GOVERNMENT COLLEGE OF ENGINEERING
BARGUR
Regulations-2017
AUTONOMOUS
Curriculum for B.E. COMPUTER SCIENCE AND ENGINEERING
[FULL TIME]
I TO VIII SEMESTER CURRICULUM
From the Academic Year 2017 -2018 AND ONWARDS

SEMESTER I

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	**17ZHS101**	Communicative English I	**HS**	4	0	0	4
2.	**17ZBS102**	Engineering Mathematics I	**BS**	3	2	0	4
3.	**17ZBS103**	Engineering Physics I	**BS**	3	0	0	3
4.	**17ZBS104**	Engineering Chemistry	**BS**	3	0	0	3
5.	**17SES105**	Problem Solving and Python Programming	**ES**	3	0	0	3
6.	**17ZES106**	Engineering Graphics	**ES**	2	0	4	4
PRACTICALS							
7.	**17SES107**	Problem Solving and Python Programming Laboratory	**ES**	0	0	4	2
8.	**17ZBS108**	Physics Laboratory	**BS**	0	0	4	2
9.	**17ZBS109**	Chemistry Laboratory	**BS**	0	0	4	2
			TOTAL	18	2	16	27

SEMESTER II

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	**17ZHS201**	Communicative English II	**HS**	4	0	0	4
2.	**17ZBS202**	Engineering Mathematics II	**BS**	3	2	0	4
3.	**17ZBS203**	Engineering Physics II	**BS**	3	0	0	3
4.	**17SES204**	Basic Electrical,Electronics and Measurement Engineering	**ES**	3	0	0	3
5.	**17ZBS205**	Environmental Science and Engineering	**BS**	3	0	0	3
6.	**17SES206**	Structured Programming Using C	**ES**	3	0	0	3
PRACTICALS							
7.	**17ZES207**	Engineering Practices Laboratory	**ES**	0	0	4	2
8.	**17SES208**	Structured Programming Using C Laboratory	**ES**	0	0	4	2
			TOTAL	19	2	8	24

SEMESTER III

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	**17ZBS301**	Transforms and Partial Differential Equations	**BS**	3	2	0	4
2.	**17SPC302**	Object Oriented Programming using C++	**PC**	3	0	0	3
3.	**17SPC303**	Database Management Systems	**PC**	3	0	0	3
4.	**17SPC304**	Software Engineering	**PC**	3	0	0	3
5.	**17SPC305**	Data Structures	**PC**	3	0	0	3
6.	**17SES306**	Digital Principles and Systems Design	**ES**	3	0	0	3
PRACTICALS							
7.	**17SPC307**	Database Management systems Laboratory	**PC**	0	0	4	2
8.	**17SPC308**	Object Oriented Programming Laboratory Using C++	**PC**	0	0	4	2
9.	**17SES309**	Digital Principles and Systems Design Laboratory	**ES**	0	0	4	2
			TOTAL	18	2	12	25

SEMESTER IV

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	**17SBS401**	Probability and Queuing Theory	**BS**	3	2	0	4
2.	**17SPC402**	Operating Systems	**PC**	3	0	0	3
3.	**17SPC403**	Computer Architecture and Organization	**PC**	3	0	0	3
4.	**17SPC404**	Design and Analysis of Algorithms	**PC**	3	0	0	3
5.	**17SPC405**	Java Essentials	**PC**	3	0	0	3
6.	**17SPC406**	Object Oriented Analysis and Design	**PC**	3	0	0	3
PRACTICALS							
7.	**17SPC407**	Operating Systems Laboratory	**PC**	0	0	4	2
8.	**17SPC408**	CASE Tools Laboratory	**PC**	0	0	4	2
9.	**17SPC409**	DataStructures and Algorithms Laboratory	**PC**	0	0	4	2
			TOTAL	18	2	12	25

SEMESTER V

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	**17SBS501**	Discrete Mathematics	**BS**	3	2	0	4
2.	**17SPC502**	Embedded Computing Systems	**PC**	3	0	0	3
3.	**17SPC503**	Computer Networks	**PC**	3	0	0	3
4.	**17SPC504**	Theory of Computation	**PC**	3	0	0	3
5.	**17SPC505**	Artificial Intelligence	**PC**	3	0	0	3
6.		**Professional Elective – 1**	**PE**	3	0	0	3
PRACTICALS							
7.	**17SPC507**	Computer Networks Laboratory	**PC**	0	0	4	2
8.	**17SPC508**	Embedded Computing Systems Laboratory	**PC**	0	0	4	2
			TOTAL	18	2	8	23

SEMESTER VI

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	**17SHS601**	Professional Ethics and Human Values	**HS**	3	0	0	3
2.	**17SBS602**	Resource Management Techniques	**BS**	3	2	0	4
3.	**17SPC603**	Mobile Communications	**PC**	3	0	0	3
4.	**17SPC604**	Compiler Design	**PC**	3	0	0	3
5.	**17SPC605**	Parallel and Distributed systems	**PC**	3	0	0	3
6.		**Professional Elective -2**	**PE**	3	0	0	3
PRACTICALS							
7.	**17SPC607**	Mobile Application Development Laboratory	**PC**	0	0	4	2
8.	**17SPC608**	Compiler Laboratory	**PC**	0	0	4	2
9.	**17ZEE609**	Communication and Soft Skills Laboratory	**EEC**	4	0	0	2
		TOTAL		22	2	8	25

SEMESTER VII

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	**17SPC701**	Cloud Computing	**PC**	3	0	0	3
2.	**17SPC702**	Cryptography and Network Security	**PC**	3	0	0	3
3.		**Professional Elective-3**	**PE**	3	0	0	3
4.		**Professional Elective-4**	**PE**	3	0	0	3
5.		**Open Elective**	**OE**	3	0	0	3
PRACTICALS							
6.	**17SPC706**	Cryptography and Network Security Laboratory	**PC**	0	0	4	2
7.	**17SPC707**	Cloud Computing Laboratory	**PC**	0	0	4	2
			TOTAL	15	0	8	19

SEMESTER VIII

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.		**Professional Elective-5**	**PE**	3	0	0	3
2.		**Professional Elective-6**	**PE**	3	0	0	3
PRACTICALS							
3.	**17SEE803**	**Project Work**	**EEC**	0	0	12	6
			TOTAL	6	0	12	12

TOTAL NUMBER OF CREDITS: 180

CREDITS SUMMARY

Sl.No	Subject Area	Credits Per Semester								Credits total	% of Total Credits	Total No of Subjects	AICTE Recommended Range of % of Credits	
		I	II	III	IV	V	VI	VII	VIII				MIN	MAX
1.	**HS**	4	4	0	0	0	3	0	0	**11**	**6.1**	**3**	**5**	**10**
2.	**BS**	14	10	4	4	4	4	0	0	**40**	**22.2**	**12**	**15**	**20**
3.	**ES**	9	10	5	0	0	0	0	0	**24**	**13.3**	**9**	**15**	**20**
4.	**PC**	0	0	16	21	16	13	10	0	**76**	**42.2**	**29**	**30**	**40**
5.	**PE**	0	0	0	0	3	3	6	6	**18**	**10**	**6**	**10**	**15**
6.	**OE**	0	0	0	0	0	0	3	0	**3**	**1.66**	**1**	**5**	**10**
7.	**EEC**	0	0	0	0	0	2	0	6	**8**	**4.4**	**2**	**10**	**15**
TOTAL		**27**	**24**	**25**	**25**	**23**	**25**	**19**	**12**	**180**	**100**	**62**		

LIST OF PROFESSIONAL ELECTIVES

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**17SPE001**	Fundamentals of Image Processing	3	0	0	3
2.	**17SPE002**	Advanced Data Structures	3	0	0	3
3.	**17SPE003**	Project Management	3	0	0	3
4.	**17SPE004**	Essentials of Information Technology (Infosys)	3	0	0	3
5.	**17SPE005**	Data Mining	3	0	0	3
6.	**17SPE006**	C # and .NET Framework	3	0	0	3
7.	**17SPE007**	Green Computing	3	0	0	3
8.	**17SPE008**	Agile Software Development (Infosys)	3	0	0	3
9.	**17SPE009**	Software Defined Networks	3	0	0	3
10.	**17SPE010**	Social Networks Analysis	3	0	0	3
11.	**17SPE011**	Pattern Recognition	3	0	0	3
12.	**17SPE012**	Building Enterprise Applications (Infosys)	3	0	0	3
13.	**17SPE013**	Natural Language Processing	3	0	0	3
14.	**17SPE014**	Information Retrieval Techniques	3	0	0	3
15.	**17SPE015**	GPU Architecture and Programming	3	0	0	3
16.	**17SPE016**	Business Intelligence and its Applications (Infosys)	3	0	0	3
17.	**17SPE017**	Internet of Things	3	0	0	3
18.	**17SPE018**	Game Theory	3	0	0	3
19.	**17SPE019**	Open Source Systems	3	0	0	3
20.	**17SPE020**	Big Data and Analytics (Infosys)	3	0	0	3
21.	**17SPE021**	Machine Learning	3	0	0	3
22.	**17SPE022**	Geographical Information Systems	3	0	0	3
23.	**17SPE023**	Service Oriented Architecture	3	0	0	3
24.	**17SPE024**	Soft Computing	3	0	0	3
25.	**17SPE025**	Web Technology	3	0	0	3
26.	**17SPE026**	Computer Graphics and Multimedia	3	0	0	3

