H	L
CO2	H	H	H	H	L	L		L	L	L	M	L	H	L
CO3	H	H	H	H	L	L		L	L	L	M	L	H	L
CO4	H	H	H	H	L	L		L	L	L	M	L	H	L
CO5	H	H	H	H	L	L		L	L	L	M	L	H	L
18IHS 401	H	H	H	H	L	L		L	L	L	M	L	H	L

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

18IBS402	**ELEMENTS OF DISCRETE STRUCTURES**	**SEMESTER: IV**

PRE-REQUISITES: **Category: BS**

NIL

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

COURSE OBJECTIVES:

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

- Syntax and semantics of sets, propositional and predicate logic
- Basic concepts of relations and functions
- Counting Techniques
- Groups, rings and integral domain structures
- Concepts of automata theory

UNIT – I : SETS AND PROPOSITIONS	**(9 Periods)**
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 : RELATIONS AND FUNCTIONS	**(9 Periods)**
Introduction – Properties of binary relations – Closure of relations – Warshall's Algorithm – Equivalence relations and Partitions – Partial ordering relations and Lattices – Compatible relation – Functions – Composition of functions – Invertible Function.	
UNIT – III : COUNTING	**(9 Periods)**
Basics of Counting – Pigeon hole principle – Permutations and Combinations – Binomial Coefficients – Generalized Permutations and Combinations.	
UNIT – IV : 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.	
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:

1. *C.L. Liu,D.P. Mohapatra, "* ***Elements of Discrete Mathematics: A Computer Oriented Approach",*** *Tata McGraw Hill, Third Edition (SIE), 2008.*
2. *Kenneth H. Rosen, Rosen* ***"Discrete Mathematics and Its Applications: With Combinatorics and Graph Theory",****Tata McGraw Hill, Seventh Edition, 2011*

REFERENCE BOOKS:

1. *Tremblay.J.P and Manohar.R,* ***"Discrete Mathematical Structures with Applications to Computer Science",*** *Tata McGraw Hill Company, 1997, 35 th reprint 2008.*
2. *Ralph P.Girimaldi,* ***"Discrete and Combinatorial Mathematics",*** *Pearson, fifth edition, 2014.*
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 the course, the student 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 relations and functions. **[Understand]**

CO3: Employ the techniques of counting in real world problems. **[Analyze]**

CO4: Apply the concepts of groups and rings in real time applications. **[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
18IBS 402	M	H	M	H	M			M			M		H	L

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

18IPC403	COMPUTER ORGANIZATION AND ARCHITECTURE	SEMESTER: IV

PRE-REQUISITES: **Category: PC**

NIL

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

COURSE OBJECTIVES:

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

- Basic structure, operations and addressing modes of computer.
- Implementation of fixed point and floating point arithmetic operations in computer.
- Design of data path, control path and pipelining.
- Memory organization, memory performance and I/O interfacing.
- 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 – RISC Vs CISC Characteristics – 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 path – Micro-programming and Hard-wired Control –– Pipelining – Pipelining Hazards – Exceptions Handling.	
UNIT – IV : MEMORY AND I/O INTERFACING	**(9 Periods)**
Memory Technologies – Basics of Cache – 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 – Multi-core and other Shared memory Multiprocessors – Interconnection Networks – Performance Considerations.	

Contact Periods:

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

TEXT BOOKS:

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",*** *McGraw-Hill Inc, 6th edition, 2012.*

REFERENCE BOOKS:

1. *Andrew S. Tanenbaum, **"Structured Computer Organization",** Pearson Education, 6th Edition, 2012.*
2. *William Stallings, **"Computer Organization and Architecture: Designing for Performance",** Pearson Education, 8th Edition, 2010.*
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, 2007.*

COURSE OUTCOMES:

Upon completion of the course, the student 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 cache 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	H	H	H	H	H	M						M	H	L
CO2	H	H	H	H	H	M						M	H	L
CO3	H	H	H	H	H	M						M	H	L
CO4	H	H	H	H	H	M						M	H	L
CO5	H	H	H	H	H	M						M	H	L
18IPC 403	H	H	H	H	H	M						M	H	L

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

18IPC404	**DATABASE DESIGN AND MANAGEMENT**	**SEMESTER: IV**

PRE-REQUISITES: **Category: PC**

NIL

L	T	P	C
3	0	0	3

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, recovery and data object locking protocols.
- Querying and Accessing NoSQL.

UNIT – I : CONCEPTUAL MODELLING AND RELATIONAL MODEL	**(9 Periods)**
Database system structure – Data Models – Introduction to Network and Hierarchical models – ER model – Relational model – Relational Algebra and Calculus - SQL – Data definition – Queries in SQL – Updates – Views – PL/SQL: Triggers – Procedures – Functions – Integrity and Security – Relational Database design – Functional dependencies and Normalization for Relational Databases.	
UNIT – II : 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 – III : TRANSACTION MANAGEMENT	**(9 Periods)**
Introduction – Need for Concurrency control – Desirable properties of transaction – Schedule and Recoverability – Serializability and Schedules – Concurrency Control – Types of locks – Two Phase locking – Deadlock –Time stamp based concurrency control – Recovery techniques – Immediate update – Deferred update – Shadow paging.	
UNIT – IV : NoSQL DATABASE AND DATA MODEL	**(9 Periods)**
Emergence of NoSQL – Aggregate Data Models- Aggregates – Key value data models – Column Family Stores – Summarizing Aggregate Oriented Databases – Data model - Relationships – Graph Databases – Schemaless Database – Materialized Views – Modelling for data Access.	
UNIT – V : IMPLEMENTING NoSQL DATABASE	**(9 Periods)**
Distribution Model – Consistency: Update, Read, Relaxing – Map and Reduce - Taxonomy of Nosql Database: Key Value Database – Document Databases – Column Family Stores – Graph Databases.	

Contact Periods:

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

TEXT BOOKS:

1. *Ramez Elmasri and Shamkant B. Navathe,* ***"Fundamental Database Systems",*** *Pearson Education, 6th Edition, 2011*
2. *Pramod J. Sadalage Martin Fowler,* ***"NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence",*** *Pearson, 2012.*

REFERENCE BOOKS:

1. *Abraham Silberschatz, Henry F. Korth and S. Sudarshan,* ***"Database System Concepts",*** *McGraw Hill, 6th Edition, 2011*
2. *Peter Rob and Corlos Coronel,* ***"Database System, Design, Implementation and Management",*** *Cengage Learning, 10th edition, 2013*
3. *Kristina Chodorow,* ***"MongoDB: The Definitive Guide",*** *O'Reilly Publication, 2nd Edition, 2013.*
4. *Shashank Tiwari,* ***"Professional NoSql",*** *John Wiely & Sons, 2011.*

COURSE OUTCOMES:

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

CO1: Build a database management system that satisfies relational theory using normalization, data modeling and retrieve the information using SQL. **[Analyze]**

CO2: Illustrate data storage, query processing and optimization techniques such as B Tree, B^+ Tree structure. **[Understand]**

CO3: Explain the concepts of transaction management. **[Familiarize]**

CO4: Build a NoSQL database by key-value, document and column family data models. **[Understand]**

CO5: Demonstrate the taxonomy NoSQL database and implement. **[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	L	M	L
CO2	H	H	H	H	H	L		L			M	L	H	L
CO3	M	M	M	M	H						M	L	M	L
CO4	M	L	L	L	L						M	L	L	L
CO5	H	H	H	H	H						M	L	H	L
18IPC 404	M	M	H	M	H	L		L			M	L	M	L

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

18IPC405	**INFORMATION CODING TECHNIQUES**	**SEMESTER:IV**

PRE-REQUISITES: **Category: PC**

18IES303 - Elements of Communication Engineering

L	T	P	C
3	0	0	3

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 communication.

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 memoryless 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 memoryless 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.	
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 decoder 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:

1. *Simon Haykin, Michacl moher,* ***"Communication Systems",*** *John Wiley and Sons, 5th edition, 2009.*
2. *Fred Halsall,* ***"Multimedia Communications Applications, Networks, Protocols & Standards",*** *Pearson education, Asia 2004.*

REFERENCE BOOKS:

1. *Ranjan Bose,* ***"Information Theory, Coding and Cryptography",*** *Tata McGrew Hill,* 2^{nd} *Edition, 2008.*
2. *K. Sam Shanmugam,* ***"Digital and Analog Communication Systems",*** *JohnWiley and Sons, 2010.*
3. *T. M. Cover and J. A. Thomas,* ***"Elements of Information Theory"****, John Wiley and Sons,* 2^{nd} *edition, 2006.*
4. *Andre Neabauer,* ***"Coding Theory: Algorithms, Architectures & Applications",*** *Wiley Publications, 2010.*
5. *R Avudaiammal,* ***"Information Coding Techniques",*** *McGraw Hill Education, 18 August 2009.*

COURSE OUTCOMES:

Upon completion of the course, the student 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, convolution codes, error detection and correction in the communication networks. **[Analyze]**
CO4: Apply Compression and Decompression techniques. **[Analyze]**
CO5: Apply the concepts of multimedia communication. **[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	L	L	L	M		L	M			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
18IPC 405	**H**	**H**	**L**	**L**	**L**		**L**	**M**			**L**		**M**	**L**

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

18IPC406	OPERATING SYSTEMS	SEMESTER: IV

PRE-REQUISITES: **Category: PC**

NIL

L	T	P	C
3	0	0	3

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)**
Introduction- Operating System Structures: Operating System Service-User and Operating-System Interface-System Calls-System programs - Operating System Design and Implementation-Operating System Structure-Building and Booting an Operating System-Operating System Debugging.	
UNIT – II : PROCESSES AND THREADS	**(9 Periods)**
Processes- States-Process Scheduling- Operations on Processes -IPC - Threads & Concurrency-CPU Scheduling.	
UNIT – III : PROCESS SYNCHRONIZATION AND DEADLOCK	**(9 Periods)**
Synchronization Tools- The Critical-Section Problem-Peterson's Solution-Hardware Support for Synchronization -Semaphores-Monitors-Classic Problems of Synchronization. Deadlocks – detection – prevention- avoidance.	
UNIT – IV : MEMORY MANAGEMENT	**(9 Periods)**
Main Memory-Contiguous Memory Allocation-Paging: Structure of the Page Table-Swapping-Intel 32 and 64-bit Architectures-Virtual Memory-Background-Demand Paging- Copy-on-Write-Page Replacement- Allocation of Frames -Thrashing -Memory Compression- Allocating Kernel	
UNIT – V : STORAGE MANAGEMENT	**(9 Periods)**
File System-Implementing File Systems-Mass Storage Structure-I/O Systems: Overview I/O-Hardware Application -I/O Interface-Kernel I/O Subsystem-Case Study: Linux OS	

Contact Periods:

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

TEXT BOOKS:

1. *Abraham Silberschatz, Peter B. Galvin, Greg Gagne,* ***"Operating System Concepts",*** *10th Ed., John Wiley,2018*
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 the course, the student will be able to,

CO1: Explain the structure and functions of OS. **[Familiarity]**

CO2: Apply Scheduling algorithms for Processes and Threads. **[Understand]**

CO3: Solve problems related to concurrency and Deadlocks. **[Understand]**

CO4: Apply memory management schemes. **[Understand]**

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	M	M	M		L						L	M	L
CO2	H	M	M	M		L						L	M	L
CO3	H	H	H	M		L						M	H	L
CO4	H	H	H	M		L						M	H	L
CO5	H	H	H	M		L						M	H	L
18IPC 406	H	H	H	M		L						M	H	L

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

18IMC4Z7	**CONSTITUTION OF INDIA** *(Common to all Branches)*	**SEMESTER: IV**

Category : MC

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

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To know about Indian constitution.
- To know about central and state government functionalities in India.
- To know about Indian society.

UNIT – I : INTRODUCTION	**(9 Periods)**
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Role of the Election Commission.	
UNIT – II : STRUCTURE AND FUNCTION OF CENTRAL AND STATE GOVERNMENT	**(9 Periods)**
Union Government – Structures of the Union Government and Functions – President – Vice President– Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review. State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.	
UNIT – III : CONSTITUTION FUNCTIONS OF INDIA AND INDIAN SOCIETY	**(9 Periods)**
Indian Federal System – Central – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India. Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	
UNIT – IV : POLICIES AND ACTS - GENERAL	**(9 Periods)**
Insurance and Bonding – Laws Governing Sale, Purchase and use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax , Excise and Custom duties and their Influence on Construction Cost – Legal Requirements for Planning – Property Law– Agency Law – Local Government Laws for Approval.	
UNIT – V : POLICIES AND ACTS ON INFRASTRUCTURE DEVELOPMENT	**(9 Periods)**
A Historical Review of the Government Policies on Infrastructure – Current Public Policies on Transportations – Power and telecom Sector – Plans for Infrastructure Development – Legal framework for Regulating Private Participation in Roads and Highways – Ports and Airport and Telecom	

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

TEXT BOOKS:

1. *Durga Das Basu, **"Introduction to the Constitution of India"**, Prentice Hall of India, New Delhi,2018*
2. *R.C.Agarwal, **"Indian Political System"**, S.Chand and Company, New Delhi,2004.*
3. *Maciver and Page, **" Society: An Introduction Analysis"**, Mac Milan India Ltd., New Delhi,2007*
4. *K.L.Sharma,**"Social Stratification in India: Issues and Themes"**, Jawaharlal Nehru University, New Delhi,2006*

REFERENCE BOOKS:

1. *M.Laxmikanth, **"Indian Polity"**, Mcgraw Hill Education (India) Private limited,2016.*
2. *Sharma, Brij Kishore, **" Introduction to the Constitution of India"**, Prentice Hall of India, New Delhi,2018.*

COURSE OUTCOMES:

On completion of the course, the students will able to

CO1: Understand and abide the rules of the Indian constitution.
CO2: Understand the functions of Central government.
CO3: Understand the function of state government.
CO4: Understand the various constitutional functions.
CO5: Understand the different culture among the people of India.

COURSE ARTICULATION MATRIX:

PO/PSO	**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	M					M		L
CO2						L						M		L
CO3						L						M		L
CO4						L						L		L
CO5						L	L					L		L
18IMC 4Z7						L	L					M		L

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

18IPC408	**DATABASE DESIGN AND MANAGEMENT LABORATORY**	**SEMESTER:IV**

PRE-REQUISITES: **Category: PC**

NIL

L	T	P	C
0	0	3	1.5

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.
- Concepts of triggers, functions and stored procedures in PL/SQL and NoSQL.
- Creating and accessing NOSQL database.

LIST OF EXPERIMENTS

1. DDL, DML, DCL and TCL commands.
2. Built-In functions and Relational Algebra operations in open source DBMS-MySQL.
3. Materialized views.
4. Stored Procedures, Functions and Triggers in PL/SQL.
5. Cursor Implementation in PL/SQL.
6. Create, update and delete NoSQL database NoSQL.
7. Querying NoSQL database using NoSQL.
8. Build and utilize index of NoSQL
9. Cursor Implementation in NoSQL
10. Mini Project: (Any application development using MySQL/NoSQL) 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: 45 Periods** **Total: 45 Periods**

COURSE OUTCOMES:
Upon completion of the course, the student 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 RDBMS. **[Analyze]**

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

CO5: Populate and query NoSQL database. **[Analyze]**

CO6: 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	H	M
CO2	M	M	H	M	H			M	L	L	H	H	M	M
CO3	M	M	M	M	H			M	M	M	H	H	M	M
CO4	H	H	H	H	H			M	M	M	H	H	H	M
CO5	H	H	H	H	H	M		M	M	M	H	H	H	M
CO6	H	H	H	H	L	L	L	L			H	H	H	H
18IPC 408	H	H	H	M	H	L	L	M	M	M	H	H	H	M

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

18IPC409	**OPERATING SYSTEMS LABORATORY**	**SEMESTER: IV**

PRE-REQUISITES: **Category: PC**

NIL

L	**T**	**P**	**C**
0	0	3	1.5

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
11. Mini project

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

COURSE OUTCOMES:

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

CO1: Implement shell scripts and Inter Process Communication. **[Analyze]**

CO2: Implement CPU scheduling algorithms and memory management schemes. **[Analyze]**

CO3: Implement algorithms for deadlock prevention and avoidance. **[Analyze]**

CO4: Implement file structure and allocation of disk space. **[Analyze]**

CO5: Identify the best disk scheduling algorithm to improve the performance. **[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	M	M	L	L			M		L	L	M	L
CO2	H	M	M	M	L	L			M		L	L	M	L
CO3	H	M	M	M	L	L			M		L	L	M	L
CO4	H	M	M	M	L	L			M		L	L	M	L
CO5	H	M	M	M	L	L			M		L	L	M	L
18IPC 409	H	H	M	M	L	L			M		L	L	M	L

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

18IHS501	**TECHNOLOGY MANAGEMENT** *(Common to EEE, EIE, CSE, IT & IBT Branches)*	**SEMESTER: V**

PRE-REQUISITES: **Category: HS**

NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Intricacies of technology selection.
- Role of technology in today's business.

UNIT – I : INTRODUCTION	**(9 Periods)**
Evolution, growth of technology, role and significance of technology management, forms of technology – process, product technology, impact of technology on society and business, technology and competition.	
UNIT – II : TECHNOLOGY FORECASTING	**(9 Periods)**
Technology forecasting, characteristics, principles, process, forecasting methods and techniques.	
UNIT – III : ACQUISITION OF NEW TECHNOLOGY	**(9 Periods)**
Alternative for acquiring new technology, reasons to obtain new technology, management of acquired technology, measures of scale and mechanisms for acquiring technologies. Technology transfer-models, modes of transfer, dimensions of technology transfer, features of technology package- routes of technology transfer.	
UNIT – IV : HUMAN ASPECTS OF TECHNOLOGY MANAGEMENT	**(9 Periods)**
Integration of people and technology, factors considered in technology management – organizational, psychological, organizational structure and technology –technological change and industrial relations.	
UNIT – V : SOCIAL ASPECTS OF TECHNOLOGY MANAGEMENT	**(9 Periods)**
Technology assessment and environmental impact analysis(EIA)-EIA-process, scope, issues in report preparation, elements of environmental problem, case study on social impact of technology.	

Contact Periods:

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

TEXT BOOKS:

1. *Sanjiva Shankar Dubey, **"Technology and Innovation Management",** PHI Learning Private Ltd., 2017.*

REFERENCE BOOKS:

1. *Gerard H. Gaynor, **"Hand Book Technology of Management"**, McGraw Hill professional, 2009.*
2. *Khalil, T, **"Management of technology: The Key to competitiveness and wealth creation"** Tata McGraw Hill, Delhi, 2013.*
3. *Ralph Katz**, "The human side of Managing Technological Innovation: A Collection of Readings",** 2nd Edition Oxford University Press, 2003*

COURSE OUTCOMES:

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

CO1: Learn to manage ideas and knowledge in a technology-based organization. [**Familiarize]**

CO2: Equipped with skills needed to implement technology polices and strategies. [**Familiarize]**

CO3: Formulate technology polices and strategies for businesses. **[Understand]**

CO4: Appropriately choose the new technologies. **[Analyse]**

CO5: Future technological requirements. [**Familiarize]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	M		M	H	H	H	H	M	M	M	M	H
CO2	M	M	M		M	H	H	H	H	M	M	M	M	H
CO3	M	M	M		M	H	H	H	H	M	M	M	M	H
CO4	M	M	M		M	H	H	H	H	M	M	M	M	H
CO5	M	M	M		M	H	H	H	H	M	M	M	M	H
18IHS 501	M	M	M		M	H	H	H	H	M	M	M	M	H

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

18IPC502	**WEB TECHNOLOGY**	**SEMESTER: V**

PRE-REQUISITES: **Category: PC**

NIL

L	**T**	**P**	**C**
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 event handling – 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 – XQUERY– Introduction to AJAX – Web services: Concepts – Writing java Web Service and Web Service client – WSDL – XML Schema – Introduction to SOAP and REST.	
UNIT – V : WEB SECURITY ,OTHER TECHNOLOGIES	**(9 Periods)**
Security Threats: cross site scripting, SQL injection – Two factor three factor authentication – Web application authentication – password based authentication – Authorization fundamentals – Introduction to technologies: JSON, AngularJS, React, Node.JS, JQuery, and MongoDB.	

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. *Bryan Sullivan, Vincent Liu, "**A beginners guide: Web Application Security**", McGrawHill 2011*

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.*
4. *Budi kurniawan, **"Servlet & JSP :A Beginner's tutorial",** Brainy Software, 2016*

COURSE OUTCOMES:

Upon completion of the 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	
18IPC 502	H	L	L	H	M	L		L					H	L

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

18IPC503	**DATA COMMUNICATION AND NETWORKING**	**SEMESTER: V**

PRE-REQUISITES: **Category: PC**

NIL

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

COURSE OBJECTIVES:

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

- To understand the division of network functionality into layers
- To familiarize the functions and protocols of each layer of TCP/IP protocol suite
- To understand the flow of information from one node to another node in the network
- To understand the components required to build different types of network
- To learn concepts related to network addressing

UNIT – I : DATA COMMUNICATIONS	**(9 Periods)**
Transmission Impairments – Bandwidth Limitations –Multiplexing and Spreading– Encoding Techniques – Transmission Media – guided Media –Unguided Media:Wireless- Cable Pinouts – Crossover – Straight Through – Rollover-Switching-Circuit Switching-Datagram Switching-Virtual Circuit Switching- ISO/OSI Model.	
UNIT – II : DATA LINK LAYER	**(9 Periods)**
Link Layer – Framing – Addressing – Error Detection/Correction – Multiple Access Protocols – Address Resolution Protocol (ARP) – Ethernet Basics – CSMA/CD – Token Ring- FDDI- Virtual LAN (VLAN) – Wireless LAN (802.11) – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN– Zigbee WAN Technologies – ATM – Frame Relay – MPLS.	
UNIT – III : NETWORK LAYER	**(9 Periods)**
IPV4 Address -Packet Format – IP Addressing – Subnetting – IPV6 Address-Packet Format-Transition from IPV4 to IPV6- Classless Inter Domain Routing (CIDR) – Private Addressing – Network Address Translation – BOOTP/DHCP-ICMP – Routing Principles – Distance Vector Routing(RIP) – Link State Routing (OSPF) – Path Vector Routing (BGP).	
UNIT – IV : TRANSPORT LAYER	**(9 Periods)**
Process to Process Delivery – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Stream Control Transmission Protocol(SCTP) – Congestion Control in TCP – Congestion Control in Frame Relay- Integrated Services-RSVP-Differentiated Services.	
UNIT – V : INTRODUCTION / APPLICATION LAYER	**(9 Periods)**
Evolution of Computer Networking – Network edge and core-Layered Architecture – Internet Architecture (TCP/IP) – Addressing-physical Addressing-Logical addressing-Port Addressing-Application Layer Protocols – DNS- HTTP – FTP – Telnet – Email – RTP-RTCP-Voice over IP	

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, fourth Edition, 2017.*

REFERENCE BOOKS:

1. *James F. Kurose, Keith W. Ross,* ***"Computer Networking, A Top-Down Approach Featuring the Internet",*** *Pearson Education, Sixth Edition, 2012.*
2. *Larry L. Peterson, Bruce S. Davie,* ***"Computer Networks: A Systems Approach",*** *Morgan Kaufmann Publishers Inc., Fifth Edition, 2011.*
3. *William Stallings,* ***"Data and Computer Communications",*** *Pearson Education, Tenth Edition, 2013.*
4. *Douglas E. Comer,* ***"Internetworking with TCP/IP (Volume I) Principles, Protocols andArchitecture",*** *Pearson Education, Sixth Edition, 2013.*
5. *Nader F. Mir,* ***"Computer and Communication Networks",*** *Prentice Hall, Second Edition, 2014.*
6. *Ying-Dar Lin, Ren-Hung Hwang and Fred Baker,* ***"Computer Networks: An Open Source Approach",*** *McGraw Hill Publisher, 2011.*
7. *Rich Seifert, James Edwards,* ***"The All New Switch Book: The Complete Guide to LAN Switching Technology",*** *Wiley Publishing Inc, 2008.*

COURSE OUTCOMES:

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

CO1: Identify the components required to build different types of networks. **[Familiarize]**

CO2: Choose the required functionality at each layer for given application. **[Understand]**

CO3: Identify solution for each functionality at each layer. **[Understand]**

CO4: Trace the flow of information from one node to another node in the network. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H	H	M	L	L				H	H	L
CO2	H	H	H	H	H	M	L	L				H	H	L
CO3	H	H	H	H	H	M	L	L				H	H	L
CO4	H	H	H	H	H	M	L	L				H	H	L
18IPC 503	H	H	H	H	H	M	L	L				H	H	L

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

18IPC504	**ANALYSIS AND DESIGN OF ALGORITHMS**	**SEMESTER: V**

PRE-REQUISITES: **Category: PC**

18IPC305 Datastructures and Applications

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Significance of complexity of the algorithm.
- Brute force and divide-and-conquer.
- Dynamic programming, Greedy technique.
- NP Completeness.

UNIT – I : ALGORITHM COMPLEXITY	**(9 Periods)**
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms.	
UNIT – II : BRUTE FORCE AND DIVIDE-AND-CONQUER	**(9 Periods)**
Brute Force - Closest-Pair and Convex-Hull Problems-Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem. Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen‟s Matrix Multiplication-Closest-Pair and Convex-Hull Problems.	
UNIT – III : DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	**(9 Periods)**
Computing a Binomial Coefficient – Warshall‟s and Floyd‟ algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique– Prim‟s algorithm- Kruskal's AlgorithmDijkstra's Algorithm-Huffman Trees.	
UNIT – IV : BACK TRACKING & BRANCH AND BOUND	**(9 Periods)**
Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem-Graph Coloring-Articulation Points-Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem.	
UNIT – V : NP COMPLETENESS	**(9 Periods)**
Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees - P, NP and NP-Complete Problems-Coping with the Limitations - Approximation Algorithms for NP-Hard Problems - Knapsack Problem – Traveling Salesman Problem	

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

TEXT BOOKS:

1. *AnanyLevitin , **"Introduction to the Design and Analysis of Algorithms",** Pearson education, Thired edition 2014.*
2. *Michael T. Good rich, Roberto Tamassia, **"Algorithm Design: Foundations Analysis and Internet Examples",** Second Edition Wiley India, Reprint 2008.*

REFERENCE BOOKS:

1. *Thomas H. Cormen Charles E. Leiserson Ronald L. Rivest Clifford Stein,* ***"Introduction to Algorithms",*** *Third edition The MIT press 2009*
2. *Jon Kleinberg and Eva Tardos,* ***"Algorithm Design",*** *Pearson new international edition 2013.*
3. *Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "***Data Structures and Algorithms***", Pearson Education, Reprint 2000.*

COURSE OUTCOMES:

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

CO1: Compare the complexity of algorithms in problem solving process. **[Analyze]**

CO2: Apply Brute Force and Divide and Conquer Strategy **[Analyze]**

CO3: Analyze asymptotic runtime complexity of dynamic programming and Greedy algorithms.**[Analyze]**

CO4: Analyze asymptotic runtime complexity of branch & bound and Backtracking. **[Understand]**

CO5: Apply algorithms to solve a problem Coping with the Limitations of Algorithmic power.**[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H	L	L	L		L		L	L	H	L
CO2	H	H	H	H	L	L	L		L		L	L	H	L
CO3	H	H	H	H	L	L	L		L		L	L	H	L
CO4	H	H	H	H	L	L	L		L		L	L	H	L
CO5	H	H	H	H	L	L	L		L		L	L	H	L
18IPC 504	H	H	H	H	L	L	L		L		L	L	H	L

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

18IPC507	**DATA COMMUNICATION AND NETWORKING LABORATORY**	**SEMESTER: V**

PRE-REQUISITES: **Category: PC**

NIL

L	**T**	**P**	**C**
0	0	3	1.5

COURSE OBJECTIVES:

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

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

LIST OF EXPERIMENTS

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

Contact Periods:

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

COURSE OUTCOMES:

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

CO1: Implement various protocols using TCP and UDP. **[Understand]**

CO2: Compare the performance of different transport layer protocols. **[Analyze]**

CO3: Usesimulation tools to analyze the performance of various network protocols. **[Understand]**

CO4: Analyze various routing algorithms. **[Analyze]**

CO5: Implement error correction codes. **[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	M	L	L	L	L	L	H	H	L
CO2	H	H	H	H	H	M	L	L	L	L	L	H	H	L
CO3	H	H	H	H	H	M	L	L	L	L	L	H	H	L
CO4	H	H	H	H	H	M	L	L	L	L	L	H	H	L
CO5	H	H	H	H	H	M	L	L	L	L	L	H	H	L
18IPC 507	H	H	H	H	H	M	L	L	L	L	L	H	H	L

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

18IEE508	**WEB TECHNOLOGY AND APPLICATION DEVELOPMENT LABORATORY**	**SEMESTER: V**

PRE-REQUISITES: **Category: EEC**

NIL

L	T	P	C
0	0	4	2

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
- Designing User interface of an application and Connectivity of front end and back end.
- Designing multithreaded application and Creating alerts in mobile application.

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/JSP
5. Application to demonstrate cookies and session management.
6. Database connectivity using Servlet and JSP/PHP
7. Form validation using AJAX.
8. Displaying an XML document from server in the form of HTML table in client side.
9. Develop an application that makes use of database
10. Implement an application that implements Multi threading
11. Develop a mobile application that use GPS location information
12. Implement mobile application that writes data to the SD card
13. Implement mobile application that creates an alert upon receiving a message

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

COURSE OUTCOMES:

Upon completion of the course, the student 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]**
CO6: Develop mobile application with features like User Interface, Back end Connectivity, Multi threading and users alert. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H				M							L	L	
CO2	H	M	M		M						L	L	H	L
CO3	H	M	M		M						L	L	H	L
CO4	H	L			L							L	M	
CO5	H		M		M							L	M	
CO6	H	H	H		H				M	M	M	L	H	L
18IEE 508	H	M	M		M						L	L	M	L

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

18IPC601	**FUNDAMENTALS OF MACHINE LEARNING**	**SEMESTER:VI**

PRE-REQUISITES: **Category: PC**

1. 18IBS301 – Probability Theory and Applied Statistics

L	T	P	C
3	0	0	3

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)**
Introduction- Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning: Classification and Regression Trees, Support vector machines - Model Selection and feature selection – Decision trees-Ensemble methods :Bagging - Boosting - Real-world applications.	
UNIT – II : UNSUPERVISED LEARNING	**(9 Periods)**
Unsupervised learning : Clustering, Instance-based learning- K-nearest Neighbor, Locally weighted regression, Radial Basis Function - EM- Mixtures of Gaussians-The Curse of Dimensionality-Dimensionality Reduction -Factor analysis -Principal Component Analysis -Probabilistic PCA-Independent components analysis.	
UNIT – III : PROBABILISTIC GRAPHICAL MODELS	**(9 Periods)**
Graphical Models -Undirected graphical models-Markov Random Fields -Directed Graphical Models -Bayesian Networks -Conditional independence properties -Inference –Learning-Generalization -Hidden Markov Models – Machine learning tools – R,Scikit Learn, Octave, BigML, WEKA.	
UNIT – IV : REINFORCEMENT LEARNING	**(9 Periods)**
Reinforcement Learning – Introduction -Elements of Reinforcement Learning – Learning Task – Q-learning – k-armed Bandit Elements – Model-Based learning – Value Iteration – Policy iteration – Temporal Difference Learning - Exploration Strategies – non-deterministic rewards and actions.	
UNIT – V : ADVANCED LEARNING	**(9 Periods)**
Introduction to learning theory - Modeling structured outputs: multi-label classification, introduction to Conditional Random Fields (CRFs)- Spectral clustering- Semi-supervised learning - Recommendation systems - Active Learning - Learning from streaming data, online-learning - Deep learning.	

Contact Periods:

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

TEXT BOOKS:

1. *Tom Mitchell, "**Machine Learning**", McGraw-Hill, 1997.*

REFERENCE BOOKS:

1. *Christopher Bishop,* ***"Pattern Recognition and Machine Learning",*** *Springer, 2016.*
2. *Trevor Hastie, Robert Tibshirani, Jerome Friedman,* ***"The Elements of Statistical Learning"****, Springer, Second Edition, 2013.*

COURSE OUTCOMES:

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

CO1: Design a neural network for an application of your choice. **[Analyze]**

CO2: Implement supervised learning algorithms for an application of your choice. **[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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IPC 601	H	H	H	H	L	L	L	L	L	L	L	L	M	M

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

18IPC602	**SOFTWARE ENGINEERING**	**SEMESTER:VI**

PRE-REQUISITES: **Category: PC**

NIL

L	**T**	**P**	**C**
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",*** *Eighth Edition , McGraw Hill, 2015.*
2. *Ian Sommerville ,* ***"Software Engineering",*** *9th Edition, Pearson Education Asia, 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”,*** *Fourth Edition, Pearson Education, 2010.*
4. *Pankaj Jalote,* ***“An Integrated Approach to Software Engineering”,*** *Third Edition, Narosa publications, 2011.*

COURSE OUTCOMES:

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

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

CO2: Elicit requirements and modelling. **[Usage]**

CO3: Apply design processes for architectural, component, user interface, pattern based and Web /Mobile Apps. **[Usage]**

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

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

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L	M	L	L	L	L	L	L	L	L	L	M	L
CO2	L	H	L	H	L	H	L	L	L	L	L	L	M	L
CO3	H	L	M	L	H	L	L	L	L	L	L	L	M	L
CO4	H	L	L	L	L	L	L	L	H	L	H	L	M	M
CO5	L	M	L	H	L	H	L	L	H	L	L	L	M	M
18IPC 602	H	M	M	M	M	M	L	L	M	L	L	L	M	M

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

18IPC603	**FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING**	**SEMESTER:VI**

PRE-REQUISITES: **Category: PC**

NIL

L	**T**	**P**	**C**
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.
- Multi rate signal processing 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 – Efficient Computation of DFT – FFT Algorithms – Radix-2 and Radix-4 FFT Algorithms – Decimation in Time – Decimation in Frequency – Application of FFT algorithms.	
UNIT – III : 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. Realization of FIR filters – Linear phase, Traversal structures.	
UNIT – IV : IIR FILTERS	**(9 Periods)**
Design of analog Butterworth and Chebyshev Filters – Frequency transformation in analog domain Design of IIR digital filters - Impulse invariance techniques, Bilinear transformation – Realization of IIR filters - Direct, cascade and parallel forms.	
UNIT – V : MULTI-RATE SIGNAL PROCESSING & APPLICATION	**(9 Periods)**
Introduction to Multi-rate signal processing-Decimation –Interpolation –multistage implementation-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 the course, the student 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: Design FIR filter. **[Analyze]**

CO4: Design IIR filter. **[Analyze]**

CO5: Understand the concepts Multi rate signal processing. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IPC 603	M	H	M		L		H				M		M	M

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

18IVL607	**MACHINE LEARNING LABORATORY**	**SEMESTER:VI**

PRE-REQUISITES: **Category: PC**

NIL

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

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

- The concepts of machine learning.
- Supervised and unsupervised learning and their applications.
- The theoretical and practical aspects of Probabilistic Graphical Models.
- The concepts and algorithms of reinforcement learning.
- The aspects of computational learning theory.

LIST OF EXPERIMENTS
1. Linear Regression 2. Probabilistic Model 3. Decision tree Classification 4. K-means Clustering 5. Support vector machines 6. Ensemble methods 7. Reinforcement Learning 8. Multi layer Perceptron

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

COURSE OUTCOMES:

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

CO1: Classify using Linear Regression. **[Usage]**

CO2: Implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results. **[Assessment]**

CO3: Implement Classification algorithms. **[Usage]**

CO4: Implement Clustering algorithms**. [Assessment]**

CO5: Identify applications suitable for different types of machine learning with suitable justification. **[Assessment]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	M	M	L	L	L	L	L	L	L	M	M
CO2	M	M	H	M	M	L	L	L	L	L	L	L	M	M
CO3	M	M	M	M	H	L	L	L	L	L	L	L	M	M
CO4	M	M	M	M	M	L	L	L	L	L	L	L	M	M
CO5	M	M	M	M	H	L	L	L	L	L	L	L	M	M
18IVL 607	**H**	**M**	**M**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**M**	**M**

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

18IEE608	**OPEN SOURCE AND TOOLS LABORATORY**	**SEMESTER: VI**

PRE-REQUISITES: **Category: EEC**

NIL

L	**T**	**P**	**C**
0	0	3	1.5

COURSE OBJECTIVES:

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

- Python basic types, controls, functions and data structures.
- Virtualization concept.
- Python apps
- Visualization of data

LIST OF EXPERIMENTS

1. Python basic types and control flow statements
2. Python functions and Data Structures(List, Dictionary and Tuples) and Modules
3. String formatting, file I/O, errors, exceptions and exception handling, access MySQL databases from Python
4. Build simple Python apps.
5. Create widgets using GTK+ and call backs
6. Virtualization- Install and run a guest OS within Qemu/ XEN
7. Transfer files between the host and the guest.
8. Utilization of Numpy packages, visualization of data, statistical package(ploty)
9. Openstack/Eucalyptus implementation, Restful webservices
10. Mini project

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to,
CO1: Implement basics of python programming. **[Analyze]**
CO2: Implement python data structure and handle exceptions. **[Analyze]**
CO3: Develop python apps and xen virtualization. **[Analyze]**
CO4: Utilize visualization and statistical packages. **[Analyze]**
CO5: work with Openstack/Eucalyptus/ Restful webservices. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	M	M	L		M					L	M	L
CO2	H	H	M	L	L		L					L	M	L
CO3	H	H	M	L	L		M					L	M	L
CO4	H	H	M	L	L		L					L	M	L
CO5	H	H	M	M	M		L					L	M	L
18IEE 608	**H**	**H**	**M**	**M**	**M**		**M**					**L**	**M**	**L**

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

18IHS701	**PROFESSIONAL ETHICS** *(Common to Mech, EEE, ECE, EIE & IT)*	**SEMESTER:VII**

PRE-REQUISITES: **Category: HS**

NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To possess knowledge on ethics, safety, rights, responsibilities and global issues on engineering and technology.

UNIT I : **ENGINEERING ETHICS**	**(9 Periods)**
Senses of 'Engineering Ethics' - Variety of moral issued - Types of inquiry - Moral dilemmas - Moral autonomy - Kohlberg's theory - Gilligan's theory - Consensus and controversy – Models of Professional Roles - Theories about right action - Self-interest - Customs and religion - Uses of ethical theories.	
UNIT II : ENGINEERING AS SOCIAL EXPERIMENTATION	**(9 Periods)**
Engineering as experimentation - Engineers as responsible experimenters - Codes of ethics - A balanced outlook on law - The challenger case study.	
UNIT III : **SAFETY**	**(9 Periods)**
Safety and risk - Assessment of safety and risk - Risk benefit analysis and reducing risk - The three mile island and chernobyl case studies.	
UNIT IV : **RESPONSIBILITIES AND RIGHTS**	**(9 Periods)**
Collegiality and loyalty - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Professional rights - Employee rights - Intellectual Property Rights (IPR) - Discrimination.	
UNIT V : GLOBAL ISSUES	**(9 Periods)**
Multinational corporations - Environmental ethics - Computer ethics - Weapons development - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership - Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers(IETE)(India).	

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

TEXT BOOKS:

1. *Charles E. Harris, Michael S. Pritchard and Michael J. Rabins,* ***"Engineering Ethics – Concepts and Cases",*** *Cengage Learning, 2009*
2. *Mike Martin and Roland Schinzinger* ***"Ethics in Engineering"*** *McGraw-Hill, New York 1996*
3. *Govindarajan M, Natarajan S, Senthil Kumar V. S "****Engineering Ethics****" Prentice Hall of India, New Delhi, 2004*

REFERENCE BOOKS:

1. *Charles D. Fleddermann,* ***"Engineering Ethics",*** *Pearson Education / Prentice Hall, New Jersey,2004 (Indian Reprint)*
2. *Charles E Harris, Michael S. Protchard and Michael J Rabins, "****Engineering Ethics– Concepts and Cases****", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available).*
3. *John R Boatright, "****Ethics and the Conduct of Business****", Pearson Education, New Delhi, 2003*
4. *Edmund G Seebauer and Robert L Barry, "****Fundamentals of Ethics for Scientists and Engineers****", Oxford University Press, Oxford, 2001*

COURSE OUTCOME:

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

CO1: Recognize the theories and principles of professional ethics.

CO2: Understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories..

CO3: Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.

CO4: Analysis of safety and risk benefit analysis.

CO5: Acquire knowledge on professional rights and responsibilities of an engineer.

CO6: Outline the global issues and codes of ethics.

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	M	M	L	H	L	L	M	M	H	M
CO2	H	M	M	L	M	L	L	M	H	L	L	H	M	M
CO3	H	M	M	L	M	H	M	H	L	M	M	L	M	H
CO4	H	H	M	M	M	M	M	L	L	M	M	H	L	H
CO5	H	M	M	M	M	M	M	M	L	L	H	M	M	L
CO6	H	M	M	H	L	M	L	H	L	M	M	H	M	M
18IHS 701	H	M	M	M	M	M	M	M	L	M	M	H	M	M

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

18IPC702	CRYPTOGRAPHY AND NETWORK SECURITY	SEMESTER: VII

PRE-REQUISITES: **Category: PC**

18IBS301- Probability Theory and Applied Statistics

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, 7th edition William stallings,2017.*
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 the course, the student will be able to,

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

CO2: Apply number theory to perform encryption and decryption **[Analyse]**

CO3: Apply principles and algorithms of public key cryptosystems **[Analyse]**

CO4: Apply the concepts of Authentication and key management schemes. **[Analyse]**

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

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	H	H	M	M	L	M			L	M	H	M
CO2	M	H	H	H	M	M	L	M			L	M	H	M
CO3	M	H	H	H	M	M	L	M			L	M	H	M
CO4	M	H	H	H	M	M	L	M			L	M	H	M
CO5	M	H	H	H	M	M	L	M			L	M	H	M
18IPC 702	M	H	H	H	M	M	L	M			L	M	H	M

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

18IPC703	**INTERNET OF THINGS AND ITS APPLICATIONS**	**SEMESTER:VII**

PRE-REQUISITES: **Category: PC**

NIL

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

COURSE OBJECTIVES:

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

- Smart Objects and IoT Architectures
- Various IOT-related protocols
- Simple IoT Systems using Arduino and Raspberry Pi
- Data analytics and cloud in the context of IoT
- IoT infrastructure for popular applications

UNIT – I : FUNDAMENTALS OF IoT	**(9 Periods)**
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.	
UNIT – II : IoT PROTOCOLS	**(9 Periods)**
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.	
UNIT – III : DESIGN AND DEVELOPMENT	**(9 Periods)**
Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.	
UNIT – IV : DATA ANALYTICS AND SUPPORTING SERVICES	**(9 Periods)**
Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.	
UNIT – V : CASE STUDIES/INDUSTRIAL APPLICATIONS	**(9 Periods)**
Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.	