OPEN ELECTIVES

[Students should select open electives offered by other Departments]

CSE:

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**17SOE001**	Programming in C++	3	0	0	3
2.	**17SOE002**	Java Programming	3	0	0	3
3.	**17SOE003**	Python Programming	3	0	0	3
4.	**17SOE004**	Web Designing	3	0	0	3
5.	**17SOE005**	Android Application Development	3	0	0	3

ECE:

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**17LOE001**	Real Time Systems	3	0	0	3
2.	**17LOE002**	Wireless Sensor Networks	3	0	0	3
3.	**17LOE003**	Industrial Automation and Robotics	3	0	0	3
4.	**17LOE004**	Principles of VLSI design	3	0	0	3
5.	**17LOE005**	Applied Electronics	3	0	0	3
6.	**17LOE006**	Wireless Networks	3	0	0	3

EEE:

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**17EOE001**	Matlab Programming	3	0	0	3
2.	**17EOE002**	Renewable Energy Sources	3	0	0	3
3.	**17EOE003**	Energy Management and Auditing	3	0	0	3
4.	**17EOE004**	Smart Grid	3	0	0	3

MECH:

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**17MOE001**	Disaster Management and Mitigation	3	0	0	3
2.	**17MOE002**	Environmental Management	3	0	0	3
3.	**17MOE003**	Composite materials	3	0	0	3
4.	**17MOE004**	Renewable Energy Sources and Technology	3	0	0	3
5.	**17MOE005**	Intellectual Property Rights	3	0	0	3
6.	**17MOE006**	Engineering Economics and Financial Accounting	3	0	0	3
7.	**17MOE007**	Material Characterizations	3	0	0	3
8.	**17MOE008**	Global Warming and Climate Change	3	0	0	3

ONE CREDIT COURSES

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**17SOC001**	Tools for Machine Learning	3	0	0	1
2.	**17SOC002**	Microsoft Office Suite	3	0	0	1
3.	**17SOC003**	Project using Arduino	3	0	0	1
4.	**17SOC004**	Software Project Management	3	0	0	1
5.	**17SOC005**	Linux Administration	3	0	0	1
6,	**17SOC006**	Network Simulation Tools	3	0	0	1

MANDATORY INDUCTION PROGRAM (3 WEEKS DURATION)

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

1. INDUCTION PROGRAM

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

It is proposed a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

1.1PHYSICAL ACTIVITY

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

1.2 CREATIVE ARTS

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

1.3 UNIVERSAL HUMAN VALUES

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc.Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through dos and don'ts but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be overemphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

1.4 LITERARY

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

1.5 PROFICIENCY MODULES

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

1.6 LECTURES BY EMINENT PEOPLE

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

1.7 VISITS TO LOCAL AREA

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

1.8 FAMILIARIZATION TO DEPT./BRANCH & INNOVATIONS

The students should be told about different method of study compared to coaching. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other faculties.

2. SCHEDULE

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

2.1 INITIAL PHASE

Time	**Activity**
Day 0 Whole day	Students arrive - Hostel allotment. (Preferably do pre allotment)
Day 1	
09:00 am - 03:00 pm	Academic registration
04:30 pm - 06:00 pm	Orientation
Day 2	
09:00 am - 10:00 am	Diagnostic test (for English etc.)
10:15 am - 12:25 pm	Visit to respective depts.
12:30 pm - 01:55 pm	Lunch
02:00 pm - 02:55 pm	Director's address
03:00 pm - 05:00 pm	Interaction with parents
03:30 pm - 05:00 pm	Mentor-mentee groups - Introduction within group (Same as Universal Human Values groups)

2.2 REGULAR PHASE

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

2.2.1 DAILY SCHEDULE

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Session	**Time**	**Activity**	**Remarks**
	Day 3 onwards 06:00 am	Wake up call	
I	06:30 am - 07:10 am	Physical activity (mild exercise / yoga)	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the Groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values / Creative Arts	Complementary Alternate
	01:00 pm - 02:25 pm	Lunch	

IV	02:30 pm - 03:55 pm	Afternoon Session	See below
V	04:00 pm - 05:00 pm	Afternoon Session	See below
	05:00 pm - 05:25 pm	Break / light tea	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	Rest and Dinner	
VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off. Saturdays have the same schedule as above or have outings.

2.2.2 AFTERNOON ACTIVITIES (NON-DAILY)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	**Session**	**Remarks**
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For 3 days - interspersed (e.g., 3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book Reading / Lecture)	IV	For 3-5 days
Proficiency Modules	V	Daily, but only for those who need it

2.3 CLOSING PHASE

Time	**Activity**
Last But One Day 08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day Whole day	Examinations (if any). May be expanded to last 2 days, in case needed

2.4 FOLLOW UP AFTER CLOSURE

A question comes up as to what would be the follow up program after the formal 3-weekInduction Program is over? The groups which are formed should function as mentor-mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychologicaletc. (For every 10 undergraduate first year students, there would be a senior student as a student guide, and for every 20 students, there would be a faculty mentor.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline. Here we list some important suggestions which have come up and which have been experimented with.

2.4.1 FOLLOW UP AFTER CLOSURE - SAME SEMESTER

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

2.4.2 FOLLOW UP - SUBSEQUENT SEMESTERS

It is extremely important that continuity be maintained in subsequent semesters. It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students are shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

SEMESTER I

17ZHS101	COMMUNICATIVE ENGLISH I	L	T	P	C
		4	0	0	4

OBJECTIVES:

•	To develop the active skills as well as the passive skills of the first year Engineering and Technology students.
•	To help learners develop their speaking skills and speak flawlessly in real life situations.
•	To help learners acquire vocabulary by the way of reading skills.
•	To help learners enhance their listening skills which will enable them to listen to lectures and comprehend them by asking questions, seeking clarifications.
•	To help learners improve their writing skills by practicing dialogue writing, and writing short essays.

UNIT I	**12**

Listening - Short texts- Short formal and informal conversations- listening to TV and Telephonic interviews. **Speaking**- Introducing one self- exchanging personal information. **Reading** -Skimming and Scanning. **Writing** -Letter writing - E-mail writing. **Grammar**- introducing Tenses (Simple Present, Present Continuous, and Present Perfect) Articles, **Vocabulary:** Prefix & Suffix and Compounds.

UNIT II	**12**

Listening- Listening to announcements- listening to news. **Speaking –** Greetings and congratulating and taking leave. **Reading –** Finding key information in a given text. **Writing**- Short narrative descriptions- dialogue writing. **Grammar**- Tenses (Present Perfect Continuous, Simple Past)- WH questions, Yes-No questions, Prepositions **Vocabulary**: Word-formation, Synonym & Antonym.

UNIT III	**12**

Listening- Listening to dialogue **Speaking –** describing a person, experience, expressing opinions. **Reading**- Reading longer text, reading science articles. **Writing**- Paragraph Writing- informal letter writing. **Grammar**- Tenses (Past continuous, Past Perfect),degrees of comparison, direct-indirect speech **Vocabulary**: One- word substitution

UNIT IV	**12**

Listening- Listening to product descriptions. **Speaking**- describing an object- process. **Reading** - Reading comprehension. **Writing**- completing sentences- writing about scientific objects and inventions. **Grammar**- Tenses (Past Perfect Continuous, Simple Future) **Vocabulary**: Phrasal verbs.

UNIT V	**12**

Listening- Listening to talks & conversations. **Speaking**- participating in conversations & responding. **Reading**- Reading longer text & close reading. **Writing** –Creative Writing. **Grammar**- Tenses (Future Continuous, Future Perfect, Future Perfect Continuous), conditionals **Vocabulary**- collocations, idioms.

TOTAL : 60 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Read articles of a general kind in magazines and newspapers.
2.	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
3.	Comprehend conversations and short talks delivered in English.

4.	Write short essays of a general kind and personal letters and emails in English.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Board of Editors,**"**Using English A Course book for undergraduate Engineers and Technologists", Orient Black Swan Limited, Hyderabad, 2015.

REFERENCES:

1.	*Richards, C. Jack. "Interchange Students' Book-2", New Delhi: CUP, 2015.*
2.	*Bailey, Stephen,"Academic Writing: A Practical guide for student", New York, Rutledge,2011.*
3.	*Seely, John,"The Oxford guide to writing & Speaking", New York, 1998.*

17ZBS102	ENGINEERING MATHEMATICS I	L	T	P	C
		3	2	0	4

OBJECTIVES:

•	To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
•	To make the student knowledgeable in the area of infinite series and their convergence so that applications. he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling
•	To familiarize the student with functions of several variables. This is needed in many branches in mathematical modeling.
•	To introduce the concepts of improper integrals, Gamma, Beta and Error functions
•	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their needed in engineering applications.

UNIT I	MATRICES	9+6

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of eigen values and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II	SEQUENCES AND SERIES	9+6

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III	APPLICATIONS OF DIFFERENTIAL CALCULUS	9+6

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV	FUNCTIONS OF SEVERAL VARIABLES	9+6

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V	MULTIPLE INTEGRALS	9+6

Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

TOTAL (L : 45 + T : 30): 75 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Solve problems on matrices and to apply concepts of matrix theory whenever applicable in the field of engineering.
2.	Solve problems using convergence tests on sequences and series and to apply them in engineering field appropriately.