Contact Periods:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

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

CO1: Explain the concept of IoT. **[Understand]**

CO2: Analyze various protocols for IoT**. [Analyze]**

CO3: Design IoT system using Rasperry Pi/Arduino. **[Analyze]**

CO4: Apply data analytics and use cloud offerings related to IoT. **[Analyze]**

CO5: Analyze applications of IoT in real time scenario. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H					M	M						M	L
CO2	H		M	M		L							M	
CO3	H	L	M	M	H	L	M						H	L
CO4	H	L	M	M	H	L							H	
CO5	H	L	M	M		L	L						H	L
18IPC 703	H	L	H	H	M	M	L						H	L

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

18IPC707	**INTERNET OF THINGS LABORATORY**	**SEMESTER:VII**

PRE-REQUISITES: **Category: PC**

1. 18IES302 - Digital Logic Design
2. 18IES304 – Basics of Microprocessors and Microcontroller
3. 18IPC403 - Computer Organization and Architecture

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

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

- Architecture of arduino and raspberry pi.
- Interfacing of microcontrollers with various sensors
- Interfacing of microcontroller to control various electrical and electronic devices
- Interfacing of communication modules with microcontrollers
- Building IoT application**s**.

LIST OF EXPERIMENTS

1. Study of arduino and raspberry pi.
2. Interfacing with temperature sensor
3. Interfacing with light sensor
4. Led brightness control based on ambience light
5. Display text message in LCD.
6. Interfacing 7 segment display
7. Experiments based on various sensors.
8. Interfacing GSM module
9. Interfacing Bluetooth module
10. Building home automation system using IoT

Contact Periods:

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

COURSE OUTCOMES:

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

CO1: Identify the suitable microcontroller for their applications [**Familiarize]**

CO2: Build applications to collect data from the environment**[Analyse]**

CO3: Build applications to control electronic and electrical devices**.[Analyze]**

CO4: Interface communication modules with microcontrollers**[Analyse]**

CO5: Build IoT based applications. **[Analyse]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H												L	L
CO2	H	M	M	M	M	L	L	L	L	L	L	L	M	M
CO3	H	M	M	M	M	L	L	L	L	L	L	L	L	M
CO4	H	M	M	M	M	L	L	L	L	L	L	L	L	M
CO5	H	M	M	M	M	L	L	L	L	L	L	L	L	M
18IPC 707	H	M	M	M	M	L	L	L	L	L	L	L	M	M

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

18IEE708	**MINI PROJECT**	**SEMESTER:VII**

PRE-REQUISITES: **Category: EEC**

NIL

L	**T**	**P**	**C**
0	0	8	4

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.

COURSE OUTCOMES:

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

CO1: Analyze and identify inter and intra disciplinary problems linked with society. **[Analyze]**

CO2: Perform exhaustive literature survey on identified problem.**[Understand]**

CO3: Design and implement the system using appropriate tools and techniques.**[Analyze]**

CO4: Work effectively as a team to achieve overall project/product objective.**[Analyze]**

CO5: Develop and deliver a good quality product presentation and technical documentation. **[Analyze]**

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 120 Periods** **Total: 120 Periods**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IEE 708	H	H	H	H	H	M	H	M	M	H	H	M	H	H

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

18IEE801	**PROJECT WORK**	**SEMESTER:VIII**

PRE-REQUISITES: **Category: EEC**

NIL

L	T	P	C
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.

COURSE OUTCOMES:

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

CO1: Analyze and identify inter and intra disciplinary problems linked with society.**[Analyze]**

CO2: Perform exhaustive literature survey on identified problem.**[Understand]**

CO3: Design and implement the system using appropriate tools and techniques.**[Analyze]**

CO4: Work effectively as a team to achieve overall project/product objective.**[Analyze]**

CO5: Develop and deliver a good quality product presentation and technical documentation. **[Analyze]**

Contact Periods:

Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 240 Periods** **Total: 240 Periods**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IEE 801	H	H	H	H	H	M	H	M	M	H	H	M	H	H

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

18IPE$01 DATA MINING AND DATA WAREHOUSING

PRE-REQUISITES: **Category: PE**

18IPC404 – Database Design and Management

L	T	P	C
3	0	0	3

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 complex data mining.

UNIT – I : DATA MINING	**(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)**
Data Mining Applications - Social Impacts of Data Mining - Graph Mining – Mining Complex Data Types – Spatial Data Mining – Multimedia Data Mining– Text Mining – Mining the world wide web.	

Contact Periods:

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

TEXT BOOKS:

1. *Jiewei Han, Micheline Kamber,* ***"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 the course, the student 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:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	H	M	H	L					L		H	L
CO2	M	H	H	M	H	L					L		H	L
CO3	M	H	H	L	M	L	L				L		H	L
CO4	M	H	H	M	H	L	L				L		H	L
CO5	M	M	H	H	H	L					L		H	L
18IPE $01	M	H	H	M	H	L	L				L		H	L

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

18IPE$02	WIRELESS SENSOR NETWORKS

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Gain basic knowledge on requirements, technologies and applications of sensor networks and differentiate sensor and mobile ad-hoc networks.
- Acquire knowledge on Single-Node Architecture and Network Architecture
- Learn about the MAC protocols used in networking of sensors
- Gain knowledge on topology and functioning of sensor network
- Gain knowledge on software and hardware platforms for establishing sensor

UNIT – I : OVERVIEW OF WIRELESS SENSOR NETWORKS	**(9 Periods)**
Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- Enabling Technologies for Wireless Sensor Networks.	
UNIT – II : ARCHITECTURES	**(9 Periods)**
Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.	
UNIT – III : NETWORKING OF SENSORS	**(9 Periods)**
Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.	
UNIT – IV : INFRASTRUCTURE ESTABLISHMENT	**(9 Periods)**
Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.	
UNIT – V : SENSOR NETWORK PLATFORMS AND TOOLS	**(9 Periods)**
Operating Systems for Wireless Sensor Networks, Sensor Node Hardware-Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.	

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

TEXT BOOKS:

1. *Holger Karl, Andreas Willig,* ***"Protocols and Architectures for Wireless Sensor Networks",*** *John Wiley, 2007.*

REFERENCE BOOKS:

1. *Feng Zhao & Leonidas J. Guibas,* ***"Wireless Sensor Networks- An Information Processing Approach",*** *Elsevier-Morgan Kaufmann, 2004.*
2. *Kazem Sohraby, Daniel ivlinoli & TaiebZnati,* ***"Wireless Sensor Networks-Technology, Protocols and Applications",*** *John Wiley, 2007.*
3. *Anna Hac,* ***"Wireless Sensor Network Designs",*** *John Wiley, 2003.*
4. *BhaskarKrishnamachari,* ***"Networking Wireless Sensors",*** *Cambridge Press, 2005*

COURSE OUTCOMES:

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

CO1: Differentiate mobile adhoc and sensor networks with respect to their characteristics and technologies used. **[Familiarize]**

CO2: Compare and analyze the performance of Single-Node and Network Architectures. **[Understand]**

CO3: Design and manage network of sensors using wireless networking protocols like Mediation Device protocol, addressing schemes and routing techniques. [**Analyse]**

CO4: Explain how topology, Clustering, Time Synchronizing, Localization and Positioning techniques are used to effectively establish the sensor network. **[Familiarize]**

CO5: Simulate wireless sensor network using Node-level Simulators and State-centric programming. **[Analyse]**

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	H	L
CO2	M	H	M							M		L	M	L
CO3	H	M	M							L		L	L	L
CO4	H	H	M							M		M	H	M
CO5	M	M	M							L		L	M	L
18IPE $02	H	H	M							M		L	M	L

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

18IPE$03	**SOFTWARE TESTING**

PRE-REQUISITES: **Category: PE**

NIL

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

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 Smarter 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 effect graphing-error guessing- compatibility testing- user documentation testing- Domain testing Using White–Box Approach to Test 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 Test- The Test Harness- Running the Unit tests and Recording results- Integration tests- 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, 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, 2012.*
4. *Ron Patton,* ***"Software Testing",*** *Second Edition, Sams Publishing, Pearson Education, 2004.*
5. *Aditya P. Mathur,* ***"Foundations of Software Testing – Fundamental algorithms and techniques",*** *Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2011.*

COURSE OUTCOMES:

Upon completion of the course, the student 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								H	
CO4	L	M	M	L							L		H	L
CO5	M	H	H	M	M	L		L		M	H		H	M
18IPE $03	M	M	M	L	H	L		L		L	L		H	L

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

18IPE$04 SOFTWARE PROJECT MANAGEMENT

PRE-REQUISITES: **Category: PE**

1. 18IPC602 – Software Engineering

L	T	P	C
3	0	0	3

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 (CRM) 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 – Managing contracts – 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"**, Fifth Edition, Tata McGraw Hill, 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, 2006.
2. Rishabh Anand*,**"Software Project Management A Process Driven Approach",*** S.K. Kataria & Sons, 2016.
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 the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M		H			H						L	M	L
CO2		M		H								M	M	M
CO3	H		H	H					H			M	H	M
CO4		L								H	H	H	L	M
CO5	H		L	M								H	M	H
18IPE $04	H	M	H	H		L			L	L	L	H	H	L

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

18IPE$05	**SOFTWARE QUALITY ASSURANCE**

PRE-REQUISITES: **Category: PE**

1. 18IPC602 – Software Engineering

L	**T**	**P**	**C**
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 - McCall‟s 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 – Reviews – Software Testing – Software Testing implementations – 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, 1997.*
3. *Gordon G Schulmeyer,* ***"Handbook of Software Quality Assurance",*** *Third Edition, Artech House Publishers 2007.*
4. *Nina S Godbole,* ***"Software Quality Assurance: Principles and Practice",*** *Alpha Science International, Ltd, 2004.*

COURSE OUTCOMES:

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

CO1: Utilize the 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: Demonstrate their capability to adopt quality standards. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M		H		H								H	
CO2	H	H	H		H			L			H		L	H
CO3													M	
CO4	M		H						H				H	H
CO5	H		M	M						H			M	H
18IPE $05	M	H	H	M	H			L	H	H	H		H	H

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

18IPE$06	ENTERPRISE RESOURCE PLANNING

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

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)**
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, Second Edition, 2008.*

REFERENCE BOOKS:

1. *Vinod Kumar Garg, N. K. Venkitakrishnan,* ***"Enterprise Resource Planning: Concepts and Practice"****, PHI Learning private limited, Second 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 the course, the student will be able to,

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

CO2: Apply ERP technologies like supply chain management, advanced planning systems, Product data management in E-business **[Usage]**

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 in ERP [**Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			H		M	H							H	
CO2	M		H	M	H			L			H			L
CO3		H			H								H	H
CO4	M		H		H								M	H
CO5	H	H	H		H									H
18IPE $06	M	H	H	M	H	H		L			H		H	H

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

18IPE$07	**INTELLECTUAL PROPERTY RIGHTS**

PRE-REQUISITES: **Category: PE**

NIL

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

COURSE OBJECTIVES:

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

- Types and importance of Intellectual Property Rights.
- Copyrights and Patent Laws.
- Trade secrets and unfair Competition.
- Patents and Digital Products and laws.
- Intellectual Property Development.

UNIT – I : INTRODUCTION AND TRADE MARKS	**(9 Periods)**
Introduction, Types of intellectual property, International organizations, Agencies and Treaties, Importance of Intellectual property rights - Purpose and function of trademarks, Acquisition of trade mark rights, Protectable matter, selecting, and evaluating trade mark, trade mark registration processes.	
UNIT – II : LAW OF COPY RIGHTS AND PATENTS	**(9 Periods)**
Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.	
UNIT – III : TRADE SECRETS AND UNFAIR COMPETITION	**(9 Periods)**
Trade secret law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation – Misappropriation right of publicity, false advertising.	
UNIT – IV : DIGITAL PRODUCTS AND LAWS	**(9 Periods)**
Patents for Digital Technologies – Copyrights in Digital Space – Copyright Act – Information Technology Act – WIPO treaties – Trademarks Online – Domain Names.	
UNIT – V : DEVELOPMENT OF INTELLECTUAL PROPERTY	**(9 Periods)**
New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.	

Contact Periods:

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

TEXT BOOKS:

1. *Deborah. E. Bouchoux,* ***"Intellectual property right",*** *The law of Trademarks, copy right patents and Trade secrets Cengage learning, 4th edition 2012.*
2. *V. Scople Vinod,* ***"Managing Intellectual Property: Strategic Imperative",*** *Prentice Hall of India pvt Ltd, 4th edition, 2014.*

REFERENCE BOOKS:

1. *Prabuddha ganguli, **"Intellectual property right – Unleashing the knowledge economy",** Tata McGraw Hill Publishing company ltd.*
2. *Derek Bosworth and Elizabeth Webster, **"The Management of Intellectual Property",** Edward Elgar Publishing Ltd., 2013.*

COURSE OUTCOMES:

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

CO1: Describe the importance of Intellectual Property Rights and Trademarks. **[Understand]**

CO2: Gain some basic knowledge about laws of Copyrights and patents. **[Analyze]**

CO3: Analyze the Trade secrets and unfair competition. **[Understand]**

CO4: Gain knowledge on Copyright and Patent laws for digital data. **[Understand]**

CO5: Develop products with Intellectual Property Rights. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	H	M	H		L	L	L	L	L	H	H	H
CO2	M	H	H	M	H	L	L	L	L	L	L	H	H	H
CO3	M	H	H	L	M		L	L	L	L	L	H	H	H
CO4	M	H	H	M	H		L	L	L	L	L	H	H	H
CO5	M	M	H	H	H		L	L	L	L	L	H	H	H
18IPE $07	M	H	H	M	H	L	L	L	L	L	L	H	H	H

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

18IPE$08	**INFORMATION RETRIEVAL**

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Basic knowledge of information retrieval.
- Query languages used in IR
- 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 : QUERY LANGUAGES	**(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: The Concepts andTechnology behind search",** ACM Press Books, 2nd edition, 2011.*

REFERENCE BOOKS:

1. *Chowdhury. G.G,* ***"Introduction to Modern Information Retrieval",*** *Neal-Schuman Publishers, 3rd edition, 2010.*
2. *Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze,* ***"Introduction to Information Retrieval",*** *Cambridge University Press. 2008.*
3. *David A. Grossman, Ophir Frieder,* ***"Information Retrieval: Algorithms and Heuristics",*** *springel, 2nd edition, 2004.*

COURSE OUTCOMES:

Upon completion of the course, the student 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
18IPE$08	H	H	H	H	M	L			M	M			H	M

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

18IPE$09	EMBEDDED SYSTEM

PRE-REQUISITES: **Category: PE**

18IPC403- Computer Organization and Architecture

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

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

UNIT – I : INTRODUCTION TO EMBEDDED SYSTEM	**(9 Periods)**
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. *Jiacun Wang, **"Real time embedded system"**, Willey**,** 2017.*
4. *Wayne Wolf, **"Computers as Components- Principles of Embedded Computer System Design",** Morgan Kaufmann Publisher, 2012.*
5. *MykePredko, **"Programming and Customizing the 8051 Microcontroller",** Tata McGraw Hill, 1999.*
6. *Tammy Noergaard, **"Embedded Systems Architecture",** Elsevier, 2013.*

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L	L	L	L		H					M	L	L
CO2	H	L	L	L	L		H					M	L	L
CO3	H	M	M	M	L		H					M	M	L
CO4	H	L	L	L	L		H					M	L	L
CO5	H	L	L	L	L		H					M	L	L
18IPE $09	H	L	L	L	L		H					M	M	L

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

18IPE$10	**CLOUD COMPUTING**

PRE-REQUISITES: **Category: PE**

18IPC507- Data Communication and Networking

L	T	P	C
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 virtualization concepts.
- Intensive computation in Cloud computing.
- Applications and management of cloud computing

UNIT – I : INTRODUCTION	**(9 Periods)**
Principles of Parallel and Distributed Computing - Eras of Computing - Parallel vs. Distributed Computing - Hardware Architectures 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 Environments-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 Ahead - Technologies for Data-Intensive Computing - Storage Systems - Programming - Introducing the MapReduce Programming Model-cloud Platforms in Industry - Amazon Web Services - Compute Services - Storage Services - Communication Services -Google AppEngine - 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. *Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi,* ***"Mastering Cloud Computing"****, Tata McGraw Hill Education Private Limited, 2013.*
2. *M.N. Rao,* ***"Cloud computing",*** *PH1Learning Private Limited, 2015.*

REFERENCE BOOKS:

1. *Nikos Antonopoulos, Lee Gillam,* ***"Cloud Computing: Principles, Systems and Applications",*** *Springer, 2012.*
2. *Rajkumar Buyya, James Broberg, Andrzej M. Goscinski,* ***"Cloud Computing: Principles and Paradigms",*** *Wiley - India, 2011.*
3. *Ronald L. Krutz, Russell Dean Vines,* ***"Cloud Security: A Comprehensive Guide to Secure Cloud Computing",*** *Wiley-India, 2010.*

COURSE OUTCOMES:

Upon completion of the course, the student 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 full and para virtualization. [**Understand**]

CO4: Design map reduce programming model. [**Analyze**]

CO5: List the applications of cloud. [**Understand**]

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L	M	M	L	L	M					L	M	L
CO2	M	L	M	M	L	L	M					L	M	L
CO3	M	L	M	M	L	L	M					L	M	L
CO4	M	L	M	M	L	L	M					L	M	L
CO5	M	L	M	M	L	L	M					L	M	L
18IPE $10	M	L	M	M	L	L	M					L	M	L

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

18IPE$11	ADVANCED DATA STRUCTURES

PRE-REQUISITES: **Category: PE**

18IPC305-Data Structures and Applications

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Basic data structures and analysis of algorithms
- Operations of priority queues
- Concepts of dictionary structures
- Multidimensional, spatial structures and Tries

UNIT – I : FUNDAMENTALS	**(9 Periods)**
Analysis of Algorithms: Operation Counts-Step Counts-Counting Cache Misses-Asymptotic Complexity-Recurrence EquationsBasic Structures:Arrays-Linked Lists-Stacks and Queues-Trees:Tree Representation-Binary Trees and Properties-Binary Tree Traversals-Threaded Binary Trees-Tournament Trees-Graphs:Graph Representations-Searching a Graph.	
UNIT – II : PRIORITY QUEUES	**(9 Periods)**
Leftist Trees:Height-Biased Leftist Trees-Weight-Biased Leftist Trees-Skew Heaps:Basics of Amortized Analysis-Meldable Priority Queues and Skew Heaps-Binomial, Fibonacci, and Pairing Heaps-Double-Ended Priority Queues:Definition and an Application-Symmetric Min-Max Heaps-Interval Heaps-Min-Max Heaps-Deaps-Meldable DEPQs	
UNIT – III : DICTIONARY STRUCTURES	**(9 Periods)**
Bloom Filter and Its Variants-Finger Search Trees-Randomized Dictionary Structures-Trees with Min Weighted Path Length.	
UNIT – IV : MULTIDIMENSIONAL AND SPATIAL STRUCTURES	**(9 Periods)**
Multidimensional Spatial Data Structures-Planar Straight Line Graphs-Interval, Segment, Range, Priority Search Trees-Quadtrees and Octtrees	
UNIT – V : MISCELLANEOUS DATA STRUCTURES	**(9 Periods)**
Tries-Suffix Trees and Suffix Arrays-String Searching-Binary Decision Diagrams- Persistent Data Structures	

Contact Periods:

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

TEXT BOOKS:

1. *Dinesh P. Mehta, Sartaj Sahni,* ***"Handbook of Data Structures and Applications",*** *Chapman & Hall/CRC Computer and Information Science Series, 2nd Edition, 2018.*

REFERENCE 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.*
3. *Michael T.Goodrich, R.Tamassia and Mount,* ***"Data structures and Algorithms in C++",*** *John Wiley and Sons, 2nd edition, 2011.*
4. *Peter Brass,* ***"Advanced Data Structures",*** *Cambridge University Press, 1st Edition,2008.*

COURSE OUTCOMES:

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

CO1: Implement basic data structures and analyze its complexity. **[Analyze]**

CO2: Insert, Delete and update elements in various priority queues. **[Understand]**

CO3: Implement different dictionary structures. **[Understand]**

CO4: Apply Multidimensional and Spatial DataStructures. **[Analyze**]

CO5: Apply appropriate data structure for String searching. **[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	L	L	M	L
CO2	H	H	L	M	L				L	L	L	L	H	L
CO3	H	M	L	M	L				L	L	L	L	M	M
CO4	H	H	L	M	L				L	L	M	L	H	M
CO5	H	H	H	H	L				L	L	M	L	H	M
18IPE $11	H	H	L	M	L				L	L	M	L	H	M

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

18IPE$12 FOUNDATIONS OF INFORMATION SECURITY

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
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 – Compromises to Intellectual Property- Deviations in QoS – Espionage or Trespass - Software Attacks – Technical Failures or Errors - Legal, Ethical and Professional Issues – Law and Ethics in Information Security – International Laws and Legal Bodies – Ethics and Information Security – Codes of Ethics and Professional Organizations.	
UNIT – III : PLANNING FOR SECURITY AND RISK MANAGEMENT	**(9 Periods)**
Information Security Planning and Governance – Blueprint for Security – Information Security Policy – Standards and Practices - Overview of Risk Management – Risk Identification – Risk Assessment – Risk Control Strategies – Quantitative Versus Qualitative Risk Control Practices – Risk Management Discussion Points.	
UNIT – IV : 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.	
UNIT – V : IMPLEMENTING INFORMATION SECURITY	**(9 Periods)**
Physical Security : Physical access Controls – Failure of supporting utilities and structural collapse – Interception of data – Securing Mobile and Portable Systems – Special considerations – Information Security project Management: Technical and Non Technical Aspects - Security Certification and Accreditation – Credentials for Information Security Professionals – Security maintenance Management Models – Digital Forensics.	