3.	Solve problems on differential and integral calculus and will be exposed to their applications in engineering.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		M	L								L	H	M
CO2	H	M		M	L								L	H	M
CO3	H		M	M	L								L	H	M

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

TEXT BOOKS:

1.	Bali N. P, Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2.	Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1.	*Dass, H.K.,Er. Rajnish Verma, "Higher Engineering Mathematics",S. Chand Private Ltd., 2011.*
2.	*Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.*
3.	*Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.*
4.	*Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.*
5.	*Sivarama Krishna Das P., Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, Pearson Publishing, 2011.*

17ZBS103	ENGINEERING PHYSICS I	L	T	P	C
	Common to MECH, EEE, ECE & CSE	3	0	0	3

OBJECTIVES:

- To develop knowledge on properties of solids
- To use the principles of lasers, its types and its application
- To make students to understand about fiber optics and its applications.
- To develop knowledge on thermal properties of materials
- To apply principles of quantum physics in engineering field.

UNIT I PROPERTIES OF MATTER **9**

Elasticity – Hooke's law – Stress – Types of Stresses – Strain- Types of Strain - Young's Modulus – Rigidity Modulus – Bulk Modulus –Poisson's ratio – Relationship between three elastic constants and Poisson's ration – Torsional Pendulum – Factors affecting elasticity of materials - Bending moment of a Beam – Depression of cantilever (Theory and Experiment) – Determination of Young's modulus – Uniform and non-uniform bending (Theory and Experiment).

UNIT II LASERS **9**

Introduction to LASER – Interaction of light radiation with materials – Stimulated absorption – Spontaneous emission – Stimulated emission –Einstein's A and B co-efficient derivation – Concept of LASER – Population inversion – Pumping action – Methods for pumping action – Characteristics of LASER - Types of Lasers (Nd-YAG, He-Ne) – Industrial and medical applications of lasers.

UNIT III FIBRE OPTICS **9**

Introduction – Structure of Optical Fibre – Guiding mechanism – Total internal reflection – Critical Angle – Conditions for total internal reflection – Principle and Propagation of light in Optical Fibres – Numerical aperture and acceptance angle – Types of optical fibres (Material, refractive index and mode) – their characteristics and applications – Losses associated in optical fibres.

UNIT IV THERMAL PHYSICS **9**

Introduction to Heat flow – Modes of heat transfer (Conduction, Convection and Radiation) – Thermal conductivity – Expression for thermal conductivity – Newton's law of cooling – Linear heat flow – Heat conduction through a compound media(Series and parallel) – Lee's disk method for determination of thermal conductivity of bad conductors – Application: Heat exchangers, refrigerators.

UNIT V QUANTUM PHYSICS **9**

Concept of Blackbody radiation – Wien's displacement law – Rayleigh-Jean's law - Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh-Jean's law from Planck's law – Matter waves – De-Broglie's Hypothesis – Properties of matter waves - Wave-particle duality – Wave function – Physical Significance – Schrodinger wave equation – Time dependent and time independent – Application of Schrodinger wave equation – Particle in a 1 D box.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Learn about, three types of elastic modulus, related laws and basics of thermal conductivity of different solid materials with relevant Newton's law of cooling.
2. Apply the functional knowledge of different types of lasers in their engineering

	applications.
3.	Attain the basic knowledge of fibre optics and apply in their engineering & medical applications.
4.	Apply the fundamental principles of quantum physics in engineering field.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	P. Mani, "Engineering physics", Dhanam Publications, 2017.
2.	G. Senthi kumar, "Engineering physics", VRB Publishers.
3.	A.Marikani, "Engineering Physics", PHI Learning Pvt., India 2009.

REFERENCES:

1.	*R. K. Gaur and S.C. Gupta, "Engineering physics", Dhanpat Rai publications, New Delhi 2003.*
2.	*M. N. Avadhanulu and P. G. Kshirsagar, "A text book of engineering physics", S. Chand and Company Ltd, New Delhi, 2005.*
3.	*K. Rajagopal, "Engineering Physics", PHI, New Delhi, 2011.*
4.	*P. K. Palanisamy, "Engineering Physics", SCITECH Publication, 2011.*
5.	*M. Arumugam, "Engineering physics", Anuradha Publishers.*

17ZBS104	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make students conversant with water parameters, boilers, need for water treatment and its merits and demerits.
- Students ought to be aware of fundamental principles behind different electrochemical reactions, corrosion of materials and methods to prevent corrosion.
- To learn the chemistry behind polymers, synthesis, merits, demerits and its applications in various field.
- To acquire basic knowledge in renewable, non renewable and alternate energy resources and the chemical reactions involved in cell, batteries and its applications.
- To learn the working principle of various spectroscopy and its applications.
- To acquire basic knowledge in Nano materials, synthesis, properties and uses.

UNIT I WATER TECHNOLOGY 9

Characteristics – alkalinity and its significance – hardness (problems) - types and estimation by EDTA method – specifications of drinking water (BIS and WHO standards) – potable water treatment – boiler feed water - requirements – disadvantages of using hard water in boilers (Scales & Sludge, Boiler corrosion, Priming & Foaming, Caustic embrittlement) – water treatment – Internal treatment – external treatment – zeolite method - Demineralization process – desalination – reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Electrochemical cells – reversible and irreversible cells – EMF – measurement of EMF – single electrode potential – Nernst equation (Problems) – reference electrode – standard hydrogen electrode and calomel electrode – ion selective electrode – glass electrode and measurement of pH – electrochemical series and its applications.

Corrosion: Corrosion – Pilling Bedworth rule - dry corrosion and its mechanism - electrochemical corrosion and its mechanism – types (galvanic, pitting, differential aeration) – factors influencing corrosion – corrosion control methods – sacrificial anode method – impressed current method – corrosion inhibitors – protective coatings – paints – constituents – functions – metallic coatings – electroplating (Cu) and electro less plating (Ni).

UNIT III POLYMERS AND COMPOSITES 9

Polymers: Definition – classification – functionality – polymerization – degree of polymerization – types (addition, condensation, copolymerization) – mechanism (free radical) – plastics – thermoplastics and thermosetting plastics – preparation, properties and uses of individual polymers (PVC, TEFLON, Nylon-6,6, Nylon-6, PET, epoxy resin) – rubber - vulcanization of rubber – applications - Advanced polymeric materials and electronic devices – conducting and semiconducting polymers – liquid crystal properties – dendrimers and their difference from polymers.

Composites: definition – type's polymer matrix composites – Fibre Reinforced Polymers – applications – advanced composite materials – physical and chemical properties – applications.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy – fission fusion reactions – light water nuclear reactor for power generation – breeder reactor – solar energy conversion – solar cells – wind energy – batteries: alkaline batteries – lead –acid, Ni-Cd, and Li-ion batteries – fuel cells – principles and applications – advantages and disadvantages.

UNIT V	**ANALYTICAL TECHNIQUES AND NANOMATERIALS**	**9**

Spectroscopy: Electromagnetic spectrum - Fundamentals of spectroscopy – Instrumentation, working principle and applications of UV-Visible spectrophotometer, Atomic Absorbance Spectrophotometer, Flame photometer.

Nanomaterials: Introduction to nanotechnology in electronics - nanomaterial's – fullerenes carbon nanotubes **–** nanowires – Electronics and mechanical properties - **synthesis** of nanomaterial – top down and bottom up approach – applications of nanomaterials in electronic devices (Semiconductors, LED & OLED) – electronics and telecommunication – medicines.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Analyze water borne problems faced in boilers, need for water treatment and various methods and techniques for treating hard water.
2.	Understand polymerization reactions and its applications in engineering field.
3.	Understand the mechanism behindvarious types of electrochemical reactions which in turn help in understanding the causes for corrosion and prevention methods.
4.	Acquire knowledge about energy conversion and chemical reaction taking place in renewable energy resources, batteries and fuel cells.
5.	Acquire in-depth knowledge on various nanomaterials and its applications in electronic devices.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. Vairam S, Kalyani P, Suba Ramesh., "Engineering Chemistry", Wiley India PvtLtd.,New Delhi, 2011.
2. Dara S.S,Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi, 2010.

REFERENCES:

1. *Pahari A, Chauhan B, "Engineering Chemistry", Firewall Media, New Delhi, 2010.*
2. *Rao, C. N. R.; Govindaraj, A, "Nanotubes and Nanowires",United Kingdom, Royal Society of Chemistry, 2005.*
3. *Sabu Thomas, Nandakumar Kalarikkal, Maciej Jaroszewski, Josmine P. Jose; "Advanced Polymeric Materials: From Macro to Nano Length Scales", Apple Academic Press, Canada, 2016.*
4. *Jain and Jain , "Engineering Chemistry", 16th edition, Dhanpat Rqai Publishing Co.*

17SES105	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS **9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS **9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES **9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Develop algorithmic solutions to simple computational problems.
2.	Read, write, execute by hand simple Python programs.
3.	Structure simple Python programs for solving problems.
4.	Decompose a Python program into functions.
5.	Represent compound data using Python lists, tuples, and dictionaries.

6.	Read and write data from/to files in Python Programs.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/).
2.	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2", Network Theory Ltd., 2011.
3.	Dr.A.Kannan, Dr.L.Sairamesh, "Problem Solving and Python programming", United Global Publishers Pvt. Ltd., 2017.
4.	John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013.