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, 2017.*

REFERENCE BOOKS:

1. *Micki Krause, Harold F. Tipton,* ***"Handbook of Information Security Management",*** *Vol 1-3 CRC Press LLC, 6th edition, 2012.*
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 the course, the student 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: Plan for security and Risk Management. **[Familiarize]**

CO4: Understand security techniques and tools. [**Understand]**

CO5: Understand implementation of information security and practices. **[Familiarize]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	L	L	L	L	L				M	H	M
CO2	H	H	H	L	L	L	L	L				M	H	M
CO3	H	H	H	L	L	L	L	L				M	H	M
CO4	H	H	H	L	L	L	L	L				M	H	M
CO5	H	H	H	L	L	L	L	L				H	H	H
18IPE $12	H	H	H	L	L	L	L	L				M	H	M

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

18IPE$13 DISTRIBUTED SYSTEMS

PRE-REQUISITES: **Category: PE**

18IPC406 – Operating System

L	T	P	C
3	0	0	3

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 : INTRODUCTION	**(9 Periods)**
Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.	
UNIT – II : COMMUNICATION IN DISTRIBUTED SYSTEM	**(9 Periods)**
System Model – Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI – Group communication – Publish-subscribe systems – Message queues – Shared memory approaches – Distributed objects – Case study: Enterprise Java Beans -from objects to components.	
UNIT – III : PEER TO PEER SERVICES AND FILE SYSTEM	**(9 Periods)**
Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry- Distributed File Systems –Introduction – File service architecture – Andrew File system. File System: Features-File model -File accessing models – File sharing semantics Naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.	
UNIT – IV : SYNCHRONIZATION AND REPLICATION	**(9 Periods)**
Introduction – Clocks, events and process states – Synchronizing physical clocks- Logical time and logical clocks – Global states – Coordination and Agreement – Introduction – Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic Commit protocols - Distributed deadlocks – Replication – Case study – Coda.	
UNIT – V : PROCESS & RESOURCE MANAGEMENT	**(9 Periods)**
Process Management: Process Migration: Features, Mechanism – Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.	

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

TEXT BOOKS:

1. *George Coulouris, Jean Dollimore and Tim Kindberg,* ***"Distributed Systems Concepts and Design",*** *Fifth Edition, Pearson Education, 2012.*
2. *Sunil kumar,* ***"Distributed systems: Design Concepts",*** *Alpha sciences, 2016.*

REFERENCE BOOKS:

1. *Pradeep K Sinha,* ***"Distributed Operating Systems: Concepts and Design",*** *Prentice Hall of India, 2007.*
2. *Tanenbaum A.S., Van Steen M.,* ***"Distributed Systems: Principles and Paradigms",*** *Pearson Education, 2007.*
3. *Liu M.L.,* ***"Distributed Computing, Principles and Applications",*** *Pearson Education, 2004.*
4. *Nancy A Lynch,* ***"Distributed Algorithms",*** *Morgan Kaufman Publishers, USA, 2003.*

COURSE OUTCOMES:

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

CO1: Discuss trends in Distributed Systems. **[Understand]**

CO2: Apply network virtualization. **[Analyze]**

CO3: Analyze different peer to peer services. **[Analyze]**

CO4: Identify concurrency control and deadlocks. **[Familiarize]**

CO5: Design process and resource management systems. **[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					L	H	L
CO2	H	H	H	H	H	L	L					L	H	L
CO3	H	M	H	M	H	L	L					L	H	L
CO4	H	M	L	L	L	L	L					L	M	L
CO5	H	H	H	H	H	L	L					L	H	L
18IPE $13	H	H	H	H	H	L	L					L	H	L

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

18IPE$14	**SOFT COMPUTING**

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Learn the various soft computing frame works
- Be familiar with design of various neural networks
- Be exposed to fuzzy logic
- Learn genetic programming
- Learn the Hybrid soft computing techniques and applications

UNIT – I : INTRODUCTION	**(9 Periods)**
Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models – important technologies – applications. Fuzzy logic: Introduction – crisp sets- fuzzy sets – crisp relations and fuzzy relations: cartesian product of relation – classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction – biological background – traditional optimization and search techniques – Genetic basic concepts.	
UNIT – II : NEURAL NETWORKS	**(9 Periods)**
McCulloch-Pitts neuron – linear separability – hebb network – supervised learning network: perceptron networks – adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network –unsupervised learning networks: Kohonenself organizing feature maps, LVQ – CP networks, ART network.	
UNIT – III : FUZZY LOGIC	**(9 Periods)**
Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic – extension principle – fuzzy measures – measures of fuzziness -fuzzy integrals – fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules- decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems- overview of fuzzy expert system-fuzzy decision making	
UNIT – IV : GENETIC ALGORITHM	**(9 Periods)**
Genetic algorithm and search space – general genetic algorithm – operators – Generational cycle – stopping condition – constraints – classification – genetic programming – multilevel optimization – real life problem- advances in GA.	
UNIT – V : HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS	**(9 Periods)**
Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.	

Contact Periods:

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

TEXT BOOKS:

1. *J.S.R.Jang, C.T. Sun and E.Mizutani,* ***"Neuro-Fuzzy and Soft Computing",*** *PHI / Pearson Education 2015.*
2. *S.N.Sivanandam and S.N.Deepa,* ***"Principles of Soft Computing",*** *Wiley India Pvt Ltd, 2011.*

REFERENCE BOOKS:

1. *S.Rajasekaran and G.A.VijayalakshmiPai,* ***"Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications",*** *Prentice-Hall of India Pvt. Ltd., 2006.*
2. *George J. Klir, Ute St. Clair, Bo Yuan,* ***"Fuzzy Set Theory: Foundations and Applications"*** *Prentice Hall, 1997.*
3. *David E. Goldberg,* ***"Genetic Algorithm in Search Optimization and Machine Learning",*** *Pearson Education India, 2013.*
4. *James A. Freeman, David M. Skapura,* ***"Neural Networks Algorithms, Applications, and Programming Techniques",*** *Pearson Education India, 1991.*
5. *Simon Haykin,* ***"Neural Networks Comprehensive Foundation",*** *Second Edition, Pearson Education, 2005.*

COURSE OUTCOMES:

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

CO1: Apply various soft computing frame works.**[Analyze]**

CO2: Design of various neural networks.**[Analyze]**

CO3: Use fuzzy logic.**[Analyze]**

CO4: Apply genetic programming.**[Analyze]**

CO5: Discuss hybrid soft computing.**[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	L					H	H	L
CO2	H	H	H	H	H	H	L					H	H	L
CO3	H	H	H	H	H	H	L					H	H	L
CO4	H	H	H	H	H	H	L					H	H	L
CO5	H	H	H	H	H	H	L					H	H	L
18IPE $14	H	H	H	H	H	H	L					H	H	L

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

18IPE$15	**XML AND WEB SERVICES**

PRE-REQUISITES: **Category: PE**

18IPC502 - Web Technology

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

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.*
2. *Martin kalin, **"Java Web Services: Up and Running"**, O'Reilly, 2014.*

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 the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M	H	M					L	L	H	L
CO2	H	H	H	H	H	L					L	L	H	L
CO3	H	M	H	M	H	L					L	L	H	L
CO4	H	M	L	L	L	L					L	L	M	L
CO5	H	H	H	H	H	L					L	L	H	L
18IPE $15	H	H	H	H	H	L					L	L	H	L

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

18IPE$16	SEMANTIC WEB

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

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, 3 rd Edition, 2012.*
2. *Dean Allemang and James Hendler, "****Semantic Web for the Working Ontologist, Effective Modeling in RDFS and OWL",*** *Morgan Kaufmann, 2 nd 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 the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IPE $16	M	M	M	M	M	L	M	M	L	L	L		M	L

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

18IPE$17	SERVICE ORIENTED ARCHITECTURE

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

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 : SOA BASICS	**(9 Periods)**
Service Oriented Architecture (SOA) – Comparing SOA with Client-Server and Distributed architectures - Characteristics of SOA – Benefits of SOA -- Principles of Service orientation – Service layers - Business Process management	
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, 2016.*

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.*

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	M	H	M	L	M	M	L	L	L	L	M	L
CO2	M	H	M	M	M	L	M	M	L	L	L	L	M	L
CO3	M	H	M	M	M	L	M	M	L	L	L	L	M	L
CO4	M	H	M	H	M	L	M	M	L	L	L	L	M	L
CO5	M	H	M	H	M	L	M	M	L	L	L	L	M	L
18IPE $17	M	H	M	H	M	L	M	M	L	L	L	L	M	L

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

18IPE$18 VIRTUALIZATION TECHNIQUES

PRE-REQUISITES: **Category: PE**

1. 18IPC406-Operating Systems
2. 18IPC503- Data Communication and Networking

L	T	P	C
3	0	0	3

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- 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- lab requirement – 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. *Matthew portnoy,* ***"Virtualization Essentials",*** *SYBEX (Wiley Brand) 2nd Edition, 2016.*
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. *Danielle Ruest, Nelson Ruest, **"Virtualization: A Beginner's Guide"**, McGraw-Hill, 2009.*
2. *Nigel Cain, Alvin Morales, Michel Luescher, Damian Flynn Mitch Tulloch, **"Microsoft System Center -Building a virtualized Network Solutio"**, Microsoft press, 2004.*
3. *Matthew Portney, **"Virtualization Essentials"**, John Wiley & Sons, 2012.*
4. *Tim cerfing, Jeff buller, Chuck Enstall, Richard Ruiz, **"Mastering Microsoft Virtualization"**, Wiley Publication, 2010.*
5. *William Von Hagen ,**"Professional Xen Virtualization"**, Wiley publication, 2008.*
6. *Cody Bunch, **"Automating vSphere with VMware vCenter Orchestrator: Technology Hands-on"**, Pearson Education, 2012.*

COURSE OUTCOMES:

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

CO1: Identify the need of virtualization.

CO2: Use virtualization infrastructure.

CO3: Create OS level virtualization.

CO4: Identify storage level virtualization.

CO5: Analyze network level virtualization.

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IPE $18	M	H	M	H	M	L	M	M					M	L

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

18IPE$19	FUNDAMENTALS OF AUTOMATA THEORY

PRE-REQUISITES: **Category: PE**

1. 18IBS402- Elements of discrete structures

L	T	P	C
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- NFA,DFA Conversions	
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 – Non 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.*
4. *Peter Linz,* ***"An Introduction to Formal Languages and Automata*** *", Jones & Bartlett Learning,6th Edition, 2016.*

COURSE OUTCOMES:

Upon completion of the course, the student 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:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	L	L	L	L	L	L	L	L	M	L	M	L
CO2	H	H	L	L	L	L	L	L	L	L	M	L	M	L
CO3	H	H	L	L	M	L	L	L	L	L	M	L	M	L
CO4	H	H	M	M	H	L	L	L	L	L	M	L	H	L
CO5	L	M	L	M	M	L	L	L	L	L	M	L	M	L
18IPE $19	L	M	L	M	M	L	L	L	L	L	M	L	M	L

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

18IPE$20	**VIRTUAL AND AUGMENTED REALITY**

PRE-REQUISITES: **Category: PE**

NIL

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

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.*
4. *Jon Peddie,* ***"Augmented Reality",*** *where we will all live, sprnget, 2017.*
5. *Johb Bucher,* ***"Stongtelling for virtual reality : Methods and principles for crafting immersive narratives",*** *Focal Press Book 2018.*

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H		M		L	L	L			L	L	L	M	L
CO2	H	H	H	M	L					L	L	L	H	L
CO3	H					M	L			L	L	L	L	L
CO4	H		M		L	L	L			L	L	L	M	L
CO5	H	M	H	L	L	L	L			L	L	L	M	L
18IPE $20	H	L	M	L	L	L	L			L	L	L	M	L

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

18IPE$21	**INTRODUCTION TO NATURAL LANGUAGE PROCESSING**

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
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 ANALYSIS	**(9 Periods)**
Regular Expressions – Finite State Automata – Morphological Parsing – Spelling Error Detection and correction – Words and Word classes – Part of Speech Tagging.	
UNIT – III : SYNTACTIC ANALYSIS	**(9 Periods)**
Context Free Grammar – Constituency – Parsing – Probabilistic Parsing - Indian Languages.	
UNIT – IV : SEMANTIC ANALYSIS AND DISCOURSE PROCESSING	**(9 Periods)**
Meaning Representation – Lexical Semantics – Ambiguity – Word Sense Disambiguation – Cohesion – Reference Resolution – Discourse Coherence and Structure.	
UNIT – V : 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.	

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, 2 nd edition, 2008.*
2. *James Allen,* ***"Natural Language Understanding",*** *Benjamin/Cummings publishing company, 2 nd edition, 1995.*

COURSE OUTCOMES:

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

CO1: Explain the basic concepts of Natural Language. **[Understand]**

CO2: Analyze the Natural Language text. **[Analyze]**

CO3: Analyze the Natural Language text at syntax level. **[Analyze]**

CO4: Generate the Natural Language. **[Familiarize]**
CO5: Do Machine Translation. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IPE $21	H	M	H	M	H		M	L		M			M	M

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

18IPE$22	ARTIFICIAL INTELLIGENCE AND APPLICATIONS

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
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
- Uncertain Knowledge 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 is 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",*** *Third Edition, Pearson Education / Prentice Hall of India, 2009.*
2. *Elaine Rich and Kevin Knight****, "Artificial Intelligence",*** *Third Edition, Tata McGraw-Hill, 2010.*

REFERENCE BOOKS:

1. *Nils J Nilsson, **"Artificial Intelligence – A New Synthesis",** Morgan Kaufmann, New Delhi, 2007.*
2. *Mishra R B, **"Artificial Intelligence",** PHI Learning Pvt. Ltd., New Delhi, 2011.*
3. *Dan W Patterson, **"Introduction to Artificial Intelligence and Expert Systems",** PHI Learning Pvt. Ltd., New Delhi, 2010.*
4. *Deepak Khemani, **"Artificial Intelligence",** Tata Mc Graw Hill Education 2013.*

COURSE OUTCOMES:

Upon completion of the course, the student 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 knowledge and applications of AI. **[Familiarize]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			H		M	H							H	
CO2	M		H	M	H			L			H			L
CO3		H			H								H	H
CO4	M		H		H								M	H
CO5	H	H	H		H									H
18IPE $22	M	H	H	M	H	H		L			H		H	H

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

18IPE$23	MOBILE COMPUTING

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Understand the basic concepts of mobile computing
- Be familiar with the network protocol stack
- Learn the basics of mobile telecommunication system
- Be exposed to Ad-Hoc networks
- Gain knowledge about different mobile platforms and application development

UNIT – I : INTRODUCTION	**(9 Periods)**
Mobile Computing – 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 PROTOCOL AND TRANSPORT	**(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)**
Ad-Hoc 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 – Special Constrains & 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 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOKS:

1. *Prasant Kumar Pattnaik, Rajib Mall,* ***“Fundamentals of Mobile Computing”,*** *PHI Learning Pvt. Ltd, New Delhi – 2015 2nd Edition .*

REFERENCE BOOKS:

1. *Jochen H. Schller,* ***"Mobile Communications",*** *Second Edition, Pearson Education, New Delhi, 2007.*
2. *Dharma PrakashAgarval, Qing and An Zeng,* ***"Introduction to Wireless and Mobile systems",*** *Thomson Asia Pvt Ltd, 2005.*
3. *UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.*
4. *William.C.Y.Lee,* ***"Mobile Cellular Telecommunications-Analog and Digital Systems",*** *Second Edition,TataMcGraw Hill Edition ,2006.*
5. *C.K.Toh,* ***"AdHoc Mobile Wireless Networks",*** *First Edition, Pearson Education, 2002.*

COURSE OUTCOMES:

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

CO1: Explain the basics of mobile telecommunication system **[familiarity]**

CO2: Choose the required functionality at each layer for given application **[familiarity]**

CO3: Identify solution for each functionality at each layer **[familiarity]**

CO4: Use simulator tools and design Ad hoc networks **[Usage]**

CO5: Develop a mobile application **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M		M	M					M	H	L
CO2	H	H	H	M		M	M					M	H	L
CO3	H	H	H	M		M	M					M	H	L
CO4	H	H	H	M	H	M	M					M	H	L
CO5	H	H	H	M		M	M					M	H	L
18IPE $23	H	H	H	M	H	M	M					M	H	L

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

18IPE$24	HUMAN COMPUTER INTERFACE

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Foundations of Human Computer Interaction.
- The design basics of human computer interface.
- Implementation of human computer interaction process.
- Evaluation methods and supporting systems for HCI.

UNIT – I : INTRODUCTION	**(9 Periods)**
The Human – I/O channels – Memory – Reasoning and problem solving – The computer – Devices –Memory – Processing and Networks.	
UNIT – II : USER INTERACTION AND PARADIGMS	**(9 Periods)**
Models of Interaction – frameworks – Ergonomics – Interaction styles – elements of WIMP interface – interactivity – Paradigms for interaction.	
UNIT – III : DESIGN BASICS	**(9 Periods)**
Process of design – User focus – Scenarios – Navigation design – Screen design and layout – iteration and prototyping – software life cycle – usability engineering – iterative design and prototyping – design rationale – design rules.	
UNIT – IV : IMPLEMENTATION	**(9 Periods)**
Elements of windowing systems – programming the applications – toolkits – user interface management – Universal design principles – multi-modal interaction – designing for diversity.	
UNIT – V : EVALUATION AND SUPPORT	**(9 Periods)**
Goals of evaluation – evaluation through expert analysis and user participation – choosing an evaluation method – requirements of user support – approaches to user support – adaptive help system – designing user support systems.	

Contact Periods:

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

TEXT BOOKS:

1. *Alan Dix, Janet Finlay, Gregory D. Abowd Russell Beale,* ***"Human Computer Interaction",*** *Pearson Education, 3rd edition, 2004.*

REFERENCE BOOKS:

1. *Ben Shneiderman, CatherinePlaisant,* ***"Designing the User Interface: Strategies for Effective Human-Computer Interaction",*** *5e, Pearson Education 2005.*
2. *Wilbert O. Galitz,* ***"The Essential Guide to User Interface Design : An Introduction to GUI Design Principles and Techniques",*** *3rd edition, John Wiley, 2007 .*
3. *Yvonne Rogers,Helen Sharp,Jennifer Preece,* ***"Interaction Design",*** *3rd Edition Wiley 2011.*

COURSE OUTCOMES:

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

CO1: Compare human and computer by their performance. **[Familiarize]**

CO2: Explore various design strategies applied in HCI design. [**Understand]**

CO3: Apply the design strategies of HCI. **[Understand]**

CO4: Implement the user interface for various devices. **[Understand]**

CO5: Evaluate the user interface in the devices. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IPE $24	M	H	M	H	M	L	M	M					M	L

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

18IPE$25	**SOCIAL NETWORK ANALYSIS**

PRE-REQUISITES: **Category: PE**

NIL

L	**T**	**P**	**C**
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 the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			H		M					M			M	L
CO2		H		L									M	
CO3		H		L	M								M	
CO4	H	H	M	M	H								H	
CO5	H	M		M	M								M	
18IPE $25	L	H	L	M	M					L			M	L

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

18IPE$26	FOUNDATIONS OF IMAGE PROCESSING

PRE-REQUISITES: **Category: PE**

1. 18IPC603 – Fundamentals of Digital Signal Processing

L	T	P	C
3	0	0	3

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 morphological processing.
- Representation of images and Compression techniques.