REFERENCES:

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

17ZES106	ENGINEERING GRAPHICS	L	T	P	C
Common to MECH, EEE, ECE and CSE Branches		2	0	4	4

OBJECTIVES:

•	This course aims to introduce the concept of graphic communication, develop the drawing skills for communicating concepts, ideas and designs of engineering products.
•	To expose them to existing national standards related to technical drawings.
•	To draw the projection of simple solids like prisms, pyramids, cylinder etc.
•	To draw the development of surfaces to estimate the sheet metal requirement and to prepare sectional views of solids.
•	To develop skills in three-dimensional visualization of engineering components and to draw isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications – use of drafting instruments – BISconventions and specifications – size, layout and folding of drawing sheets – lettering and dimensioning.

UNIT I	PLANE CURVES AND FREE-HAND SKETCHING	6+9

Basic geometrical constructions, curves used in engineering. Conics – construction of ellipse, parabola and hyperbola by eccentricity method – drawing of tangents and normal to the above curves. Visualization concepts and free hand sketching: visualization principles –representation of three dimensional objects – layout of views- freehand sketching of multiple views from pictorial views of objects.

UNIT II	PROJECTION OF POINTS, LINES AND PLANE SURFACES	6+9

Orthographic projection – principles-principal planes-first angle projection-projection of points. Projection of straight lines inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III	PROJECTION OF SOLIDS	6+9

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids, when the axis is inclined to both the principal planes by rotating object method.

UNIT IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	6+9

Sectioning of prisms, pyramids, cylinders and cones in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – prisms, pyramids cylinders and cones.

UNIT V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	6+9

Principles of isometric projection – isometric scale –isometric projections of simple solids and truncated solids - prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - perspective projection of simple solids- prisms, pyramids and cylinders by visual ray method .

TOTAL (L : 45 + T : 30): 75 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Familiarize with the fundamentals and standards of Engineering graphics.

2.	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
3.	Draw orthographic projections of lines and plane surfaces.
4.	Draw projections of solids and development of surfaces.
5.	Visualize and draw isometric and perspective views of simple solids.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2012.
2.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2016.
3.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.

REFERENCES:

1.	*N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.*
2.	*Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2013.*
3.	*Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2013.*
4.	*Luzzader, Warren.J. and Duff John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.*
5.	*Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.*

17SES107	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	To write, test, and debug simple Python programs.
•	To implement Python programs with conditionals and loops.
•	Use functions for structuring Python programs.
•	Represent compound data using Python lists, tuples, and dictionaries.
•	Read and write data from/to files in Python.

LIST OF EXPERIMENTS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method).
3. Exponentiation (power of a number).
4. Find the maximum of a list of numbers.
5. Linear search and Binary search.
6. Selection sort, Insertion sort.
7. Merge sort.
8. First n prime numbers.
9. Multiply matrices.
10. Programs that take command line arguments (word count).
11. Find the most frequent words in a text read from a file.
12. Simulate elliptical orbits in Pygame.
13. Simulate bouncing ball using Pygame.

PLATFORM NEEDED

- Python 3 interpreter for Windows/Linux

TOTAL : 60 PERIODS

OUTCOMES:

On completion of this course, students will be able to

1.	Write, test, and debug simple python programs.
2.	Implement python programs with conditionals and loops.
3.	Develop python programs step-wise by defining functions and calling them.
4.	Use python lists, tuples, dictionaries for representing compound data.
5.	Read and write data from/to files in python.

COURSE ARTICULATION MATRIX:

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

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

17ZBS108	PHYSICS LABORATORY	L	T	P	C
Common to MECH, EEE, ECE & CSE		0	0	4	2

OBJECTIVES:

•	To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids

LIST OF EXPERIMENTS : (ANY 5 EXPERIMENTS)

1. Determination of rigidity modulus: Torsion Pendulum.
2. Determination of Young's modulus by non-uniform bending method.
3. (a) Determination of wave length and particle size using LASER.
   (b) Determination of acceptance angle in an optical fibre.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of fluid – Ultrasonic interferometer.
6. Determination of wavelength of mercury spectrum – Spectrometer grating.
7. Determination of band gap of a semiconductor.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Apply principles of elasticity, optical and thermal properties for engineering applications.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H		H	M		M						H	M	

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

17ZBS109	CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	To make students conversant with hands on water parameter analysis.
•	To make the student to acquire practical skills in the corrosion in metals.
•	To acquaint the students with the determination of molecular weight of a polymer by Ostwald viscometer.
•	To make the student acquire practical skills in analytical instruments.

LIST OF EXPERIMENTS:

1. Determination of total hardness of given water sample by EDTA method.
2. Determination of alkalinity in given water sample.
3. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
4. Conduct of metric titration using mixture of acids and strong base.
5. Determination of strength of in given hydrochloric acid using pH meter.
6. Estimation of sodium present in water using flame photometer.
7. Estimation of Zn present in effluent using Atomic Absorption Spectroscopy(AAS).
8. Corrosion experiment – weight loss method.
9. Estimation of iron content of the given solution using potentiometer meter.
10. Estimation of iron content of the given sample using Spectro photometer (thiocyanate method).

TOTAL : 60 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Be outfitted with hands-on knowledge in the qualitative and quantitative chemical analysis of water quality related parameters, corrosion studies, heavy metal analysis, etc.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H		H	M		M						H	M	L

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

SEMESTER II

17ZHS201	COMMUNICATIVE ENGLISH II	L	T	P	C
		4	0	0	4

OBJECTIVES:

•	To make learners acquire listening and speaking skills in both formal and informal contexts.
•	To help them develop their reading skills by familiarizing them with different types of reading strategies.
•	To equip them with writing skills needed for academic as well as workplace contexts.
•	To make them acquire language skills at their own pace by using e-materials and language lab components.
•	To help them give a short extempore speech and also make them participate in debates.

UNIT I **12**

Listening – Listening to different types of conversation and answering questions. Listening to announcements at railway station, airports, etc. **Speaking** – Comments on topics like weather. Turn taking – Closing a conversation (excuses, general wish, positive comment, thanks); **Reading** – Extensive reading; **Writing** – purpose statements – extended definitions – issue-writing instructions – checklists-recommendations - **Grammar**- impersonal passive voice, numerical adjectives ; Vocabulary – Homonyms, Homophones.

UNIT II **12**

Listening – Listening to situation based dialogues; **Speaking** – Conversation practice in real life situations, asking for directions, giving directions, Discussing various aspects of a film, or a book. Welcome address, Vote of Thanks, special address on special topics. **Reading –** reading a short story or an article from newspaper. **Writing** –writing a review/ summary of a story / article. **Grammar** –Concord, compound words.

UNIT III **12**

Listening – Listening to the conversation – Understanding the structure of conversations. **Speaking** – Conversation skills with a sense of stress, intonation, pronunciation and meaning – seeking information – expressing feelings, **Reading** – speed reading – reading passages with time limit - skimming; **Writing** – Minutes of meeting – writing summary after reading articles from journals; **Grammar**- Cause and effect expressions; **Vocabulary** – Words used as nouns and verbs without any change in spelling.

UNIT IV **12**

Listening – Viewing model interviews (face-to- face, telephonic and video conferencing); **Speaking** – role play practice in telephone skills – listening and responding, asking questions – note taking – passing on messages, Role play and mock interview for grasping interview skills; **Reading** – Reading the profile of the company concerned – scanning; **Writing** – Applying for a job – cover letter – resume preparation – vision, mission and goals of the candidate; **Grammar**- reported speech **Vocabulary** – Idioms and their meanings.

UNIT V **12**

Listening – Viewing a model group discussion ; **Speaking** – Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/ agreement – assertiveness in expressing opinions- mind mapping technique; **Reading** – Note making skills – making notes from books, or any form of written materials – Intensive reading; **Writing** – Types of reports / Project report – report format – recommendations/ suggestions - **Grammar** – Use of Clauses ; Vocabulary – Collocation; fixed and semi-fixed expressions.

TOTAL : 60 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Read technical texts and write area specific texts effortlessly.
2.	Listen and comprehend lectures and talks in their area of specialization successfully.
3.	Speak appropriately and effectively in varied formal and informal contexts.
4.	Write reports and winning job applications.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Board of editors. "Fluency in English A Course book for Engineering and Technology", Orient Blackswan, Hyderabad: 2016.

REFERENCES:

1.	*Comfort, Jeremy, et al,"Speaking Effectively: Developing speaking skills for Business English", Cambridge University Press, Cambridge, Reprint 2011.*
2.	*Dutt P. Kiranmai and Rajeevan Geetha, "Basic Communication Skills", Foundation Books, 2013.*
3.	*Means,L. Thomas and Elaine Langlois,"English & Communication For Colleges", CengageLearning , USA, 2007.*
4.	*Redston, Chris & Gillies Cunningham,"Face2Face (Pre-intermediate student's Book & Workbook)", Cambridge University Press, New Delhi: 2005.*

17ZBS202	ENGINEERING MATHEMATICS II	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential Equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 9+6

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green‘s theorem in a plane, Gauss divergence theorem and Stokes‘theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+6

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy‘s and Legendre‘s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORMS 9+6

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transforms -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS 9+6

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = z+k$, kz, $1/z$, z^2, e^z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+6

Complex integration – Statement and applications of Cauchy‘s integral theorem and Cauchy‘s integral formula – Taylor‘s and Laurent‘s series expansions – Singular points – Residues – Cauchy‘s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL (L : 45 + T : 30): 75 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Solve problems on vector calculus and to apply them in any other field theory related subjects.
2. Solve differential equations and will be exposed to their applications in various fields of engineering.
3. Solve problems on Laplace transforms and will be able to use Laplace transform in

	finding solutions of differential and integral equations and other engineering applications.
4.	Solve complex integration problems and will be exposed to various applications of analytic functions and conformal mapping in engineering.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2.	Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1.	*Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Ltd., 2011.*
2.	*Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.*
3.	*Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.*
4.	*Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.*

17ZBS203	ENGINEERING PHYSICS II	L	T	P	C
	Common to MECH, EEE, ECE & CSE	3	0	0	3

OBJECTIVES:

•	To describe the properties of conducting material.
•	To understand the theory of semi-conducting materials and basic electron devices
•	To get the knowledge about properties of magnetic materials.
•	To understand the polarization process in dielectric materials and their temperature, frequency dependence and the causes of dielectric breakdown.
•	To acquire some exciting prospects of modern engineering materials.

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9

Conductors – Classification of conducting materials – Ohm's Law – Electrical conductivity – Relation between current density, drift velocity and mobility – Classical free electron theory of metals – Expression for electrical conductivity of a metal – Thermal conductivity – Expression for thermal conductivity of a metal – Wiedemann – Franz law – success and failuresof classical free electron theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states.

UNIT II	SEMICONDUCTOR PHYSICS	9

Introduction – Intrinsic semiconductor – Energy band diagram – Direct and indirect semiconductors – Carrier concentration in an intrinsic semiconductor (derivation) – Extrinsic semiconductors – Carier concentration in n-type & p-type semiconductors –Hall effect – Determination of Hall coefficient (Theory) – Application of Hall effect.

UNIT III	MAGNETIC AND SUPERCONDUCTING MATERIALS	9

Magnetization – Magnetic flux – Magnetic flux density – Intensity of Magnetisation – Magnetic field intensity – magnetic permeability – magenetic susceptibility – Magnetic field and induction – Types of magnetic materials – Microscopic classification of magnetic materials – Ferromagnetism : origin and exchange interaction – Domain theory- Hard and soft magnetic materials – Magnetic storage devices – Hard disk.

Superconductivity: Properties – Type I and Type II Superconductors- BCS theory of Superconductivity – Application of Superconductors – SQUID.

UNIT IV	DIELECTRIC PROPERTIES OF MATERIALS	9

General properties of Dielectric materials – Electrical susceptibility – Dielectric constant – Electronic, ionic, orientational and space-charge polarization – Frequency and Temperature dependence of Polarisation– Internal field – Claussius – Mosotti relation (derivation) – Dielectric breakdown – Dielectric loses – Use of dielectric materials (capacitor and transformer) - Ferroelectricity and its applications.

UNIT V	MODERN ENGINEERING MATERIALS	9

Metallic glasses – Properties of metallic glasses – Shape memory alloys (SMA) – Preparation, properties and applications of Shape memory alloys (SMA) – Characteristics of Shape memory alloys – Characteristics, properties of Ni-Ti alloy, application, advantages and disadvantages of

shape memory alloys (SMA) – Nanomaterials – Different forms of nanomaterials – Preparations –Pulsed Laser Deposition, Chemical Vapour Deposition and Applications.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Explore knowledge about free electron theory and density of states of conducting materials with related laws.
2. Compare intrinsic and extrinsic semiconductor, density of electrons and holes calculation, Hall effect with applications and basic semiconductor devices.
3. Learn comparatively about different type of magnetic materials, superconducting materials and apply in their engineering field.
4. Attain the functional knowledge of different types of dielectric materials, polarization mechanism and their qualitative engineering applications.
5. Know more about preparation of modern engineering materials and materials suitability for their own engineering field.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. P. Mani, "Engineering physics", Dhanam Publications, 2011.
2. G. Senthil kumar, "Engineering physics", VRB Publishers.
3. A.Marikani, "Engineering Physics" PHI Learning Pvt., India 2009.
4. Wahen M. A., "Solid state physics: Structure and properties of materials", Narosa publishing house, 2009.

REFERENCES:

1. *R. K. Gaur and S. C. Gupta, "Engineering physics", Dhanpat Rai publications, New Delhi 2003.*
2. *M. N. Avadhanulu and P. G. Kshirsagar, "A text book of engineering physics" S. Chand and Company,Ltd, New Delhi 2005.*
3. *K. Rajagopal, "Engineering Physics", PHI, New Delhi, 201.*
4. *M. Arumugam, "Engineering physics", Anuradha publishers.*

17SES204	BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the fundamentals of electronic circuit constructions.
- To learn the fundamental laws, theorems of electrical circuits and also to analyse them
- Study the basic principles of electrical machines and their performance
- To study the different energy sources, protective devices and their field applications
- To understand the principles and operation of measuring instruments and transducers

UNIT I ELECTRICAL CIRCUITS **9**

Basic elements of Electric circuits including sources, Resistor, Inductor and Capacitor - Mesh and Nodal analysis of simple circuits - Basics of AC circuits - Power and Power factor - Introduction to three phase circuits and its connections (Star and Delta).

UNIT II ELECTRICAL MACHINES **9**

Principle, classification, characteristics and Applications of DC Generators, Motors, Transformers, Three phase induction machines, Alternators, Synchronous Motors.

UNIT III ELECTRONIC DEVICES AND CIRCUITS **9**

Introduction- PN Junction diode and its characteristics - Zener diode - BJT Configurations and characteristics - FET Configuration and characteristics - Introduction to Op Amps -Amplifiers, Oscillators, Differentiators - Integrators - Multivibrator using 555 Timer IC, Voltage Regulator IC using LM 723 and LM 317.

UNIT IV DIGITAL ELECTRONICS **9**

Reviewofnumbersystems,binarycodes,errordetection andcorrectioncodes(Parity andHamming code)- Combinationallogic-representationoflogicfunctions-SOPandPOS forms,K-maprepresentations – simplificationandimplementationofcombinationallogic–multiplexers, demultiplexers ,encoders and decoders- codeconverters,adders, and subtractors.

UNIT V MEASUREMENTS **9**

Characteristics of measurement-Errors in measurement - Moving coil and moving iron meters, Energy meter, Watt meter and Multimeter - Three phase Power measurement - Instrument Transformers (CT and PT) - Introduction to Digital Measurements – Oscilloscopes(CRO and DSO) - Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect, RTD, Strain gauge, LVDT and LDR.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Analyze electric circuits.
2. Understand operation of electric machines and transformers.
3. Understand the concepts of various analog and digital electronic devices.
4. Have the knowledge to measurement and metering for electric circuits.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	M		H								L	M	
CO2	M	M		L	H	H							L	M	

CO3	M	M	M	L	H	H								L	
CO4	M	M	M		H									L	
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	R.Muthukrishnan,S.Salivahanan, "Basic Electrical and Electronics Engineering",Tata McGraw Hill, 2015.
2.	B.L. Theraja and A.K.Theraja,"A Text Book of Electrical Technology", Vol-I and II, S. Chand & Co. 2014.

REFERENCES:	
1.	*Allan S Moris,"Measurement and Instrumentation Principles", Elseveir, 2006.*
2.	*Rajendra Prasad,"Fundamentals of Electrical engineering", Prentice Hall of India,2006.*
3.	*S.K.Bhattacharya,"Basic Electrical and Electronics Engineering", Pearson India, 2011.*

17ZBS205	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds.

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II	ENVIRONMENTAL POLLUTION & HEALTH RISK	9

Definition – causes, effects and control measures of: (a) Air pollution: Causes, effects and prevention (b) Water pollution: Causes, effects and prevention (c) Soil pollution: Causes, effects and prevention - (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – soil waste management: causes, effects and control measures of municipal solid wastes – pollution case studies

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III	NATURAL RESOURCES	9

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Energy Conversion processes – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual

in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill

UNIT IV	**SOCIAL ISSUES AND THE ENVIRONMENT**	**9**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark) - central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V	**HUMAN POPULATION AND THE ENVIRONMENT**	**9**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA) – GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Apply the knowledge of environmental science in identifying, to formulate and to solve the environmental problems.
2.	Public awareness of environmental function is at infant stage.
3.	Ignorance and incomplete knowledge has led to misconceptions.
4.	Develop and improve in standard of living has led to serious environmental disasters.
5.	Acquireknowledge about environmental laws.
6.	Acquire in-depth knowledge on population explosion and role of IT in environmental management.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES:

1.	*R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances andStandards", Vol. I and II, Enviro Media.*

2.	*Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ.,House, Mumbai, 2001.*
3.	*Dharmendra S. Sengar, "Environmental law", Prentice hall of India pvt ltd, New Delhi,2007.*
4.	*Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2005.*

17SES206	STRUCTURED PROGRAMMING USING C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn various problem solving methods and constructs.
- To get introduced to Structured Programming unsing C Language.
- To learn about various Library Functions and Contol statements in C.
- Learn to use arrays, strings, functions, pointers,
- Be Exposed to structures, unions and Files in C.

UNIT I BASICS OF PROBLEM SOLVING AND C **9**

Computer Programming Languages - Problem Solving Methods - Flow Chart, Developing Algorithm - Procedural Programming (Modular and Structural)- Program Compilation, Execution, Debugging, Testing - C Program Development Environment, Writing Portable C Code - C Program Structure- Character Set- Keywords- Data Types and Sizes – Constants, Variables- Declaration Operators – Arithmetic Operators, Increment, Decrement Operators, Relational &Logical Operators, Comma Operator, Bit Wise Operators, Assignment Operators and Expression, Conditional Expression, Precedence and Order of Evaluation.