UNIT – I : FUNDAMENTALS	**(9 Periods)**
Elements of Digital Image Processing System – Image sensing and acquisition – Image sampling and quantization – Basic relationship between Pixels Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.	
UNIT – II : IMAGE ENHANCEMENT	**(9 Periods)**
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	
UNIT – III : IMAGE RESTORATION	**(9 Periods)**
Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.	
UNIT – IV : IMAGE SEGMENTATION AND MORPHOLOGICAL PROCESSING	**(9 Periods)**
Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	
UNIT – V : IMAGE COMPRESSION AND RECOGNITION	**(9 Periods)**
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.	

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, 4rd edition, 2017.*
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. *Dr.S.Annadurai, Dr.R.ShanmugaLakshmi,* ***"Fundamentals of Digital Image Processing",*** *Pearson Education, 2007.*
3. *Jain A.K,* ***"Fundamentals of Digital Image Processing",*** *Prentice Hall of India, 2002.*
4. *Jae S. Lim,* ***"Two–Dimensional Signal and Image Processing",*** *Prentice Hall Inc, 1990.*
5. *Willliam K Pratt,* ***"Digital Image Processing",*** *John Willey, 4th edition, 2002.*

COURSE OUTCOMES:

Upon completion of the course, the student 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: Perform morphological processing and image segmentation. **[Understand]**

CO5: Apply suitable compression and image representation techniques to an image. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IPE $26	H	H	H	H	H	L	L	L	M	M	M	M	H	M

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

18IPE$27	**PERVASIVE COMPUTING**

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
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. *Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec& Klaus Rindtorff:* ***"Pervasive Computing: Technology and Architecture of Mobile Internet Applications",*** *Pearson Education, New Delhi, Sixth Edition, 2009.*

REFERENCE BOOKS:

1. *Frank Adelstein, Sandeep KS Gupta, Golden Richard III, Loren Schwiebert,* ***"Fundamentals of mobile and pervasive computing",*** *McGraw Hill, 2005.*
2. *Rahul Banerjee,* ***"Lecture Notes in Pervasive Computing",*** *Outline Notes, BITS-Pilani, 2012.*
3. *Guruduth S. Banavar, Norman H. Cohen, and Chandra Narayanaswami,* ***"Pervasive Computing: An Application-Based Approach",*** *Wiley Interscience, 2012.*

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	M	L	L	L	L	L	L	L	L	M	L
CO2	H	M	M	M	L	L	L	L	L	L	L	L	M	L
CO3	H	H	H	H	M	L	L	L	L	L	L	L	H	L
CO4	H	H	H	H	M	L	L	L	L	L	L	L	H	L
CO5	H	H	H	H	M	L	L	L	L	L	L	L	H	L
18IPE $27	H	H	H	H	M	L	L	L	L	L	L	L	H	L

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

18IPE$28	**SOFTWARE DEFINED NETWORKING**

PRE-REQUISITES: **Category: PE**

18IPC503 - Data Communication and Networking

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Fundamentals of Software Defined Networks.
- Seperation of the data Plane and Control Plane.
- Principles of Software Defined Network Programming.
- Various Applications of Software Defined Networks.

UNIT – I : INTRODUCTION	**(9 Periods)**
Evolution of Software Defined Networking (SDN) – Modern Data Centre – Traditional Switch Architecture – Need for SDN – Evolution of SDN –Working of SDN – Centralized and Distributed Control Plane and Data Plane.	
UNIT – II : OPEN FLOW AND SDN CONTROLLERS	**(9 Periods)**
OpenFlow specification - Drawbacks of Open SDN – SDN via APIs – SDN via Hypervisor-Based Overlays - SDN via Opening up the device – Network Function Virtualization – Alternatives Overlap and ranking – SDN protocol models – SDN controller Models – Application Models – Approaches to SDN security.	
UNIT – III : DATA CENTRES AND OTHER ENVIRONMENTS	**(9 Periods)**
Data centre: Demands – Tunneling technology – Path technology – Ethernet Fabrics – SDN use Cases – Consistency Policy Configuration – Wide Area Networks – Service Providers - Campus Networks - Hospitality Networks and Mobile Networks	
UNIT – IV : SDN PROGRAMMING AND APPLICATIONS	**(9 Periods)**
Network Function Virtualization – SDN players – Types of Applications - SDN Controllers - Controller Considerations - Device Considerations – Creating Network Virtualization Tunnels – Offloading flows in Data centre – Access Control for campus – Traffic Engineering for service Providers.	
UNIT – V : SDN OPEN SOURCE	**(9 Periods)**
OpenFlow – Switch Implementation – Controller Implementation – Orchestration and Network Virtualization – Simulation, Testing and Tools – Open Source Cloud Software: OpenStack, CloudStack – Juniper SDN framework – IETF SDN framework – Open Daylight controller.	

Contact Periods:

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

TEXT BOOKS:

1. *Paul Goransson and Chuck Black,* ***"Software Defined Networks: A Comprehensive Approach",*** *First Edition, Morgan Kaufmann, 2014.*
2. *Thomas D. Nadeau, Ken Gray,* ***"SDN: Software Defined Networks",*** *O'Reilly Media, 2013.*

REFERENCES BOOKS:

1. *Siamak Azodolmolky, **"Software Defined Networking with Open Flow",** Packet Publishing, 2013.*
2. *Vivek Tiwari, **"SDN and Open Flow for Beginners‖, Amazon Digital Services",** Inc., 2013.*
3. *Fei Hu, Editor, **"Network Innovation through Open Flow and SDN: Principles and Design",** CRC Press, 2014.*

COURSE OUTCOMES:

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

CO1: Analyze the evolution of Software Defined networks **[Analyze]**

CO2: Express the various components of SDN and its uses. **[Understand]**

CO3: Explain the use of SDN in the current Networking Scenario. **[Familiarize]**

CO4: Design and develop various applications of SDN. **[Understand]**

CO5: Demonstrate the SDN open source framework and software. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	H	M	H			L			M		M	L
CO2	H	H	H	H	H	L		L			M	L	H	L
CO3	M	M	M	M	H						M	L	M	L
CO4	M	L	L	L	L						M	L	L	L
CO5	H	H	H	H	H						M	M	H	L
18IPE $28	M	M	H	M	H	L		L			M	L	M	L

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

18IPE$29 COMPUTER GRAPHICS

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

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 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 Periods)**
2D Viewing –Window–Viewport Transformation –Two dimensional Geometric transformations – Line, Polygon, Curve and Text clipping algorithms.	
UNIT – III : 3D CONCEPTS	**(9 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 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 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: 0 Periods** **Practical: 0 Periods** **Total: 45 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, 1 st edition, 2004.*

REFERENCE BOOKS:

1. *F. S. Hill Jr.* ***"Computer Graphics using OpenGL",*** *Pearson Education, 2 nd edition, 2001.*
2. *Prabhat K Andleigh, Kiran Thakrar,* ***"Multimedia systems design",*** *PHI, 1 st edition, 1996.*

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IPE $29	**H**	**H**	**L**	**M**	**L**		**M**	**L**	**L**	**M**	**L**	**L**	**M**	**M**

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

18IPE$30*	DATA ANALYTICS

PRE-REQUISITES: **Category: PE**

NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Statistical Theroy
- Data Modeling Techniques
- Quality Control Methods
- Fundamentals of Big Data
- Applications of Big Data

UNIT – I : STATISTICAL THEORY	**(9 Periods)**
Data Harmonization – Data preparation, missing value treatment, data transformation, data enrichment. Sample and Population, different methods of selecting samples from populations, advantages and disadvantages. Sampling techniques.	
UNIT – II : DATA MODELING TECHNIQUES	**(9 Periods)**
Correlation – Linear & Non-linear Regression Models – Logistics Regression – Estimation of model parameters – Variation inflation factors - Significance levels for selection procedures. Components of time series – Methods of their determination - Box-Jenkins & Smoothing models. Short-term economic forecasting.	
UNIT – III : QUALITY CONTROL	**(9 Periods)**
Control Charts for variable and attributes - Acceptance Sampling by attributes-Single - double, multiple and sequential Sampling plans. Concepts of AOQL and ATI- Acceptance Sampling by variables - use of Dodge - Romig and other tables.	
UNIT – IV : BIG DATA FUNDAMENTALS	**(9 Periods)**
Introduction to big data – Data storage and analysis – Rational data base management systems – grid computing – volunteer computing. Map reduce – data format – analyzing the data with Unix or Hadoop or SAS – scaling out – data flow – combine functions – Hadoop concepts and file system – directories – Data flow. Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.	
UNIT – V : APPLICATIONS OF BIG DATA	**(9 Periods)**
Log parsing – Json - ETL operation – Procurement – text mining – big data clusters – forecasting models. Web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management –big data and healthcare – big data in medicine – advertising and big data.	

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

REFERENCE BOOKS:

1. *Feller, W. (1972) :* ***Introduction to Probability Theory and its Applications****, Vol. II, Second Edition, Wiley Eastern.*
2. *Rao, C.R. (1973):* ***Linear Statistical Inference****, Second Edition, Wiley Eastern*
3. *Goon,A.M.,Gupta,M.K.and Dasgupta,B.(1989).An Outline of Statistical Theory-Vol.II.*
4. *Montgomary,D.C.,(1985):****Introduction to Quality Control*** *John Wiley.*
5. *Kanti Swarup, Gupta P.K., and Man Mohan. (1977):* ***Operations Research****, Sultan Chand and Sons*
6. *Box, G.E.P., and Jenkins, G.M., (1976):* ***Time Series Analysis- Forecasting and Control****. Holden-Day San Francisco*
7. *Gujarathi, D and Dawn Porter (2008) :* ***Basic Econometrics,*** *5th Edition, McGraw-Hill.*
8. *Tom White, "****Hadoop: The Definitive Guide****", Third Edition, O'Reilley, 2012.*
9. *Vignesh Prajapati,* ***Big data analytics with R and Hadoop****, SPD 2013*
10. *W. G. Cochran,* ***Sampling Techniques****.*

COURSE OUTCOMES:

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

CO1: Apply statistical theory concepts for data preparation, transformation sampling techniques. **[Understand]**
CO2: Use different data modeling techniques. **[Understand]**
CO3: Apply quality control techniques. **[Understand]**
CO4: Understand the fundamentals of big data. **[Familiarize]**
CO5: Apply big data technologies in medicine, advertising, marketing etc. **[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		M	L	M		M	H	H	M
CO2	H	H	H	H	H		M	L	M		M	H	H	M
CO3	H	H	H	H	H		M	L	M		M	H	H	M
CO4	H	H	H	H	H		M	L	M		M	H	H	M
CO5	H	H	H	H	H		M	L	M		M	H	H	M
18IPE $30*	H	H	H	H	H		M	L	M		M	H	H	M

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

18COE$01	CLIMATE CHANGE AND ADAPTATION *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Able get knowledge about Climate system and its changes and causes
- Able to learn about impacts, adaptation and mitigation of climate change
- Able to learn about clean technology and clean energy

UNIT – I : EARTH’S CLIMATE SYSTEM	**(9 Periods)**
Introduction-Climate in the spotlight - The Earth’s Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies - Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.	
UNIT – II : OBSERVED CHANGES AND ITS CAUSES	**(9 Periods)**
Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – climate change modeling.	
UNIT – III : IMPACTS OF CLIMATE CHANGE	**(9 Periods)**
Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.	
UNIT – IV : CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES	**(9 Periods)**
Adaptation Strategy/Options in various sectors – Water – Agriculture –- Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.	
UNIT – V : CLEAN TECHNOLOGY AND ENERGY	**(9 Periods)**
Clean Development Mechanism – Carbon Trading - examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.	

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

TEXT BOOKS:

1. *Jan C. van Dam, **“Impacts of Climate Change and Climate Variability on Hydrological Regimes”**, Cambridge University Press, 2009.*
2. *Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., **“Climate Change and Water”**. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.*
3. *Dash Sushil Kumar, **“Climate Change – An Indian Perspective”**, Cambridge University Press India Pvt. Ltd, 2007.*
4. *IPCC Report Technical paper VI – Climate change and Water, 2008.*

REFERENCE BOOKS:

1. *IPCC fourth assessment report - The AR4 synthesis report, 2007*
2. *IPCC fourth assessment report –Working Group I Report, “ The physical Science Basis”,2007*
3. *IPCC fourth assessment report - Working Group II Report, **“Impacts, Adaptation and Vulnerability”**, 2007*
4. *Climate change 2014: Impacts, Adaptation and Vulnerability, IPCC*
5. *Climate change 2013: The Physical Science basis, IPCC.*
6. *www.environment.gov.au/climate-change/adaptation.*
7. *www.environment.org/explore-topics/climate-change/what.we.do/climate-adaptation*.

COURSE OUTCOMES:

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

CO1: Understand the climatic system and the factors influencing the climatic changes
CO2: Assess the uncertainty and impact of climatic changes
CO3: Understand the impacts of climate change in various sectors.
CO4: Develop strategies for adaptation and mitigation of climatic changes
CO5: Identify clean technologies for sustainable growth

COURSE ARTICULATION MATRIX:

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1			M			L	L					L	L	L	L	L
CO2	L					L	L					L	M	M	M	L
CO3						L	L					L		H	H	
CO4	M	M	L	M		L	M					L	L	M	M	M
CO5	L	M	M	M		L	H					L	L	M	L	M
18COE $01	L	M	M	M		L	M					L	L	M	M	M

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

18COE$02

DISASTER MANAGEMENT AND MITIGATION

(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: 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 (9 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 (9 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 Acceptibility, Alternatives, Personnel. Political/ social, Economic. vulnerability-Physical Profile, Social Profile, Environmental Profile, Economic Profile. Factors Influncing Vulnerability, risk Perception.

UNIT - III : MITIGATION AND PREPAREDNESS (9 Periods)

Mitigation - types of mitigation ,Ostacles in mitigation, Assement 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 (9 Periods)

Governmental Disaster management agencies- Fire, law, emergency management, Emergency medical service, Millitary 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 GovernmentalOrganaisations – operations, NGO/ Millitary coordination, standard of conduct. The role of Private sector and academia.

Multilateral organaisations - UN agencies and progammes, Regional &Inernationalorganaisations. 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 OUTCOME:

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:

PO/PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO																
CO1		L			L	L		L								L
CO2	L	H		M	L	M						L	L			L
CO3	L	L			H	M						L	L			L
CO4	L	M		L	L	M	M									L
CO5		M		L	L	M										L
18COE $02	L	M		L	L	M	M					L	L			L

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

18COE$03	**ENERGY EFFICIENT BUILDINGS** *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand the Concepts of Sustainable Environment, basics of energy analysis, simulation and management.
- To understand the concept of managing air quality.
- To understand the Green building concepts.

UNIT – I : INTRODUCTION	**(9 Periods)**
Life cycle impacts of materials and products – sustainable design concepts – strategies of design for the environment -the sun-earth relationship and the energy balance on the earth's surface, climate, wind – solar radiation and solar temperature – sun shading and solar radiation on surfaces – energy impact on the shape and orientation of buildings – thermal properties of building materials.	
UNIT – II : ENERGY EFFICIENT TECHNIQUES	**(9 Periods)**
Passive Cooling And Day Lighting – Active Solar And Photovoltaic- Building Energy Analysis Methods- Building Energy Simulation- Building Energy Efficiency Standards- Lighting System Design- Lighting Economics and Aesthetics- Impacts of Lighting Efficiency – Energy Audit and Energy Targeting- Technological Options For Energy Management.	
UNIT – III : INDOOR ENVIRONMENTAL QUALITY MANAGEMENT	**(9 Periods)**
Psychrometry- Comfort Conditions- Thermal Comfort- Ventilation And Air Quality Air Conditioning Requirement- Visual Perception- Illumination Requirement- Auditory Requirement-Energy Management Options- Air Conditioning Systems- Energy Conservation In Pumps- Fans And Blowers-Refrigerating Machines- Heat Rejection Equipment- Energy Efficient Motors- Insulation.	
UNIT – IV : GREEN BUILDING CONCEPTS	**(9 Periods)**
Green Building Concept- Green Building Rating Tools- Leeds And IGBC Codes. – Material Selection Embodied Energy- Operating Energy- Façade Systems- Ventilation Systems- Transportation- Water Treatment Systems- Water Efficiency- Building Economics.	
UNIT – V : GREEN BUILDING DESIGN CASE STUDY	**(9 Periods)**
Students To Work Through A Controlled Process of Analysis And Design To Produce Drawings and Models Of Their Own Personal Green Building Project. Topics Include Building Form, Orientation and Site Considerations; Conservation Measures; Energy Modeling; Heating System And Fuel Choices; Renewable Energy Systems; Material Choices; and Construction Budget-Students Will Research Green Construction and Design in A Particular -Construction Context and Report Their Results to the Class.	

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

TEXT BOOKS:

1 *Kibert, C.* ***“Sustainable Construction: Green Building Design and Delivery”****, John Wiley & Sons, 4th Edition, 2016.*
2 *Edward G Pita,* ***“An Energy Approach- Air-Conditioning Principles and Systems”****, Pearson Education, 2003.*
3 *Satyajit Ghosh, Abhinav Dhaka,* ***“Green structures: Energy efficient buildings”****, 2015.*

REFERENCE BOOKS:

1 *Colin Porteous,* ***“The New Eco-Architecture”****, Spon Press, 2002.*
2 *Ganesan T P,* ***“Energy Conservation in Buildings”****, ISTE Professional Center, Chennai, 1999.*
3 *NPTEL* ***“Energy Efficiency and Simulation”****, Prof.E.Rajsekar., IIT Roorkee.*
4 *Energy Conservation Building Codes: www.bee-india.nic.in*
5 *Lever More G J,* ***“Building Energy Management Systems”****, E And FN Spon, London, 2000.*
6 *NPTEL* ***“Energy efficiency acoustics and day lighting in building”****, Prof.B.Bhattacharjee., IIT Delhi.*

COURSE OUTCOMES:

On completion of the course, the students will be able to
CO1: Understand the Concepts of Sustainable Environment.
CO2: Understand the basics of energy analysis, simulation and management.
CO3: Understand the concept of managing air quality.
CO4: Understand the Green building concepts.
CO5: Create drawings and models of their own personal green building project

COURSE ARTICULATION MATRIX:

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	M	L			M	M	L	L	L		L	L	M	L	L
CO2			L	L		L	L					L		L		
CO3		L				L	M	L				L		L		
CO4	L	M					H					M		M		
CO5	M	M	H	L			H	L	M		M	M		H	L	M
18COE $03	L	M	H	L		M	H	L	L	L	M	M	L	H	L	M

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

18MOE$04	NANOTECHNOLOGY AND SURFACE ENGINEERING *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To Understand and analyze the concepts of Quantum confinement, Dimensional structures and Properties of Nanosystems
- To be familiar with various methods of synthesis of Nanomaterials
- To analyze and understand the mechanical and electrical properties of Nanomaterial and its applications

UNIT – I: PROPERTIES OF NANOMATERIALS	**(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 – Electrodeposition - Spray Pyrolysis - Flame Pyrolysis – Metal nano-crystals by Reduction – Solvo-thermal 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 – Applications	
UNIT – III : MECHANICAL AND ELECTRICAL PROPERTIES	**(9 Periods)**
Nanoscale Mechanics - Introduction – Mechanical properties – The Elasticity of Nanomaterials – Elasticity of Bulk Nanomaterials –Plastic Deformation of Nanomaterials – Crystals and Crystal Plasticity – From Crystal Plasticity to Polycrystal Plasticity. Introduction - Energy Storage Basics - Electrical Energy Storage Devices and Impact of Nanomaterials - Electrochemical Properties of Nanoscale Materials - Aerogels and Structure-Directed Mesoporous and Macroporous Solids - Nanoparticles - Nanotubes, Nanowires, and Nanorolls	
UNIT – IV : FUNDAMENTALS OF SURFACE ENGINEERING	**(9 Periods)**
Surface engineering - classification, definition, scope and general principles, Conventional surface engineering - Surface engineering by material removal: Cleaning, pickling, etching, grinding, polishing, buffing / puffing, Surface engineering by material addition - From liquid bath, hot dipping, Electro-deposition / plating.	
UNIT – V : SURFACE MODIFICATION	**(9 Periods)**
Surface modification of steel and ferrous components - Pack carburizing, Aluminizing, calorizing, diffusional coatings (principle and scope of application), Surface modification using liquid/molten bath: Cyaniding, liquid carburizing (diffusion from liquid state), Surface modification using gaseous medium: Nitriding, Carbo-nitriding (diffusion from gaseous state).	

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

TEXT BOOKS:

*1.Kelsall Robert W, Ian Hamley and Mark Geoghegan, —**“Nanoscale Science and Technology”**, Wiley Eastern, 2004.*
*2. N John Dinardo, **“Nanoscale Charecterisation of Surfaces & Interfaces**”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000*
*3. ASM Metals Hand Book –Vol. 5, **“Surface Engineering”**, 1996*

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. *GuozhongGao,**“Nanostructures & Nanomaterials: Synthesis, Properties & Applications**”, Imperial College Press (2004).*
4. *K.G. Budinski, **“Surface Engineering for Wear Resistances”,** Prentice Hall, Englewood Cliffs, 1988.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to
CO1: Analyze the particle size, particle shape, particle density, Size effect and properties of Nanostructures.
CO2: Acquire knowledge in various methods of synthesis of Nanomaterials.
CO3: Analyze the Elasticity of Nanomaterials, Electrical Energy Storage Devices and Aerogels.
CO4: Apply various Nanomaterials to the LED, Transistor Applications.
CO5: Apply various surface engineering techniques

COURSE ARTICULATION MATRIX

CO/ PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	M	M	L	L	M	L	M	M	M	L	M	M	M	M	M
CO2	H	H	M	H	H	L	L	M	M	M	L	H	M	H	M
CO3	H	H	L	H	M	M	L	L	M	M	M	M	M	H	M
CO4	L	H	M	H	M	M	L	L	M	M	M	M	M	H	M
CO5	M	M	L	M	M	L	M	M	M	L	M	M	M	H	M
18MOE$04	H	H	L	M	H	M	H	H	M	H	M	M	M	M	M

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

18MOE$05	**MECHATRONICS** *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To study the mechatronics system and understanding the concepts of integration and design of mechatronics system.