UNIT II LIBRARY FUNCTIONS AND CONTROL **8**

Library Functions – Data Input and Output Function: Getchar, Putchar, Scanf, Printf, Gets, Puts Functions - Preprocessor Directives - Branching: If - Else Statement, Nested If Statement, Switch Case, Looping: While, Do-While, For - Nested Control Structures Break, Continue, Goto Statement.

UNIT III ARRAYS AND STRINGS **9**

Single Dimensional Array, Strings, and Two – Dimensional Arrays, Array of Strings, Multidimensional Array: Initialization, Unsized Array Initialization, Variable Length Arrays.

UNIT IV FUNCTIONS AND POINTERS **11**

Definition of Function – Prototypes – Storage Classes – Scope Rules – Recursion – Command Line Argument - Pointer Declaration - Operations On Pointer - Passing Pointers to a Function – Calling Function: Call by Value, Call by Address – Return Statement – Passing Arrays to Function - Pointers and One Dimensional, Multidimensional Array – Array of Pointers –Function Pointers – Dynamic Memory Allocation

UNIT V STRUCTURES, UNION AND FILES **9**

Definition - Processing a Structure - User Defined Data Types- Typedef, Array of Structure,and Pointer to Structure- Passing Structure to Functions - Self-Referential Structures - Nested Structures – Union - Introduction to Files-File Access-File Organization-File Operations.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Explore the basic concepts in C.
2. Write simple programs in C.
3. Write programs based on arrays.
4. Write programs using functions, pointers and concepts like memory allocation.
5. Write programs using Structures and Files.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	H	M			L						H		M

CO2		M	H		M		L						H		M
CO3		M	H		M		L						H		M
CO4		M	H	M			L						H		M
CO5		M	H	M			L						H		M
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Byron S. Gottfried and Jitendar Kumar Chhabra, "Programming with C", Tata McGraw Hill Publishing Company,New Delhi, 2011.
2.	Kernighan B. W. and Ritchie D. M., "C Programming Language (ANSI C)", Prentice Hall of India Private Limited, New Delhi, 2010.

REFERENCES:	
1.	*Herbert Schildt, "C The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2010.*
2.	*PradipDey and ManasGhosh, "Programming in C", Oxford University Press, New Delhi, 2009.*
3.	*Deitel and Deitel, "C How to Program", Pearson Education, New Delhi, 2011.*

17ZES207	ENGINEERING PRACTICESLABORATORY	L	T	P	C
	GROUP A (CIVIL &MECHANICAL)	0	0	4	2

OBJECTIVES:

- To train the students in safety handling of tools, equipment and machineries, plumbing operation and basic carpentry exercises.
- To impart skill in fabricating simple components using basic machining processes, sheet metal and metal joining process like welding, soldering, etc.
- To expose them in house wiring, basic electrical circuits and Electronic components and equipments.

CIVILENGINEERINGPRACTICES — 15

A) PLUMBING WORKS:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers and elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

B) CARPENTRY USING POWER TOOLS ONLY:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: To make basic carpentry joints by sawing, planing and cutting.

MECHANICALENGINEERINGPRACTICES — 15

A) WELDING:

1. Preparation of arc welding of butt joints, lap joints and tee joints.
2. Gas welding practice.

B) BASIC MACHINING:

1. Simple Turning and Facing.
2. Drilling Practice.

C) SHEET METAL WORK:

1. Forming & Bending.
2. Model making – Trays, funnels, etc.
3. Different type of joints.

D) MACHINE ASSEMBLY PRACTICE:

1. Study of centrifugal pump.
2. Study of air conditioner.

GROUP B (ELECTRICAL &ELECTRONICS)

ELECTRICALENGINEERINGPRACTICES — 15

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.

3. Stair case wiring.
4. 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

ELECTRONICSENGINEERINGPRACTICES	**15**

1. Study of Electronic components and equipments – Resistor, colour codingmeasurement of AC signal parameter (Peak-Peak, rms, Time period, frequency) using CRO.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of Halfwave and Full wave rectifiers.

TOTAL : 60 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Fabricate components by carpentry and pipe connections including plumbing works.
2.	Use welding equipment to fabricate permanent joints by welding and also can perform basic machining operations.
3.	Fabricate electrical and electronics circuits.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H		H		L						H	M	
CO2	M	M	H	M	H		L						H	M	
CO3	M	M	H		H		L						H	M	

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

17SES208	STRUCTURED PROGRAMMING USING C LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Be Familiar with basic Unix/Linux Commads.
- Learn to create simple C programs using I/O statements.
- Be exposed to Decision making, Looping constructs.
- Enable effective use ofarrays, strings, functions , Pointers.
- Implement the concepts of structure , Union and file organization.

LIST OF EXPERIMENTS:

First ten programs must be done in Unix/Linux environment and the other programs may be done in an IDE in Windows Environment. Modular programming and working with multiple files must be illustrated in the lab.

Programs illustrating the following statements/concepts:

1. Basic Unix/Linux commands.
2. Writing portable C code.
3. Formatted I/O statements.
4. Decision Making statements: Simple If, If – else, Switch- case.
5. Looping Statements: For, While, Do – while.
6. Single dimensional arrays.
7. Multi-dimensional array.
8. Operations on Strings.
9. Pass by value and pass by address.
10. Recursion.
11. Structures and nested structures.
12. String handling operations using pointers.
13. Operations on arrays using pointers.
14. Passing data through command line arguments.
15. Operations on files.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Write C programs, which involve decision making and arrays, functions and structures.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H		H		L						H	M	

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

REFERENCES:

1. *Herbert Schildt, "C - The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2010.*

SEMESTER III

17ZBS301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9+6

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+6

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV FOURIER TRANSFORMS 9+6

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9+6

Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL (L : 45 + T : 30): 75 PERIODS

OUTCOMES:	On completion of this course, students will be able to
•	Understand the concepts of Fourier series and its construction when discrete and continuous form is known
•	Acquire fluency in Fourier transforms in order to solve improper integrals
•	Understand the standard and special types of partial differential equations

•	Gain fluency in solving boundary value problems
•	Understand the Z transform methods to find solutions of difference equations.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2016.
2.	Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
3.	Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd., 1998.

REFERENCES:

1.	*Bali. N.P Manish Goyal, "A Textbook of Engineering Mathematics",Laxmi Publications Pvt Ltd, 9th Edition 2016.*
2.	*Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.*
3.	*Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2016.*
4.	*Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.*
5.	*Ray Wylie C, Barrett .L.C, "Advanced Engineering Mathematics", 6th Edition,Tata McGraw Hill Education Pvt Ltd, New Delhi, 2012.*
6.	*Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.*

17SPC302	OBJECT ORIENTED PROGRAMMING USING C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be familiar with the Object oriented programming concepts usins C++.
- Learn the basics of Programming in C++ using Classes and objects.
- Be familiar with the C++ concepts of abstraction, encapsulation, Constructor.
- Be familiar with the C++ concepts of polymorphism, overloading and Inheritance
- Be exposed to concepts of Virtual Functions, Streams, Files, Templates and Exceptions.

UNIT I INTRODUCTION TO OOP, CLASSES AND OBJECTS **9**

Introduction of Object Oriented Programming – Characteristics of Object Oriented Languages – C++ Programming basics - Loops and Decisions – Function Components - Passing Parameters – Class Specification- Member Function Definition – Constructors – Destructors – C++ objects as data types – Objects as function arguments - Structures and Classes - Static Class Data – const and Classes – Inline function.

UNIT II OPERATOR OVERLOADING **9**

Operator Function – Overloading Unary and Binary Operators - Overloading The Operator Using Friend Function-Stream Operator Overloading-Data Conversion.

UNIT III INHERITANCE **9**

Derived and Base Class – Protected access specifier – Derived class constructors - Overriding member functions - Single Inheritance- Protected Data With Private Inheritance- Multiple Inheritance- Multi Level Inheritance- Hierarchical Inheritance- Hybrid Inheritance- Multipath Inheritance.

UNIT IV VIRTUAL FUNCTIONS **9**

Need For Virtual Function - Pointer to Derived Class Objects- Array of Pointer to Base Class Objects- Pure Virtual Functions- Abstract Classes- Virtual Destructors – Virtual Dynamic Binding – Run Time Type Identification(RTTI).

UNIT V STREAMS, FILES, TEMPLATES AND EXCEPTIONS **9**

Stream Classes – Advantages of Streams – Manipulators- User Defined Manipulators- File Streams-File Pointer and Manipulation-File Open and Close- Sequential and Random Access – Function templates – Class Templates – Template and Inheritance - Exceptions – Multiple exceptions – Exceptions with arguments.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Use object oriented approach to programming.
2. Write programs using operator overloading.
3. Establish the use of inheritance for software reuse.
4. Write programs using virtual functions.
5. Use exceptional handling methods and templates.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. Robert Lafore," Object Oriented Programming in C++", Pearson India, 2008.
2. Bjarne Stroustrup,"Programming: Principles and Practice using C++", Addison-Wesley, 2008.

REFERENCES:

1. *Herbert Schildt, "C++: The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2011.*
2. *Stanley B. Lippman and JoseeLajoie, "C++ Primer", Pearson India,, 2010.*
3. *Deital&Deital, "C++: How To Program", PHI Learning, New Delhi, 2010.*
4. *Venugopal K. R., RajkumarBuyya and Ravishankar T, "Mastering C++", Tata McGrawHill Publishing Company, New Delhi,2009.*

17SPC303	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand basics of DBMS.
- Introduce the different models in database.
- Introduce the Data Definition Language and querying using SQL
- Understand in detail transaction processing.
- Acquire knowledge of advanced databases

UNIT I INTRODUCTION TO DATABASE SYSTEMS 9

Data - Database Applications - Evolution of Database - Need for Database Management –Data models - Database Architecture - Key Issues and Challenges in Database Systems.

UNIT II ER AND RELATIONAL MODELS 9

ER Models – ER to Relational Mapping –Object Relational Mapping - Relational Model-Constraints - Keys - Dependencies - Relational Algebra - Normalization - First, Second, Third& Fourth Normal Forms - BCNF – Join Dependencies.

UNIT III DATA DEFINITION AND QUERYING 9

Basic DDL - Introduction to SQL - Data Constraints - Advanced SQL - Views - Triggers - Database Security – Embedded & Dynamic SQL.

UNIT IV TRANSACTIONS AND CONCURRENCY 9

Introduction to Transactions - Transaction Systems - ACID Properties - System & MediaRecovery - Need for Concurrency - Locking Protocols – SQL for Concurrency – Log BasedRecovery - Two Phase Commit Protocol - Recovery with SQL- Deadlocks & ManagingDeadlocks.

UNIT V ADVANCED TOPICS IN DATABASES 9

Indexing & Hashing Techniques - Query Processing & Optimization - Sorting & Joins – Database Tuning - Introduction to Special Topics - Spatial & Temporal Databases – DataMining and Data Warehousing.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Classify modern and futuristic database applications based on size and complexity.
2. Map ER model to Relational model.
3. Write queries using normalization criteria.
4. Compare and contrast various indexing strategies in different database systems.
5. Appraise how advanced databases differ from traditional databases.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M				L								H
CO2		H	M		M										M
CO3	H		H		L										H

CO4	M	H	M											L	H
CO5	M	H	M				M								H
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2010.
2.	Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson/Addison - Wesley, 2010.
REFERENCES:	
1.	*C.J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", Pearson Education, Eighth Edition, 2006.*
2.	*Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw Hill,2015.*
3.	*Narain Gehani and Melliyal Annamalai., "The Database Book Principles and Practice Using the Oracle Database System", Universities Press, 2012.*

17SPC304	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the phases in a software project.
- Understand fundamental concepts of requirements engineering.
- Learn various Analysis Modeling Approaches.
- Understand the major considerations for enterprise integration and deployment
- Learn various testing and maintenance measures.

UNIT I	SOFTWARE PROCESS MODELS	9

The Evolving Role of Software – Software – The changing Nature of Software – Legacy software – A generic view of process– A layered Technology – A Process Framework – The Capability Maturity Model Integration (CMMI) – Process Assessment –Personal and Team Process Models – Product and Process – Process Models – The Waterfall Model – Incremental Process Models – Incremental Model – The RAD Model – Evolutionary Process Models – Prototyping – The Spiral Model – The Concurrent Development Model – Specialized Process Models – The Unified Process.

UNIT II	REQUIREMENT ENGINEERING	9

Software Engineering Practice – Communication Practice – Planning Practice - Modeling Practice– Construction Practice – Deployment - Requirements Engineering - Requirements Engineering Tasks – Initiating the Requirements Engineering Process - Eliciting Requirements– Developing Use Cases – Building the Analysis Models –Elements of the Analysis Model – Analysis Pattern – Negotiating Requirements – Validating Requirements.

UNIT III	ANALYSIS MODELLING	9

Requirements Analysis – Analysis Modeling Approaches – Data Modeling Concepts – ObjectOriented Analysis – Scenario Based Modeling – Flow Oriented Modeling – Class BasedModeling – Creating a Behaviour Model.

UNIT IV	DESIGN AND TESTING	9

Design Engineering – Design Process -Design Quality - Design Model - User Interface Design – Testing Strategies - Testing Tactics - Strategies Issues for Conventional and Object Oriented Software - Validation Testing – System Testing – Art of Debugging – Project Management.

UNIT V	QUALITY AND MAINTENANCE	9

Software Evolution - Verification and Validation -Critical Systems Validation – Metrics for Process, Project and Product-Quality Management - Process Improvement – Risk Management- Configuration Management – Software Cost Estimation.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Differentiate the perspective of various software process models.
2.	Elicit the requirements for real-time problems.
3.	Compile a SRS pertaining to industry standards.
4.	Create a behavioural model from the set of requirements.
5.	Develop a user-interface design for the given system.
6.	Outline various software metrics and their context in measuring software programs and estimate the software cost.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International edition, Seventh edition, 2009.
2. Ian Sommerville, "Software Engineering", Ninth Edition, Pearson Education, 2008.

REFERENCES:

1. *Stephan Schach, "Software Engineering", Tata McGraw Hill, 2007.*
2. *Pfleeger and Lawrence,"Software Engineering: Theory and Practice", Pearson Education,SecondEdition, 2001.*

17SPC305	DATA STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be familiar with the basics of C programming language.
- Be exposed to the concepts of ADTs
- Learn linear data structures – Arrays, list, stack, and queue.
- Be exposed to sorting, searching, hashing algorithms
- Be familiar with the concept of graphs.

UNIT I ARRAYS AND LINKED LISTS 9

Data Structures - Types of Data Structures - Array Representation –Operations - Applications: Linear and Binary Search - Insertion Sort -Bubble Sort – Matrices - Special Matrices - Linked List Representation - Operations - Types - Applications: Polynomial Addition -Sparse Matrices - Garbage Collection and Compaction.

UNIT II STACKS,QUEUES AND TREES 9

StackRepresentation - Operations - Applications -Expression Handling - QueueRepresentation - Operations - Types of Queues: Circular Queue – Deque - Priority Queue. TREES: Terminologies - Binary Trees: Types - Representation - Traversal - Binary Search Trees: Representation – Operations**.**

UNIT III PRIORITY QUEUES AND SEARCH TREES 9

Priority Queues – Binary Heap – Applications of Priority Queues- Heap Sort – d-Heaps – Leftist Heaps – Skew Heaps - AVL Trees- Splay Trees - B-Trees – B+ Trees – Red Black Trees -2-3-4 trees – Tries. Applications, Expression Trees.

UNIT IV GRAPHS 9

GraphTerminologies - Types of Graphs - Representation - Operations - Traversal Techniques: Breadth First Search -Depth First Search. Applications: Topological Sort– Minimum Spanning Tree – Prim‘s – Kruskal‘s Algorithm – Applications of Depth First Search – Biconnectivity – Euler Circuits – Finding Strong Components.

UNIT V HASHING 9

Hash Function – Separate Chaining - Linear Probing – Quadratic Probing – Double Hashing - Rehashing – Extendible Hashing.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Write programs using arrays and linked lists.
2. Develop programs using stacks, queues and trees.
3. Identify the use of priority queues and search trees.
4. Understand the use of graphs and algorithms in computer applications.
5. Use hashing for searching data.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M												H	M
CO2	H	L												H	M
CO3		M	H		H		L						M	H	L

CO4	H	L					M							H	M
CO5	H	M					L						L	H	M

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

TEXT BOOKS:	
1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2010.
2.	Venkatesan R and Lovelyn Rose S, "Data Structures", Wiley India Pvt Ltd, New Delhi, 2015.

REFERENCES:	
1.	*Salaria R S, "Data Structures and Algorithms using C", Fifth Edition, Khanna Book Publishing, New Delhi, 2012.*
2.	*Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithm", Second Edition,Universities Press, 2011.*
3.	*Jean Paul Tremblay and Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill Publishing Company,New Delhi, 2012.*
4.	*Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 2011.*

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17SES306	DIGITAL PRINCIPLES AND SYSTEMS DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn the various number systems.
- Learn Boolean Algebra
- Understand the various logic gates.
- Be familiar with various combinational circuits.
- Be familiar with designing synchronous and asynchronoussequential circuits.
- Be exposed to designing using PLD

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

IC Digital Logic Families - Characteristics of digital IC's, Transistor – Transistor Logic family, Standard TTL characteristics, Other TTL series, Open collector TTL, WiredOR/AND connection, Tristate TTL, Emitter-Coupled Logic family, ECL NOR/OR gate andits characteristics, Metal-oxide semi-conductor (MOS) family, NMOS and CMOS gates andtheir characteristics, CMOS transmission gate circuits-Review of logic Gates, Demorgan's Theorem - K maps– simplification and representation using NAND, NOR gates.

UNIT II COMBINATIONAL LOGIC 9

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations,Code Conversion – Decoders and Encoders – Multiplexers – Real Time Application ofCombinational Circuits- Introduction to HDL – HDL Models of Combinational circuits.

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 9

Sequential Circuits – Latches and Flip Flops – Shift Registers – Counters- State Reduction andState Assignment - Analysis and Design Procedures – HDL for Sequential Logic Circuits.

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 9

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

UNIT V MEMORY AND PROGRAMMABLE LOGIC 9

RAM and ROM – Memory Decoding – Error Detection and Correction –PROM – ProgrammableLogic Array – Programmable Array Logic – Sequential Programmable Devices – Application -Specific Integrated Circuits.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Design and analyse digital circuits.
2. Simplify complex boolean functions.
3. Implement design using MSI chips and PLDs.
4. Build digital systems involving combinational and sequential logic.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	H			L	M						L	H	

CO2	L	M	H				M						M	H	
CO3	L	M	H			L	M						M	L	
CO4	L	M	H				M						M	H	
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	M. Morris Mano and Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson Education, 2012.