UNIT – I : SYSTEM MODELS	**(9 Periods)**
Introduction - Definition of Mechanical Systems, Philosophy and approach. Systems and Design - Mechatronic approach, Integrated Product Design - Modeling- Analysis and Simulation, Man-Machine Interface.	
UNIT – II : SENSORS AND TRANSDUCERS	**(9 Periods)**
Sensors and transducers - classification, Development in Transducer technology, Optoelectronics - Shaft encoders, CD Sensors, Vision System.	
UNIT – III : DRIVES AND ACTUATORS	**(9 Periods)**
Drives and Actuators - Hydraulic and Pneumatic drives - Electrical Actuators - servo motor and Stepper motor, Drive circuits, open and closed loop control - Embedded Systems - Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems.	
UNIT – IV : SMART MATERIALS	**(9 Periods)**
Smart materials - Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators - Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation.	
UNIT – V : MICROMECHATRONIC SYSTEMS	**(9 Periods)**
Micromechatronic systems - Microsensors, Microactuators - Micro-fabrication techniques - LIGA Process- Lithography, etching, Micro-joining. Application examples - Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.	

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

TEXT BOOKS:

*1. W.Bolton, **“Mechatronics”**, Longman,2nd Edition,1999*

REFERENCE BOOKS:

1. *Michael B. Histand and David G.Alciatore, **"Introduction to Mechatronics and Measurement Systems"**, Tata McGraw Hill, 2nd Edition,2003*
2. *D.A.Bradley, D.Dawson, N.C.Buru and A.J.Loader**, "Mechatronics"** Chapman and Hall,1993*
3. *Dan S Necsulescu, **"Mechatronics"**, Pearson Education Asia,2005*
4. *Devdas Shetty, Richard A. Kolk, **"Mechatronics System Design"**, Thomson, PWS publishing, 2007.*
5. *Smaili.A and Mrad.F, **"Mechatronics: Integrated Technologies for Intelligent Machines",** Oxford university press, 2008*

COURSE OUTCOMES:

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

CO1: Identify the key elements of mechatronics system and models.

CO2: Select appropriate sensors and transducers for industrial application.

CO 3: Integrate mechanical, electrical, electronics, control systems in the mechatronics system design

CO 4. Select the proper smart material for mechatronics system.

CO 5: Apply the principles of mechatronics in industrial needs.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	H	M	L	H	L	L	H	L	M	L	M	H	L
CO2	H	H	H	L	L	H	L	L	M	L	M	L	M	H	L
CO3	H	H	H	L	L	H	L	L	M	L	M	L	M	H	L
CO4	H	H	H	M	H	H	L	L	M	M	L	L	H	H	L
CO5	H	H	H	M	L	H	L	L	H	M	M	M	H	H	L
18MOE$05	H	H	H	H	L	H	L	L	M	L	M	L	M	H	L

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

18MOE$06	**RENEWABLE ENERGY SOURCES** *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

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 Geothermal resources, Utilization for electricity generation and direct heating, Wellhead power generating units. Overview of micro and mini hydel power generation.	
UNIT – V: RENEWABLE ENERGY POLICIES	**(9 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. *Sunil S. Rao and Dr. B.B. Parulekar,* ***"Energy Technology",*** *Khanna Publishers, Second Ed. 1997*
2. *Pai and Ramaprasad,****"Power Generation through Renewal sources",*** *Tata McGraw Hill – 1991*

REFERENCE BOOKS:

1. *Rai , G.D.,* ***"NonConventional sources of Energy"****, Khanna Publishers , IV Ed.,2009*
2. *Bansal NK, Kleeman and Meliss, M* ***"Renewable Energy Sources and Conversion Techniques"****, Tata McGraw Hill, 1996*
3. *Roland Wengenmayr, Thomas Buhrke,* ***"Renewable energy: Sustainable energy concepts for the future"****, Wiley-VCH, 1st edition, 2008.*

COURSE OUTCOMES:

On completion of the course 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**	**PSO 3**
CO1	H	M	M	M	M	M	M			L	L	L	H	M	M
CO2	H	H	M	M	M	M	M	L		L	L	L	H	H	H
CO3	H	M	M	M	M	M	M	M			L	L	M	H	H
CO4	M	H	M	L	M	H	M	M		L	L	L	H	H	H
CO5	M	H	H	H	M	M	M	M		L	L	L	M	H	M
CO6	H	M	M	M	M	M	M		H	H	L	L	M	H	M
18MOE$06	H	H	M	M	M	M	M	L	L	L	L	L	H	H	H

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

18EOE$07	**RENEWABLE POWER GENERATION SYSTEMS** *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
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 Geothermal resources, Utilization for electricity generation and direct heating, Wellhead power generating units. Overview of micro and mini hydel power generation.	
UNIT-V : RENEWABLE ENERGY POLICIES	**(9 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. 2016*
2. *Rai , G.D., "**Non-Conventional sources of Energy**", Khanna Publishers , V Ed.,2016*

REFERENCE BOOKS:

1. *Khan. B.H, “Non-Conventional Energy Resources”, The McGraw Hills, Second edition, 2016.*
2. *Bansal NK, Kleeman and Meliss, M* ***"Renewable Energy Sources and Conversion Techniques"****, Tata McGraw Hill, 1996*
3. *Roland Wengenmayr, Thomas Buhrke,” Renewable energy: Sustainable energy concepts for the future”, Wiley-VCH, 1st edition, 2008.*

COURSE OUTCOMES:

CO1: Understand the concept of various Non-Conventional energy resources

CO2: Familiarize the principles of operation of renewable energy technologies

CO3: Realize the need for utilizing the energy from clean and Sustainable energy resources.

CO4: Interpret advantages and disadvantages of different renewable sources of energy

CO5: Comprehend the environmental aspects and the correlation between different operational parameters

CO6: Evaluate the options and estimate the energy generation through renewable sources

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	M	M	-	M	H	-	-	-	-	-	H	M	M
CO2	H	H	M	L	M	M	M	L	-	-	-	-	H	H	H
CO3	H	M	M	M	M	M	M	-	-	-	-	-	M	H	H
CO4	M	H	M	L	M	H	M	-	-	-	-	-	H	H	H
CO5	M	H	L	H	M	M	M	-	-	-	L	-	M	H	M
CO6	H	M	M	L	M	M	M	-	L	-	L	-	M	H	M
18EOE $07	H	H	M	M	-	M	M	L	L	-	L	-	H	H	H

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

18EOE$08	ELECTRIC VEHICLES *(Common to All Branches)*

Category : OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the technology of Electric and Hybrid Electric Vehicles and their business perspective

UNIT-I : INTRODUCTION	**(9 Periods)**
Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.	
UNIT-II : ELECTRIC TRAINS	**(9 Periods)**
Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives- drive system efficiency.	
UNIT-III : ANALYSIS OF ENERGY STORAGE	**(9 Periods)**
Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.	
UNIT-IV : ENERGY MANAGEMENT STRATEGIES	**(9 Periods)**
Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.	
UNIT-V : BUSINESS PERSPECTIVE OF ELECTRIC VEHICLE	**(9 Periods)**
Design of a Hybrid Electric Vehicle (HEV) - Design of a Battery Electric Vehicle (BEV) Hybrid Electric Heavy Duty Vehicles, Fuel Cell Heavy Duty Vehicles. Business: E-mobility business, electrification challenges, Connected mobility and Autonomous mobility- case study: E-mobility Indian Roadmap Perspective. Policy: EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs.	

Contact Periods:

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

TEXT BOOKS:

1. *Mehrdad Ehsani, Yimin Gao, Sebatien Gay and Ali Emadi, “**Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design**”, CRC press, 2004.*
2. *C. Mi, M. A. Masrur and D. W. Gao, “**Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives**”, John Wiley & Sons, 2011.*
3. *S. Onori, L. Serrao and G. Rizzoni, “**Hybrid Electric Vehicles: Energy Management Strategies**”, Springer, 2015.*

REFERENCE BOOKS:

1. *James Larminie and John Loury, “**Electric Vehicle Technology – Explained**”, John Wiley & Sons Ltd, 2003.*
2. *Sandeep Dhameja, “**Electric Vehicle Battery Systems**”, Butterworth – Heinemann, 2002.*
3. *Ronald K Jurgen, “**Electric and Hybrid – Electric Vehicles**”, SAE, 2002.*
4. *Ron Hodkinson and John Fenton, “**Light Weight Electric/ Hybrid Vehicle Design**”, Butterworth – Heinemann, 2001.*
5. *T. Denton, **“Electric and Hybrid Vehicles”,** Routledge, 2016.*

COURSE OUTCOMES:

CO1: Understand the basics of electric vehicle components and configuration.
CO2: Analyze suitable drive scheme for developing an electric vehicle.
CO3: Able to opt a proper energy management system.
CO4: Analyze the performance of practical HEV and EV.
CO5: Understand the infrastructure for Electric Vehicles and business potential.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
CO2	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
CO3	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
CO4	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
CO5	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
18EOE $08	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-

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

18EOE$09	**SMART GRID SYSTEMS** *(Common to All Branches)*

Category : OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

* To comprehend the underlying techniques applied to Smart Grid

UNIT-I : BASICS OF POWER SYSTEMS	**(9 Periods)**
Basics of Power Systems: Load and Generation - Power Flow Analysis- Economic Dispatch and Unit Commitment Problems. Smart Grid: Definition – Applications- Government and Industry-Standardization	
UNIT-II : SMART GRID COMMUNICATIONS	**(9 Periods)**
Two-way Digital Communications Paradigm - Network Architectures - IP-based Systems - Power Line Communications - Advanced Metering Infrastructure	
UNIT-III : WIDE AREA MEASUREMENT	**(9 Periods)**
Sensor Networks - Phasor Measurement Units- Communications Infrastructure- Fault Detection and Self-Healing Systems -Applications and Challenges	
UNIT-IV : SECURITY AND PRIVACY	**(9 Periods)**
Cyber Security Challenges in Smart Grid - Load Altering Attacks- False Data Injection Attacks- Defense Mechanisms - Privacy Challenges- Cyber Security Standards	
UNIT-V : ECONOMICS AND MARKET OPERATIONS	**(9 Periods)**
Introduction, Reasons for restructuring / deregulation of power industry, Understanding the restructuring process - Entities involved. The market place mechanisms-Energy and Reserve Markets- Market Power - Generation Firms- Locational Marginal Prices= Financial Transmission Rights	

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. *P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan "**Electrical Power Systems-Analysis, Security and Deregulation**" PHI Learning Private Limited, New Delhi, 2012.*

REFERENCE BOOKS:

1. *Lars T. Berger, Krzysztof Iniewski "**Smart Grid applications, Communications and Security**" John Wiley Publishers Ltd., 2012.*
2. *Yang Xiao, **"Communication and Networking in Smart Grids",** CRC Press Taylor and Francis Group, 2012.*
3. *Caitlin G. Elsworth, **"The Smart Grid and Electric Power Transmission",** Nova Science Publishers Inc, August 2010.*

COURSE OUTCOMES:

CO1: Demonstrate the various aspects of the smart grid, including Technologies, Components, Architectures and applications

CO2: Creating a framework to operate the grid more effectively.

CO3: Evaluate the existing grid with respect to smart grid

CO4: Upgrade the existing grid to smart grid environment

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	L	L	M	H	L	M	M	M	H	M	H	M
CO2	L	L	M	M	M	M	M	L	M	M	M	M	M	M	H
CO3	-	-	-	M	M	M	M	M	M	M	M	H	M	M	M
CO4	L	-	-	M	M	M	H	-	M	M	M	H	M	H	H
18EOE $09	L	L	M	M	M	M	H	L	M	M	M	H	M	H	H

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

18LOE$10	**MOBILE COMMUNICATION** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the concept of Mobile radio propagation, cellular system design
- To understand mobile technologies like GSM and CDMA.
- To know the mobile communication evolution of 2G, 3G and 3 GPP in detail.
- To have overview of immerging technologies application.

UNIT I WIRELESS COMMUNICATION	**(9 Periods)**
Cellular systems- Frequency Management and Channel Assignment- types of handoff and their characteristics, dropped call rates & their evaluation -MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.	
UNIT II WIRELESS NETWORKS	**(9 Periods)**
Wireless LAN – IEEE 802.11 Standards – Architecture – Services – Mobile Ad hoc Networks- WiFi and WiMAX - Wireless Local Loop.	
UNIT III MOBILE COMMUNICATION SYSTEMS	**(9 Periods)**
GSM-architecture-Location tracking and call setup- Mobility management- Handover-Security-GSM SMS – International roaming for GSM- call recording functions-subscriber and service data mgt – Mobile Number portability -VoIP service for Mobile Networks – GPRS – Architecture-GPRS procedures-attach and detach procedures-PDP context procedure-combined RA/LA update procedures-Billing	
UNIT IV MOBILE NETWORK AND TRANSPORT LAYERS	**(9 Periods)**
Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols– Multicast routing-TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing-Selective Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3G wireless Networks.	
UNIT V APPLICATION LAYER	**(9 Periods)**
WAP Model- Mobile Location based services -WAP Gateway –WAP protocols – WAP user agent profile- caching model-wireless bearers for WAP - WML – WMLScripts - WTA - iMode - SyncML.	

Contact periods:

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

TEXT BOOKS:

1. *John Schiller, “**Mobile Communications**”, Second Edition, Pearson Education, 2003.*
2. *William Stallings, “**Wireless Communications and Networks**”, Pearson Education, 2002.*

REFERENCES BOOKS:

1. *Kaveh Pahlavan, Prasanth Krishnamoorthy, "**Principles of Wireless Networks**", First Edition, Pearson Education, 2003.*
2. *Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "**Principles of Mobile Computing**", Springer, 2003.*
3. *C.K.Toh, "**AdHoc Mobile Wireless Networks**", First Edition, Pearson Education, 2002.*

COURSE OUTCOMES:

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

CO1: Understand GSM, CDMA concepts and architecture, frame structure, system capacity, services provided.

CO2: Study of evolution of mobile communication generations 2G, 2.5G, 3G with their characteristics and limitations.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	M	-	-	-	-	-	-	-	-	L	M	L	-
CO2	M	M	M	-	-	-	-	-	-	-	-	L	M	L	-
18LOE $10	M	M	M	-	-	-	-	-	-	-	-	L	M	L	-

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

18LOE$11	**INTRODUCTION TO VLSI SYSTEM DESIGN** *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce various aspects of CMOS logic design in combinational and sequential circuit to design CMOS VLSI system components.

UNIT I: CMOS LOGIC DESIGN	**(9 Periods)**
Inverter- CMOS Logic Gates: Compound Gates – Pass Transistors and Transmission Gates – Tristated – Multiplexers –CMOS Fabrication and Layout: Fabrication Process – Layout Design rule – Gate Layouts – Stick Diagrams – Design Partitioning	
UNIT II: MOS TRANSISTOR THEORY	**(9 Periods)**
Introduction – Long Channel I-V Characteristics – C-V Characteristics – Non-ideal I-V Effects – DC Transfer Characteristics – CMOS Technologies – Sources of Power Dissipation - Dynamic Power – Static Power.	
UNIT III: COMBINATIONAL CIRCUIT DESIGN	**(9 Periods)**
Circuit Families: Static CMOS – Ratioed Circuits – Cascode Voltage Switch Logic – Dynamic Circuits – Pass Transistor Circuits. Silicon-on-Insulator Circuit Design – Subthreshold Cirucit Design	
UNIT IV: SEQUENTIAL CIRCUIT DESIGN	**(9 Periods)**
Sequential static circuits – Circuit design of latched and flip-flops – Sequencing dynamic circuits – Synchronizers – Wave pipelining - VLSI clocking: CMOS clocking styles - Pipelined systems - Clock generation and distribution.	
UNIT V: DESIGN OF VLSI SYSTEMS	**(9 Periods)**
System Specifications – Structural Gate Level Modeling – Switch Level Modeling – Behavioral and RTL Modeling - Addition/subtraction – Comparators –counters —Multiplexers - Binary Decoders – Comparators – Priority Encoders – Latches - Flip-Flops and Registers – SRAM – DRAM – ROM.	

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

TEXT BOOKS:

1. *N. Weste and David Money Harris, "**CMOS VLSI Design**", Fourth Edition, Pearson Education,2011.*
2. *Uyemura, John P, "**Introduction to VLSI Circuits and Systems**", Wiley & Sons, 8th Reprint 2009*

REFERENCE BOOKS:

1. *Jan M. Rabaey, "**Digital Integrated Circuits: A Design Perspective**", PHI, Second Edition, 2012.*
2. *R. Jacob Baker, "**CMOS: Circuit Design, Layout, and Simulation**", Wiley-IEEE, Revised Second Edition, 2008.*
3. *Pucknell, "**Basic VLSI Design**", Prentice Hall, 2006.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to
CO1: Realize the CMOS logic design
CO2: Acquire knowledge on combinational and sequential circuit design of CMOS logic
CO3: Use VLSI clocking styles and realize CMOS VLSI system components

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
CO2	M	M	M	-	-	-	-	-	-	-	-	L	M	L	L
CO3	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
18LOE $11	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L

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

18LOE$12	**MICROCONTROLLER AND APPLICATIONS** *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Describe the architecture of 8051 microcontroller.
- Develop assembly program for 8051.
- Apply the instruction set of 8051 to get effective programs.
- Design system in block level using microcontroller, memory devices, buses and other peripheral devices.
- Solve real life problem using microcontroller based systems.

UNIT I: MICROCONTROLLER	**(9 Periods)**
Microcontroller Features – On chip oscillator, List of Special Function Registers (SFRs), On chip program memory, on chip data memory, I/O Ports, Watch Dog Timer, Architecture of 8051, Instruction set - Addressing modes.	
UNIT II: ASSEMBLY LANGUAGE PROGRAMMING	**(9 Periods)**
8051 Assembly Language Programming, Branch Instruction Programming -I/O Port Programming – Arithmetic and Logic Instruction Programming-code conversion programming	
UNIT III: PROGRAMMING IN C AND INTERFACING-I	**(9 Periods)**
Timers & Counters programming - Serial Port Programming - Interrupts Programming .8255 Interfacing and Programming- External Memory Interfacing - LCD interfacing, LED Interfacing	
UNIT IV: INTERFACING-II	**(9 Periods)**
Keyboard Interfacing - ADC, DAC interfacing –Temperature Transducer-Pressure and Displacement Transducer-Light Sensor - Optocoupler - Relays.	
UNIT V: APPLICATIONS OF MICROCONTROLLERS	**(9 Periods)**
Stepper Motor interface-Temperature Monitoring and Control System-Speed Control of a DC Motor - Digital Thermometer-Digital Frequency Meter.	

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

TEXT BOOKS:

1.Mohammad Ali Mazidi, Janice Gillispie Mazidi, ***"The 8051 Microcontroller and Embedded Systems (Using assembly and C)"*** *Pearson education/ Prentice Hall of India Pvt. Ltd., 2007.*
2. Ajit Pal, ***"Microcontrollers : Principles and Applications"****, Prentice-Hall of India Pvt.Ltd; 1 edition (August 2011).*

REFERENCE BOOKS:

1. *Krishna Kanth,* ***“Microprocessor and Microcontroller Archotecture,Programming and System Design using 8085, 8086, 8051”****, Prentice Hall of India, 2011.*
2. *Kenneth J.Ayala,* ***“The 8051 Microcontroller”*** *3rd edition,Thompson Delmar Learning,2007, New Delhi.*
3. *Jacob Fraden,* ***“Handbook of Modern Sensors: Physics, Design and Applications”****, 3rd ed, Springer, 2010.*
4. *Michael J. Pont,* ***“Embedded C”*** *Pearson Education India, 1st edition (*2007*);*

COURSE OUTCOMES:

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

CO1: Describe the architectures of controller

CO2: Develop Assembly program applying Digital logic and mathematics using 8051 instruction set

CO3: Design microcontroller based system within realistic constraint like user specification, availability of components etc

CO4: Interface real world sensors

CO5: Solve real life problem and construct a complete system as a solution

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
CO2	M	M	M	-	-	-	-	-	-	-	-	L	M	L	L
CO3	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
CO4	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
CO5	M	M	M	-	-	-	-	-	-	-	-	L	M	L	L
18LOE $12	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L

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

18POE$13	**RAPID PROTOTYPING** *(Common to All Branches)*

Category: OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To educate students with fundamental and advanced knowledge in the field of Rapid Prototyping technology and the associated Aerospace, Architecture, Art, Medical and Industrial applications.

<table>
<tr><td><b>UNIT- I</b></td><td><b>INTRODUCTION</b></td><td><b>(9 Periods)</b></td></tr>
<tr><td colspan="3">Need - Development of RP systems – Applications in Product Development - Virtual Prototyping- Rapid Tooling – Rapid Manufacturing - Classification of RP processes – Benefits - Applications</td></tr>
<tr><td><b>UNIT- II</b></td><td><b>REVERSE ENGINEERING AND CAD MODELING</b></td><td><b>(9 Periods)</b></td></tr>
<tr><td colspan="3">Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wireframe, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for RP- Case studies.</td></tr>
<tr><td><b>UNIT- III</b></td><td><b>LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS</b></td><td><b>(9 Periods)</b></td></tr>
<tr><td colspan="3">Classification – Liquid based systems - Stereo lithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and application. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.</td></tr>
<tr><td><b>UNIT- IV</b></td><td><b>POWDER BASED RAPID PROTOTYPING SYSTEMS</b></td><td><b>(9 Periods)</b></td></tr>
<tr><td colspan="3">Selective Laser Sintering (SLS): Principle, process, indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications – case Studies, Selective Laser Melting and Electron Beam Melting</td></tr>
<tr><td><b>UNIT- V</b></td><td><b>OTHER RAPID PROTOTYPING SYSTEMS</b></td><td><b>(9 Periods)</b></td></tr>
<tr><td colspan="3">Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, Demerits, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Bio Additive Manufacturing.</td></tr>
</table>

Contact Periods:

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

TEXT BOOKS:

1. *Chua Chee Kai and Leong Kah Fai* ***"Rapid Prototyping: Principles and Applications in Manufacturing",*** *John Wiley AND Sons, 1997*
2. *Paul F. Jacobs* ***"Stereo-lithography and other RP & M Technologies",*** *from Rapid Prototyping to Rapid Tooling, SME/ASME,1996*

REFERENCE BOOKS:

1. *Gibson, I., Rosen, D.W. and Stucker, B* ***"Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing",*** *Springer, 2010.*
2. *Chua, C.K., Leong K.F. and Lim C.S* ***"Rapid prototyping: Principles and applications",*** *second edition, World Scientific Publishers, 2010.*
3. *Gebhardt, A* ***"Rapid prototyping",*** *Hanser Gardener Publications, 2003.*
4. *Liou, L.W. and Liou, F.W* ***"Rapid Prototyping and Engineering applications: A tool box for prototype development",*** *CRC Press, 2011.*
5. *Hilton, P.D. and Jacobs, P.F* ***"Rapid Tooling: Technologies and Industrial Applications",*** *CRC press, 2005*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Appreciate the importance of computers and modern tools in manufacturing to reduce cost and matching the societal needs.

CO2: Create and analyze 2D and 3D models using CAD modeling software and integrating with manufacturing systems.

CO3: Understand the variety of Additive Manufacturing (AM) technologies apply to their potential to support design and manufacturing, case studies relevant to mass customized manufacturing.

CO4: Apply knowledge on latest techniques of manufacturing in their field of career

CO5: To monitor and control shop floor with the aid of computers

COURSE ARTICULATION MATRIX

PO/PSO	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**PS**	**PS**	**PS**
CO	**O 1**	**O 2**	**O 3**	**O 4**	**O 5**	**O 6**	**O 7**	**O 8**	**O 9**	**O 10**	**O 11**	**O 12**	**O 1**	**O 2**	**O 3**
CO1			L				M						L	L	
CO2			M											M	L
CO3			L										M	L	
CO4			M		H	M	L						M	H	L
CO5		M				L					M		L	H	
18POE$13		M	M		M	L	L				L		M	M	L

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

18POE$14	**MANAGERIAL ECONOMICS** *(Common to All Branches)*

Category: OE

L T P C
3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the fundamental economic principles necessary for production managers.

UNIT- I	**FUNDAMENTALS OF MANAGERIAL ECONOMICS**	**(9 Periods)**
Goals and Constraints - The Nature and Importance of Profits - Understanding Incentives - Economic rationality, Scarcity and opportunity cost -Marginal and Incremental Analysis.		
UNIT- II	**DEMAND ANALYSIS**	**(9 Periods)**
Demand and Supply -Market Equilibrium - Price Elasticity of Demand - Price Elasticity, Total Revenue, and Marginal Revenue - Factors Affecting Price Elasticity - Cross Price Elasticity - Income Elasticity of Demand - Other Elasticities, Elasticities for Nonlinear Demand Functions - Elasticity of Supply.		
UNIT- III	**DEMAND THEORIES**	**(9 Periods)**
Choice and Utility Theory - Law of Diminishing marginal utility - Consumer Equilibrium - Consumer Surplus - Price effect, Substitution Effect and Income Effect.		
UNIT- IV	**THEORY OF PRODUCTION AND COST**	**(9 Periods)**
The Production Function - Profit-Maximizing Input Usage - Isoquants and Isocosts - Cost Minimization and Optimal Input Substitution - The Cost Function - Breakeven analysis, Contribution analysis - Long-run Costs and Economies of Scale - Multiple Cost Functions and Economies of Scope - Learning curve.		
UNIT- V	**THEORY OF MARKET AND PRICING**	**(9 Periods)**
The Nature of Industry - Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Product pricing.		

Contact Periods:

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

TEXT BOOKS:

1. *Thomas and Maurice* ***"Managerial Economics: Concept and Applications",*** *McGraw-Hill, 2005*
2. *Maheshwari.Y* ***"Managerial Economics",*** *Prentice Hall of India, 2012*

REFERENCE BOOKS:

1. *D.N. Dwivedi,* ***"Managerial Economics",*** *Vikas Publishing house, 2015*
2. *Christopher R Thomas, S Charles Maurice,* ***"Managerial economics",*** *Mcgraw Hill, 2014*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Explain fundamentals of managerial economics.

CO2: Discuss the dynamics of market forces.

CO3: Explain about various theories of demand.

CO4: Discuss about the cost concepts related to production.

CO5: Describe about the theory of market and pricing method.

COURSE ARTICULATION MATRIX

PO/PSO **CO**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	L	L							L	M	M	L			L
CO2	L	L	L							M	M	L			L
CO3	L									L	M	L			L
CO4	L									L	L	L			L
CO5	L	M	M	L						L	M	L			L
18POE$14	L	L	L	L						L	M	L			L

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

18POE$15	HYDRAULICS AND PNEUMATICS *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students to design the hydraulic and pneumatic circuits for different applications.

UNIT- I	BASIC PRINCIPLES	(9 Periods)
Hydraulic Principles; Hydraulic Fluids; Hydraulic pumps – Classification, Characteristics, Pump Selection; Hydraulic actuators; Hydraulic valves – Pressure, Flow, Direction Controls, Applications, Symbols.		
UNIT- II	**HYDRAULIC CIRCUITS**	**(9 Periods)**
Hydraulic circuits – Reciprocating, Quick Return, Sequencing, Synchronizing, Regenerative circuit, Double pump hydraulic system; Safety Circuits.		
UNIT- III	**POWER GADGETS IN HYDRAULICS**	**(9 Periods)**
Accumulators – Classification, Circuits; Pressure Intensifier and Circuit; Mechanical-hydraulic servo system; Selection of components. Installation and Maintenance of Hydraulic power pack; Troubleshooting of fluid power circuits.		
UNIT- IV	**PNEUMATIC SYSTEMS**	**(9 Periods)**
Pneumatic Fundamentals; Control Elements; Logic Circuits; Position sensing, Pressure sensing; Electrical controls: Various switches; Electro Pneumatic and Electro Hydraulic Circuits.		
UNIT- V	**DESIGN AND SELECTION OF PNEUMATIC CIRCUITS**	**(9 Periods)**
Design of Pneumatic circuits – Classic, Cascade, Step counter; PLC and Microprocessors – Uses; Selection criteria for Pneumatic components; Installation and Maintenance of Pneumatic power pack; Fault finding; Case studies.		

Contact Periods:

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

TEXT BOOKS:

1. *Anthony Esposito, **"Fluid Power with Applications",** Pearson Education India, 7th edition, 2013.*
2. *Andrew Parr, **"Hydraulics and Pneumatics:A Technician's and Engineer's Guide",** Butterworth-Heinemann, 3rd edition, 2011.*

REFERENCE BOOKS:

1. *DudleyA Pease and John J Pippenger* ***"Basic Fluid Power",*** *Prentice Hall PTR, 2nd edition 1987.*
2. *John J Pippenger and Tyler G Hicks* ***"Industrial Hydraulics",*** *McGraw Hill,2nd edition, 1970.*
3. *J. Michael, Pinches and HohnG.Ashby* ***"Power Hydraulics",*** *Prentice Hall, 1989.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Describe the principle of fluid power
CO2: Describe the components of hydraulics
CO3: Design the hydraulic circuits for automation
CO4: Describe the components of pneumatics
CO5: Design the pneumatic circuits for automation

COURSE ARTICULATION MATRIX

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	H										M			
CO2	M											M			
CO3	M	H										M			
CO4	M											M			
CO5	M											M			
18POE$15	M	H										M			

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

18NOE$16	**MEASUREMENT AND CONTROL** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- To learn about the working of different analog and digital instruments.

UNIT I – INTRODUCTION TO MEASUREMENTS	**(9 Periods)**
Significance of measurements – Methods of measurements – Classification of Instruments – Functions of Instruments and Measurement System – Elements of measurement system – Errors in measurement — Calibration of instruments: Methods & analysis – Introduction to Transducer & types.	
UNIT II – STRAIN AND DISPLACEMENT MEASUREMENT	**(9 Periods)**
Factors affecting strain measurements – Types of strain gauges – theory of operation – strain gauge materials – strain gauge circuits and applications of strain gauges. Resistive potentiometer (Linear, circular and helical) – L.V.D.T., R.V.D.T. and their characteristics – variable inductance and capacitance transducers – Piezo electrical transducers – Hall Effect devices and Proximity sensors.	
UNIT III – PRESSURE AND TEMPERATURE MEASUREMENT	**(9 Periods)**
Mechanical devices like Diaphragm, Bellows, and Bourdon tube for pressure measurement – Variable inductance and capacitance transducers – Piezo electric transducers – L.V.D.T. for measurement of pressure. Resistance type temperature sensors – RTD & Thermistor – Thermocouples & Thermopiles, Laws of thermocouple – Radiation methods of temperature measurement.	
UNIT IV – FLOW AND LEVEL MEASUREMENT	**(9 Periods)**
Differential pressure meters like Orifice plate, Venturi tube, flow nozzle, Pitot tube, Rotameter, Turbine flow meter, Electromagnetic flow meter and Ultrasonic flow meter. Resistive, inductive and capacitive techniques for level measurement – Ultrasonic methods – Air purge system (Bubbler method).	
UNIT V – AUTOMATIC CONTROL SYSTEM	**(9 Periods)**
Elements of control systems – concept of open loop and closed loop systems – Controllers – Brief idea of proportional, derivative and integral – Pneumatic Controller – Hydraulic Controller.	

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

TEXT BOOKS

1. *A.K. Sawhney, Puneet Sawhney **"A Course in Electronic and Electrical Measurements and Instrumentation"** S.K.Kataria & Sons, Delhi, 2014.*
2. *E. D. Doeblin, **"Measurement Systems: Application and Design",** McGraw – Hill Publication, 6th Edition 2017.*

REFERENCE BOOKS

1. *S. K. Singh, **"Industrial Instrumentation & Control"**, 3rd Edition, McGraw Hill, 2016.*
2. *A.K. Sawhney, Puneet Sawhney **"A Course in mechanical measurements and Instrumentation & Control"**, Dhanapat Rai & Co, 2012.*

COURSE OUTCOMES:

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

CO 1: Explain the construction and working of instruments used for various measurements.
CO 2: Describe the methods of measurement, classification of transducers and to analyze error.
CO 3: Elaborate the basic concept of control system.
CO 4: Analyze the characteristics of various measuring instruments
CO 5: Suggest suitable instruments for a particular application

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	H	M	H	M	L	H	M	H	H	H	M	H
CO2	H	M	M	M	H	H	H	M	H	L	H	H	H	H	M
CO3	H	H	M	H	M	H	M	L	H	M	H	H	H	H	H
CO4	H	H	M	H	M	H	M	L	H	M	H	H	H	M	H
CO5	H	H	M	H	M	H	M	L	H	M	H	H	H	M	M
18NOE$16	H	H	M	H	M	H	M	L	H	M	H	H	M	H	M

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

18NOE$17	**INDUSTRIAL AUTOMATION** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- To elaborate the basic concept of automation and the components required for automation

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. *Romily Bowden, **"HART application guide and the OSI communication foundation"**, 1999*
3. *Frank D. Petruzella, **"Programmable Logic Controllers"**, 5th Edition, McGraw Hill, 2016.*

COURSE OUTCOMES:

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

CO 1: Elaborate the basic architecture of automation systems

CO 2 : Describe the various sensors and actuators involved in industrial automation

CO 3: Construct ladder logic diagram using PLC basic functions, timer and counter functions for simple applications

CO 4: Illustrate the functionary components and supervisory control of DCS with relevant diagrams

CO 5: Describe the basics of SCADA technology

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	M	L	L	L	H	L	M	L	L	H	L	L
CO2	H	H	H	H	L	L	L	H	L	M	L	L	H	L	L
CO3	H	H	M	M	L	L	M	H	L	M	L	L	H	L	L
CO4	H	H	H	H	L	L	L	H	L	M	L	L	H	L	L
CO5	H	H	M	M	M	L	L	H	L	M	L	L	H	L	L
18NOE$17	H	H	M	M	L	L	L	H	L	M	L	L	H	L	L

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

18NOE$18	**VIRTUAL INSTRUMENTATION** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- To confer applications of virtual instrumentation in various fields.

UNIT I – INTRODUCTION	**(9 Periods)**
Virtual Instrumentation and LabVIEW - Evolution of LabVIEW - Difference between LabView and conventional languages - Sequencing and data flow - Graphical programming.	
UNIT II – LabVIEW ENVIRONMENT	**(9 Periods)**
Front panel - Block diagram - Icon and Connector - Control Palette - Function Palette-Tools Palette - Creating, editing, wiring, debugging and saving VIs - sub-VIs - creating sub-VIs - simple examples-Looping: For loop, while loop-Shift registers - case and sequence; structures, formula nodes.	
UNIT III – PROGRAMMING TECHNIQUES	**(9 Periods)**
Arrays - clusters, charts and graphs, - local and global variables - property node, string and file I/O.	
UNIT IV – DATA ACQUISITION AND INSTRUMENT CONTROL	**(9 Periods)**
DAQ – Components - Buffers: Buffered and non buffered I/O - Triggering - Analog I/O-Digital I/O - Counters and timers-Instrument control: VISA, GPIB, VXI and PXI	
UNIT V – ADVANCED Lab VIEW AND APPLICATIONS	**(9 Periods)**
Connectivity in LabVIEW: an introduction - IVI - Labwindows/CVI. Applications of Lab VIEW: process control, physical, biomedical, Image acquisition and processing.	

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

TEXT BOOKS

1. *Sanjay Gupta and Joseph John, **"Virtual Instrumentation using LabVIEW"** Tata McGraw-Hill, Second edition 2010*
2. *Gary Johnson, Richard Jennings **"Lab view graphical programming",** Tata McGraw Hill, 2011.*

REFERENCE BOOKS

1. *Lisa K Wells and Jeffrey Travels, **"LabVIEW for everyone",** Prentice Hall, 3rd Edition 2009.*
2. *S. Gupta, J.P. Gupta, **"PC interfacing for data acquisition and process control",** 2nd Ed., Instrument Society of America, 2011*
3. *Jovitha Jerome, **"Virtual Instrumentation Using LabVIEW"** PHI Learning Pvt. Ltd 1st Edition, 2010*

COURSE OUTCOMES:

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

CO 1 Recognize the importance and applications of virtual instrumentation.

CO 2 Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.

CO 3 Realize the basics of interfacing and programming using related hardware.

CO 4 condition the acquired signal from the transducer to standard data formats

CO 5 Develop real time applications using LabVIEW

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	H	M	M	L	L	L	H	L	M	M	M	H	M	M
CO2		H	H	H	L	L	L	H	L	M	M	M	H	M	M
CO3		H	M	M	L	L	M	H	L	M	M	M	H	M	M
CO4		H	H	H	L	L	L	H	L	M	M	M	H	M	M
CO5		H	M	M	M	L	L	H	L	M	M	M	H	M	M
18NOE$18	M	H	M	M	L	L	L	H	L	M	M	M	H	M	M

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

18SOE$19	**PROGRAMMING IN JAVA** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Basic programming constructs in java to develop simple object oriented programs.
- Exception handling, multi-threading and I/O programming
- Development of GUI applications
- Manipulation of images.
- Network Programming

UNIT – I : FUNDAMENTALS OF JAVA PROGRAMMING	**(9 Periods)**
History and Evolution of Java- Overview of java– Operators- Control Structures– Methods- Classes and Objects– Inheritance- Packages and Interfaces- Exception Handling.	
UNIT – II : THREADS , I/O AND STRING HANDLING	**(9 Periods)**
Multi threaded Programming– Enumeration- Auto boxing– Annotations- String Handling-Input/Output: Exploring java.io.	
UNIT – III : APPLETS AND EVENT HANDLING	**(9 Periods)**
Applet class- Event Handling. Introducing the AWT: working with windows- graphics and text- Using AWT controls- Layout Manager - menus.	
UNIT – IV : IMAGING AND DATABASE CONNECTIVITY	**(9 Periods)**
Imaging: Creating- loading and displaying- Image observer- Double buffering- Media tracker- Image producer– consumer– filters– animation- Java Database Connectivity.	
UNIT – V : NETWORKING	**(9 Periods)**
Networking – Remote Method Invocation – Java Beans –Java servlets	

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

TEXT BOOKS:

1. *Herbert Schildt, **"Java, The Complete Reference** ", Tata McGrawHill, Eighth Edition, 2011.*

REFERENCE BOOKS:

1. *Deitel .H.M and Deitel.P.J, **"Java: How to Program",** Pearson Education Asia, Eighth Edition 2010.*
2. *Lay.S&Horstmann Gary Cornell, **"Core Java Vol I",** Seventh Edition, The Sun Microsystems & press Java Series, 2005.*
3. *Lay.S&Horstmann Gary Cornell, **"Core Java Vol II",** Eighth Edition, The Sun Microsystems & press Java Series, 2008.*

COURSE OUTCOMES:

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

CO1: Write simple java programs using fundamental concepts of java like control structures, inheritance, packages, interfaces and exception handling. [**Usage]**

CO2: Write java program using multithreading and string handling. [**Usage]**

CO3: Develop GUI based applications using Applets. [**Usage]**

CO4: Write java programs to display and manipulation of graphical images. [**Usage]**

CO5: Establish database connectivity.[**Familiarity]**

CO6: Develop client server programs using RMI and servlets. [**Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H		H	M	M				H	M	M	H	H	H
CO2	M	M	H		H	M	M				H	M	M	H	H	H
CO3	M	M	H		H	M	M				H	M	M	H	H	H
CO4	M	M	H		H	M	M				H	M	M	H	H	H
CO5	M	M	H		H	M	M				H	M	M	H	H	H
CO6	M	M	H		H	M	M				H	M	M	H	H	H
18SOE$19	M	M	H		H	M	M				H	M	M	H	H	H

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

18SOE$20	**CYBER SECURITY** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

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

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 Frauds in Mobile and Wireless Computing Era – Security challenges posed by mobile devices – registry setting for mobile devices – authentication service security – attacks on mobile/cell phones – Organizational measures for handling mobiles.	
UNIT – III : TOOLS AND METHODS USED IN CYBERCRIME	**(9 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, Compute Forensics and Legal Perspectives",*** *Wiley India Publications, April, 2011.*

REFERENCE BOOKS:

1. *Robert Jones, **"Internet Forensics: Using Digital Evidence to Solve Computer Crime",** O"Reilly Media, October, 2005.*
2. *Chad Steel, "**Windows Forensics: The field guide for conducting corporate computer investigations**", Wiley India Publications, December, 2006.*

COURSE OUTCOMES:

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

CO1: Explain the fundamental concepts of cybercrime and cyberoffenses. **[Familiarity]**

CO2: Describe the cybercrimes occurred in mobile and wireless devices. **[Familiarity]**

CO3: Elaborate the methods used in cybercrime. **[Familiarity]**

CO4: Explain the laws for cybercrime and its respective punishments. **[Familiarity]**

CO5: Explain the forensics Analysis of E-Mail, Network and Social Networking Sites **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	M	M	L	H	L	M				H	H	L	M	M
CO2	M	M	M	M	M	H	M	M				M	H	H	M	M
CO3	H	L	L	L	L	H	H	L				H	H	H	L	L
CO4	H	M	M	M	M	H	H	H				M	H	H	L	L
CO5	H	M	M	M	M	L	H	L				H	H	H	M	M
18SOE$20	H	M	M	M	M	H	H	M				H	H	H	M	M

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

18SOE$21

NETWORK ESSENTIALS

(Common to All Branches)

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

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"*** *5th edition, Morgan Kaufmann Publishers Inc, 2011.*

REFERENCE BOOKS:

1. *Behrouz A.Ferouzan,* ***"Data Communications and Networking"****, 5th edition, Tata McGraw-Hill, 2012.*
2. *Andrew S. Tanenbaum,* ***"Computer networks"****, PHI, 5th edition 2011.*

COURSE OUTCOMES:

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

CO1: Identify topologies and types of Computer Networks and enumerate the layers of the OSI model and TCP/IP and Explain the functions of each layer **[Familiarity]**

CO2: Explain the significance of wireless networks and configure a Wireless LAN **[Assessment]**

CO3: Describe basic routing algorithms and network services. **[Familiarity]**

CO4: Troubleshoot the router and switch interface **[Usage]**

CO5: Analyze Campus Network data traffic **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H	H	H	L	L	H	H	H	H	H	M	H	H	M
CO2	L	L	L	L	H	L	L	H	L	L	L	H	M	H	H	M
CO3	L	H	M	M	H	L	L	H	H	M	L	H	L	H	H	L
CO4	H	H	H	M	H	L	L	H	H	H	M	H	M	H	H	M
CO5	H	H	H	M	H	L	L	H	H	M	L	H	M	H	H	M
18SOE$21	M	H	H	M	H	L	L	H	H	L	M	H	M	H	H	M

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

18IOE$22	**PROGRAMMING IN PYTHON** *(Common to All Branches)*

PRE-REQUISITES: **Category: OE**

NIL

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

COURSE OBJECTIVES:

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

- Data types and variables declaration.
- Control statements, Functions and the use of basic programming.
- List, dictionary and operations used in python.
- File 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. *David I.Schneider, **"Introduction to programming using python",** person, 2015.*

REFERENCE BOOKS:

1. *Michael Dawson,* ***"Python Programming for the Absolute Beginner",*** *Premier Press, 2003.*
2. *Charles Dierbach,* ***"Introduction to Computer Science Using Python: A Computational Problem-Solving Focus",*** *Wiley Publications, 2012.*

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IOE $22	**M**	**M**	**L**	**M**	**L**		**M**	**M**			**L**	**L**	**M**	**L**

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

18IOE$23

BIG DATA SCIENCE
(Common to All Branches)

PRE-REQUISITES: **Category: OE**

NIL

L	T	P	C
3	0	0	3

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, Paul Zikopoulos,* ***"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.*
3. *Bill Franks,* ***"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics",*** *Wiley and SAS Business Series, 2012.*
4. *Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan,* ***"Harness the Power of Big data – The big data platform",*** *McGraw Hill, 2012.*
5. *Colleen Mccue,* ***"Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis",*** *Elsevier, 2007*

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
18IOE $23	M	H	M	L	H	L		L				L	M	L

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

18IOE$24	**OBJECT ORIENTED PROGRAMMING USING C++** *(Common to All Branches)*

PRE-REQUISITES: **Category: OE**

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. *Lafort Robert,* ***"Object oriented proframming in C++",*** *4th Edition.*
2. *E.Balagurusamy,* ***"Object oriented Programming with C++",*** *McGraw Hill Education Ltd, 7th Edition 2017.*

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. Kanetkar, **"Let us C++",** BPB Publications, 2nd edition 2003.*

COURSE OUTCOMES:

Upon completion of the course, the student 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: Use files, templates and handle exceptions. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	H	M			M						M	L
CO2	M	H	H	H			M						H	L
CO3	M	H	H	H			M						H	L
CO4	M	H	H	H			M						H	L
CO5	M	H	H	H			M						H	L
18IOE $24	M	H	H	H			M						H	L

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

18BOE$25	**COMPUTATIONAL BIOLOGY** *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

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

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. Andreas D. Baxevanis, **"Bioinformatics, A Practical Guide to the Analysis of Genes and Proteins"**, Third edition; Wiley-Interscience, 2004.*
*2. Baxevanis A.D. and Oullette, B.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 course the students will be able to

CO1: Understand the basic structure of Biological macromolecules

CO2: Acquire the knowledge of biological databases and its importance.

CO3: Perform pair wise and multiple sequence alignment

CO4: Predict the secondary and tertiary structure of proteins.

CO5: Understand the machine learning approaches in computational biology

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L	L		L			M				L	
CO2	M	L	L	L					L			L	L	L
CO3	L		L			M			L			L	L	
CO4	M	M	L	M	M								M	
CO5		M		H	H	M	L		M				H	H
18BOE $25	M	M	L	M	M	M	L		M			L	M	H

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

18BOE$26	FUNDAMENTAL CONCEPTS OF BIOLOGY FOR ENGINEERS *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- 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 Krein NR, ***"Microbiology"****, Tata McGraw Hill, 5th Edition, New Delhi.2001.*
3. Wulf Cruger and Anneliese Cruger, ***"A Textbook of Industrial Microbiology"****, Panima Publishing Corporation, 2nd Edition, 2000.*

REFERENCE BOOKS:

1. *David L. Nelson and Michael M Cox, **“Lehninger’s Principles of Biochemistry”**, Macmillan Worth Publisher, 4th edition, 2004.*
2. *Brain R.Eggins , **“Chemical Sensors and Biosensors”**, John Wiley & Sons, 2002.*
3. *Anton Moser, **“Bioprocess Technology, Kinetics and Reactors”**, Springer, Berlin (Verlag),1st edition, 1998*
4. *Kuby J, **“Immunology”**, WH Freeman & Co., 7th edition, 2013.*

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	L	L	-	-	-	-	-	-	-	-	-	H	M
CO2	L	M	-	L	-	-	L	M	-	-	-	-	M	M
CO3	L	M	L	L	-	-	-	L	M	-	-	L	H	H
CO4	L	L	L	L	M	-	-	-	L	-	-	-	M	H
CO5	-	-	-	-	-	-	-	-	-	-	-	-	H	H
18BOE $26	L	M	L	L	M	-	L	M	M	-	-	L	H	H

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

18BOE$27	**FUNDAMENTALS OF BIOENGINEERING** *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

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. Stanbur., Stephen J. Hall., A. Whitake., **"Principles of Fermentation Technology"**, Science & Technology Books. 2007.*
2. *Presscott, S.C., Cecil G., Dun, **"Industrial Microbiology"**, Agrobios (India), 2005.*
3. *Casida, L.E., **"Industrial Microbiology"**, New Age International (P) Ltd, 1968.*

REFERENCE BOOK

1. *Crueger, W., Anneliese Cruege.,**"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., Kristiansen B., **"Basic Biotechnology"**, Cambridge University Press, second Edition, 2001.*
4. *Michael J. Waites., **"Industrial Microbiology: An Introduction"**, Blackwell Publishing,2001.*

COURSE OUTCOMES:

Upon completion of the course in Bioprocess Principles graduates will be able to
CO1: 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	H	-	-	-	-	-	-	-	-	-	M	-
CO2	H	M	-	-	-	-	-	-	-	-	-	-	-	-
CO3	H	H	H	M	M	M	-	L	H	-	-	-	-	H
CO4	H	L	L	-	-	L	-	L	-	-	-	-	-	H
CO5	H	M	H	L	M	-	-	L	-	-	-	-	-	H
18BOE $27	H	M	H	M	M	M	-	L	H	-	-	-	M	H

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

18IVA$01	**R PROGRAMMING**

PRE-REQUISITES: **Category: VA**

NIL

L	T	P	C
1	0	0	1

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)**
Overview of R - Getting Started with R - Important R Data Structures – Vectors - Matrices and Arrays.	
UNIT – II : PROGRAMMING STRUCTURES	**(5 Periods)**
Control Statements - Arithmetic and Boolean Operators - Return Values - Functions are Objects – Recursion - Replacement Functions.	
UNIT – III : SIMULATIONS IN R	**(5 Periods)**
Math functions – functions for statistical distributions – sorting – linear algebra operations – set operations –simulation programming in R.	

Contact Periods:
Lecture: 15 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 15 Periods**

TEXT BOOKS:

1. *Norman Matloff , **"The Art of R Programming:A Tour of Statistical Software Design",** No Starch Press, 2011.*

REFERENCE BOOKS:

1. *Felix Alvaro, **"R: Easy R Programming for Beginners",** Second edition, Wiley 2018.*

COURSE OUTCOMES:

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

CO1: Explain the concepts of R-Programming. **[Familiarize]**

CO2: Apply the control structure and functions. **[Understand]**

CO3: Develop the R-Programming for Date and Time utilizations. **[Understand]**

CO4: Debug the R-Programming. [**Understand]**

CO5: Implement Profiling R Code. [**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
18IVA $01	M	H	H	H	M	M		M			L		H	M

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

18IVA$02	ETHICAL HACKING

PRE-REQUISITES: **Category: VA**

NIL

L	T	P	C
0	0	2	1

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. DoS(Denial of Service) Attacks
6. Hacking a Web Servers and websites
7. SQL Injection
8. Hacking using Social Engineering

Contact Periods:

Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 30 Periods**

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	M	H	M		H					H	L
CO2	H	M	M	M	H	M		H					H	L
CO3	H	M	M	M	H	M		H					H	L
CO4	H	M	M	M	M	H		H					H	L
CO5	H	M	M	M	M	H		H					H	L
18IVA $02	H	M	M	M	M	H		H					H	L

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

18IVA$03 .NET FRAMEWORK

PRE-REQUISITES: **Category: VA**

NIL

L	T	P	C
1	0	0	1

COURSE OBJECTIVES:

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

- Basic architecture of .NET framework
- .NET Components

UNIT – I : DESIGN AND DEVELOPMENT	**(5 Periods)**
Understanding .NET – Basic .NET Framework features - .NET Framework architecture – Design by layer – Distributed Application Layers – .NET Remoting - Windows Communication Foundation.	
UNIT – II : .NET COMPONENTS	**(5 Periods)**
Building windows application – Accessing data with ADO.NET – Programming web application with ASP.NET Web forms – Core XAML – Windows Communication Foundation (WCF) - Windows Workflow Foundation (WWF) – Windows Forms	
UNIT – III : HANDS-ON	**(5 Periods)**
Assignments, Mini Projects using .NET.	

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, ISBN-13: 978-1430225492, 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, 2008.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to,
CO1: Demonstrate the basic architecture of .NET framework. [**Understand]**
CO2: Develop Windows and Web Applications.**[Analyze]**
CO3: Apply .NET components in projects.**[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H		H		M						M	L
CO2	H	H	H		H		M						M	L
CO3	H	H	H		H		M						M	L
18IVA $03	H	H	H		H		M						M	L

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

18IVA$04	**AUTOMATED TESTING**

PRE-REQUISITES: **Category: VA**

NIL

L	T	P	C
1	0	0	1

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 the course, the student 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
18IVA $04	M	M	M	M	H	L	L	L	M	M	H	L	M	M

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

18IVA$05 | USER INTERFACE TECHNOLOGIES

PRE-REQUISITES: **Category: VA**

NIL

L	T	P	C
0	0	2	1

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 Angular JS technologies.

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

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 30 Periods**

COURSE OUTCOMES:

Upon completion of the course, the student 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]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L	M	L	M	L	L	L	L	L	L	L	M	L
CO2	H	L	M	L	M	L	L	L	L	L	L	L	M	L
CO3	H	L	M	L	M	L	L	L	L	L	L	L	M	L
CO4	H	L	M	L	M	L	L	L	L	L	L	L	M	L
18IVA $05	**H**	**L**	**M**	**L**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**M**	**L**

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

18IVA$06 UNIFIED MODELLING LANGUAGE

PRE-REQUISITES: **Category: VA**

NIL

L	**T**	**P**	**C**
0	0	2	1

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. Creating 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 the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	
18IVA$06	**H**		**M**		**M**								**M**	

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

18IVA$07	**HARDWARE TROUBLESHOOTING TECHNIQUES**

PRE-REQUISITES: **Category: VA**

NIL

L	T	P	C
0	0	2	1

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

1. Study of Motherboard and its interfacing components.
2. Study of Booting Process.
3. Install, upgrade and configure Windows operating systems.
4. Disk formatting, partitioning and Disk operating system commands
5. Install and configure computer drivers and system components.
6. Study of hubs and switch.
7. Configuring LAN, IP address and Domain name system.
8. Install, upgrade and configure Linux operating systems.
9. Installation of printer and scanner software.
10. Disassembly and Reassembly of hardware

Contact Periods:

Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 30 Periods**

COURSE OUTCOMES:

Upon completion of the course, the student 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H		L										M	
CO2	H		L		M								M	
CO3	H		L		M								M	
CO4	H		L		M								M	
CO5	H												M	
18IVA $07	**H**		**L**		**L**								**M**	

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

18IVA$08	ELECTRONIC CIRCUITS

PRE-REQUISITES: **Category: VA**

NIL

L	T	P	C
1	0	0	1

COURSE OBJECTIVES:

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

- To gain Knowledge on semiconductor Diodes
- To learn the Principles of BJT and FE
- To gain knowledge on Special Semiconductor devices

UNIT – I : PN JUNCTION AND SEMICONDUCTOR DIODES	**(5 Periods)**
Energy band structure of conductors, semiconductors and Insulators-Classification of semiconductors-conductivity of semiconductors-Drift and diffusion currents- Continuity Equation Energy and structure of PN junction diode-Diode current equation-Transition or space charge capacitance-Diffusion capacitance-Effect of temperature on PN junction diodes-Diode switching characteristics-PN diode Applications-Clippers, Clampers- Zener diode characteristics	
UNIT – II : BIPOLAR JUNCTION AND FIELD EFFECT TRANSISTORS	**(5 Periods)**
Construction of PNP and NPN Transistor-Transistor current components- Transistor as an amplifier-CE,CB and CCconfigurations-Characteristics-current gain –bandwidth modulation- Operation and Characteristics of JFET, FET as aVoltage variable resistor, Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-Enhancement and Depletion mode MOSFET.	
UNIT – III : SPECIAL SEMICONDUCTOR DEVICES	**(5 Periods)**
Construction and Characteristics of Schottky diode-Tunnel diode and Varactor diode-SCR-TRIAC Principles of Photo emissivity and photo -conductivity-Construction and characteristics of LCD-LED-Photo conductive cell-photo voltaic cell-photo diode-solar cell-phototransistors-plasma display-numeric displays opto couplers and LASER diodes.	

Contact Periods:

Lecture: 15 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 15 Periods**

TEXT BOOKS:

1. *JacobMillman, ChristosHalkias&SatyabrataJit, **"Millman'sElectronicDevicesandCircuits",** 3rd Edition McGraw Hill, 2009.*
2. *Sedra and Smith, **"Microelectronics Circuits",** Oxford, 7th Edition, 2009.*

REFERENCE BOOKS:

1. *S.Salivahanan,N.SureshkumarandA.Vallavaraj, **"ElectronicDevicesandCircuits",** 2nd Edition, TataMcGrawHill, 2008.*
2. *AllenMottershead, **"ElectronicDevicesandCircuits",** PrenticeHallofIndia,2008.*
3. *RobertL.Boylestad,LouisNashelsky, **"ElectronicDevicesandCircuitTheory",** 9th Edition ,Pearson Education,2006*

COURSE OUTCOMES:

Upon completion of the course, the student will have a,

CO1: Knowledge on semiconductor Diodes **[Familiarize]**

CO2: Knowledge on Principles of BJT and FET **[Familiarize]**

CO3: Knowledge on Special Semiconductor devices **[Familiarize]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H											L	M	L
CO2	H											L	M	L
CO3	H	M	M									L	M	L
18IVA $08	**H**	**L**	**L**									**L**	**M**	**L**

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

18IVA$09* ANDROID MALWARE ANALYSIS

PRE-REQUISITES: **Category: VA**

NIL

L	**T**	**P**	**C**
0	0	2	1

COURSE OBJECTIVES:

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

- The types of Android Malwares
- Static Analysis of Android Malwares
- Dynamic analysis of Android Malwares
- Tools used for the analysis of Android Malwares

LIST OF EXPERIMENTS

1. Study of types of Android Malwares
2. Study of methods used in Android Malware Analysis
3. Parsing of an Android package for Static Analysis
4. Analysis of AndroidManifest.xml using APK parser
5. Decompilation of Classes.dex file
6. Installation of malware APK files in an emulator
7. Dynamic Analysis of android malware using emulator

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 30 Periods**

COURSE OUTCOMES:

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

CO1: Understand the different types of android malwares. **[Understand]**
CO2: Understand different android malware analysis techniques. **[Understand]**
CO3: Analyze the android malwares statically using decompilation tools. **[Analyze]**
CO4: Analyze the android malwares dynamically using Emulator tool. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H	H	L	L	L	L	L	M	M	H	M
CO2	H	H	H	H	H	L	L	L	L	L	M	M	H	M
CO3	H	H	H	H	H	L	L	L	L	L	M	M	H	M
CO4	H	H	H	H	H	L	L	L	L	L	M	M	H	M
18IVA $09	H	H	H	H	H	L	L	L	L	L	M	M	H	M

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

18IVA$10	**APTITUDE I** *(Common to ECE & IT)*

PRE-REQUISITES: **Category: VA**

NIL

L	**T**	**P**	**C**
1	0	0	1

COURSE OBJECTIVES:

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

- To improve aptitude, problem solving skills and reasoning ability of the student.
- To collectively solve problems in teams & group.

UNIT – I : NUMBERS AND ARITHMETIC – I	**(5 Periods)**
Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds . Percentages, Profit & Loss, Simple Interest & Compound Interest, Clocks & calendars	
UNIT – II : ALGEBRA – I	**(5 Periods)**
Logarithms, Problems on ages	
UNIT – III : REASONING	**(5 Periods)**
Logical Reasoning, Analytical Reasoning.	

Contact Periods:

Lecture: 15 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 15 Periods**

TEXT BOOKS:

1. *Agarwal R.S – **"Quantitative Aptitude for Competitive Examinations",** S.Chand Limited 2011.*

REFERENCE BOOKS:

1. *Abhijit Guha, **"Quantitative Aptitude for Competitive Examinations",** Tata McGraw Hill, 3rd Edition, 2011.*
2. *Edgar Thrope, **"Test Of Reasoning for Competitive Examinations",** Tata McGraw Hill, 4th Edition, 2012.*

COURSE OUTCOMES:

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

CO1: Problem solving skills and reasoning ability of the student. **[Analyse]**

CO2: Ability to solve problems in teams & group. **[Analyse]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	M	L		M						M	M	L
CO2	M	H	M	M		M						M	M	L
18IVA $10	M	H	M	M		M						M	M	L

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

18IVA$11	**APTITUDE II** *(Common to ECE & IT)*

PRE-REQUISITES: **Category: VA**

NIL

L	T	P	C
1	0	0	1

COURSE OBJECTIVES:

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

- To improve aptitude, problem solving skills and reasoning ability of the student.
- To collectively solve problems in teams & group.

UNIT – I : ARITHMETIC – II	**(5 Periods)**
Ratios & Proportions, Averages, Mixtures & Solutions. Time, Speed & Distance, Time & Work	
UNIT – II : ALGEBRA – II	**(5 Periods)**
Quadratic Equations, Linear equations & inequalities	
UNIT – III : MODERN MATHEMATICS	**(5 Periods)**
Sets & Functions, Sequences & Series, Data Interpretation, Data Sufficiency	

Contact Periods:
Lecture: 15 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 15 Periods**

TEXT BOOKS:

1. *Agarwal R.S – **"Quantitative Aptitude for Competitive Examinations"**, S.Chand Limited 2011.*

REFERENCE BOOKS:

1. *Abhijit Guha, **"Quantitative Aptitude for Competitive Examinations"**, Tata McGraw Hill, 3rd Edition, 2011.*
2. *Edgar Thrope, **"Test Of Reasoning for Competitive Examinations"**, Tata McGraw Hill, 4th Edition, 2012*

COURSE OUTCOMES:

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

CO1: Problem solving skills and reasoning ability. **[Analyse]**
CO2: Ability to solve problems in teams & group. **[Analyse]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	M	L		M						M	M	L
CO2	M	H	M	M		M						M	M	L
18IVA $11	M	H	M	M		M						M	M	L

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

18IVA$12	**APTITUDE III** *(Common to ECE & IT)*

PRE-REQUISITES: **Category: VA**

NIL

L	**T**	**P**	**C**
1	0	0	1

COURSE OBJECTIVES:

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

- To enhance holistic development of students and improve their employability skills.

UNIT – I :	**(5 Periods)**
Video Profile- Tech Talk / Area of Interest / Extempore / Company Profile	
UNIT – II :	**(5 Periods)**
Curriculum Vitae. Mock Interview	
UNIT – III :	**(5 Periods)**
Group Discussion / Case Study	

Contact Periods:
Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

REFERENCE BOOKS:

1. *P N Joshi, **"Group Discussion on Current Topics"**, Ukain.*
2. *Acy Jackson , Kathleen Geckeis , **" How to Prepare Your Curriculum Vitae"**, TMH,2003.*

COURSE OUTCOMES:

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

CO1: Ability to communicate effectively. **[Analyse]**
CO2: Ability to improve their employability skills. **[Analyse]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H		L	L			M		H	H	H	H	M	H
CO2	M		L	M			M		H	H	H	H	M	H
18IVA $12	M		L	L			M		H	H	H	H	M	H

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