REFERENCES:	
1.	*G. K. Kharate, "Digital Electronics", Oxford University Press, 2010.*
2.	*John F. Wakerly,"Digital Design Principles and Practices", Fourth Edition, Pearson Education,2007.*
3.	*Charles H. Roth Jr, "Fundamentals of Logic Design", Fifth Edition, Jaico Publishing House,Mumbai, 2003.*
4.	*Donald D. Givone," Digital Principles and Design", Tata Mc Graw Hill, 2003.*

17SPC307	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	Be exposed to DDL Commands
•	Be familiar with DML commands
•	Learn to create SQL Queries using nested constructs, grouping, constraints etc.
•	Get introduced to TCL commands
•	Design database along with front end application

LIST OF EXPERIMENTS:

Experiment the following commands on sample Case studies

1. DDL commands
   a. Creation of tables with appropriate integrity constraints.
   b. Usage of alter, drop commands.
2. DML commands
   a. Data Insertion using different ways.
   b. Usage of truncate command.
3. SQL Queries
   a. Study of SELECT command with different clauses.
   b. Nested Queries (IN and NOT IN, EXISTS and NOT EXISTS, UNIQUE and NOT UNIQUE, op ANY, op ALL, op SOME).
   c. NULL value and OUTER JOIN Queries.
   d. Aggregation Operators.
   e. Grouping and Ordering commands.
   f. Show Integrity constraints.
   g. Views and Indices.
4. TCL commands
   a. Setting privileges.
   b. Save point, roll back commands.
5. Generation of suitable reports.
6. Implementation of suitable front end for querying and displaying the results.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Use typical data definitions and manipulation commands.
2.	Design applications to test nested and joint queries.
3.	Implement simple applications that use Views.
4.	Implement applications that require a Front End Tool and Report Generations.
5.	Critically analyze the use of Tables, Views, functions and Procedures for a realistic Database application.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M		M		M						H		M
CO2	M	H			M		L						H		M

CO3		H	H		L								H		M
CO4	M	M					H						H		M
CO5	H	H					M						H		M
(L- Low, M- Moderate, H-High)															

REFERENCES:

1. *James R. Groff, Paul N. Weinberg and Andy Oppel, "SQL: The Complete Reference", Third Edition, McGraw-Hill Education India Pvt Ltd, 2011.*

17SPC308	OBJECT ORIENTED PROGRAMMING LABORATORY USING C++	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	Get Introduced to the object oriented programming using C++
•	Learn to create simple C++ programs using I/O statements.
•	Be familiar with concepts of overloading in C++
•	Be exposed to implementation of Inheritance using C++
•	Enable effective use of templates, virtual functions etc.

LIST OF EXPERIMENTS:

Implement programs to demonstrate
1. Classes and Objects.
2. Function Overloading.
3. Call by value and Call by Reference.
4. Inline Function.
5. Static Data and Member Function.
6. Constant Functions.
7. Friend function.
8. Objects as Arguments.
9. Array of Objects.
10. Static and Dynamic Objects.
11. Constructor and Destructor.
12. Operator Overloading.
13. Data Conversion.
14. Inheritance.
15. Virtual functions.
16. Sequential and Random Accessing of Files.
17. Template Functions and Template Class.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Write programs using Classes, Objects.
2.	Implement overloading options in programs.
3.	Use file processing functions in programs.
4.	Write generic programs.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L										H		L
CO2	M			H			L						H	M	
CO3	M	H		L			M						H		L

CO4	M	H		L			M						H	M	
(L- Low, M- Moderate, H-High)															

REFERENCES :

1. *Herbert Schildt, "C++: the Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2011.*
2. *Sumita Arora,"Practical World of C++", Dhanpat Rai & CO.(Pvt.)Ltd, 2005.*

17SES309	DIGITAL PRINCIPLES AND SYSTEMS DESIGN LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Understand the various logic gates.
- Be familiar with various combinational circuits.
- Understand the various components used in the design of digital computers.
- Be exposed to sequential circuits
- Learn to use HDL.

LIST OF EXPERIMENTS:

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and implement a 4-bit binary adder / subtractor.
4. Design and implement Parity generator / checker.
5. Design and implement Magnitude Comparator.
6. Design and implement an application using multiplexers.
7. Design and implement shift –registers.
8. Design and implement synchronous counters.
9. Design and implement asynchronous counters.
10. Coding combinational circuits using HDL.
11. Coding sequential circuits using HDL.
12. Design and implementation of a simple digital system (Mini Project).

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Use theorems and K-maps to simplify boolean functions.
2. Design and implement combinational circuits like arithmetic circuits,decoder/encoder
3. Analyze a given digital circuit – combinational and sequential.
4. Design synchronous sequential circuits like registers and counters and asynchronous circuits.
5. Design and implement a simple digital system for a given specifications.

COURSE ARTICULATION MATRIX:

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

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

REFERENCES:

1. *Stephen Brown, Zvonko Vranesic,"Fundamentals of Digital Logic Design With VHDL", Third Edition, McGrawHill India, 2012.*

SEMESTER IV

17SBS401	PROBABILITY AND QUEUEING THEORY	L	T	P	C
		3	2	0	4

OBJECTIVES:

The students should be made to

- To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

UNIT I	RANDOM VARIABLES	9+6

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II	TWO DIMENSIONAL RANDOM VARIABLES	9+6

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables.

UNIT III	RANDOM PROCESSESS	9+6

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT IV	QUEUEING MODELS	9+6

Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little's formula - Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.

UNIT V	ADVANCED QUEUEING MODELS	9+6

Finite source models - M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and $M/E_K/1$ as special cases – Series queues – Open Jackson networks.

TOTAL (L : 45 + T : 30): 75 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Have a fundamental knowledge of the probability concepts.
2. Acquire skills in analyzing queueing models.
3. Understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M		H	L									H	M
CO2	M	H		M	L		H						M	H	
CO3	M	M		H	L									H	M

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

TEXT BOOKS:

1. Ibe.O.C., "Fundamentals of Applied Probability and Random Processes", 2nd Edition, Academic press (Elsevier), 2014.
2. Gross. D., Harris. C.M., "Fundamentals of Queueing Theory", 4th Edition, John Wiley and Sons, 2008.

REFERENCES:

1.	*Robertazzi T, "Computer Networks and Systems: Queueing Theory and Performance Evaluation", 3rd Edition, Springer, 2006.*
2.	*Taha H.A., "Operations Research", 10th Edition, Pearson Education, India, 2017.*
3.	*Trivedi.K.S, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2016.*
4.	*Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", 3rd Edition, Tata Mc Graw Hill Edition, New Delhi, 2014.*
5.	*Yates. R.D.,Goodman. D.J., "Probability and Stochastic Processes", 3rd Edition, Wiley India Pvt. Ltd., Bangalore, 2014.*

17SPC402	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the underlying principles, techniques and approaches in operating systems.
- To Learn functionality and processing of program execution
- To understand various memory management Schemes.
- To know how operating system interact and provides services for execution of application software.
- To Learn the basics of Linux system and perform administrative tasks on Linux Servers

UNIT I OPERATING SYSTEMS OVERVIEW 9

Introduction to operating systems – Computer system organization, architecture – Operatingsystem structure, operations – Process, memory, storage management – Protection and security– Distributed systems – Computing Environments – Open-source operating systems – OSservices – User operating-system interface – System calls – Types – System programs – OSstructure – OS generation – System Boot – Process concept, scheduling – Operations onprocesses – Cooperating processes – Inter-process communication – Examples – Multithreadingmodels – Thread Libraries – Threading issues – OS examples.

UNIT II PROCESS MANAGEMENT 9

Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multipleprocessor scheduling – Operating system examples – Algorithm Evaluation –The critical-section problem – Peterson‘s solution – Synchronization hardware –Semaphores – Classic problems of synchronization– Critical regions – Monitors –Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention –Deadlock Avoidance – Deadlock detection – Recovery from deadlock.

UNIT III STORAGE MANAGEMENT 9

Memory Management – Swapping – Contiguous memory allocation – Paging –Segmentation –Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write –Page replacement – Allocation of frames – Thrashing**.**

UNIT IV I/O SYSTEMS 9

File concept – Access methods – Directory structure – File-system mounting – Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling –Disk management – Swap-space management – Protection.

UNIT V CASE STUDY 9

The Linux System – History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-processCommunication – Network Structure – Security – Windows 10 – History – Design Principles –System Components – Terminal Services and Fast User – File system – Networking. Mac OS – Kernel -X Structure- Debugging –IPC in Mac OS.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Articulate the main concepts, key ideas, strengths and limitations of operating systems.
2. Explain the core issues of operating systems.
3. Know the usage and strengths of various algorithms of operating systems.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H		M	L								H		M
CO2	H	M		H	L		M						H		M
CO3	H	M		M	L								M		H

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

TEXT BOOKS:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne," Operating System Concepts Essentials",John Wiley & Sons Inc., 2010.

REFERENCES:

1. *Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.*
2. *D M Dhamdhere, "Operating Systems: A Concept-based Approach", Second Edition, TataMcGrawHill Education, 2007.*
3. *Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw HillEducation, 1996.*
4. *William Stallings, "Operating Systems: Internals and Design Principles", Seventh Edition,Prentice Hall, 2011.*

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17SPC403	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	To understand Memory addressing modes used by the instructions and to expose the major differentials of RISC and CISC architectural characteristics with performance evaluation of CPU.
•	To understand Basics of number representation of signed integers and to perform operations like addition and subtraction of signed integers represented multiplication and floating point addition.
•	To understand Organization of a computer system including the CPU data path and control
•	To understand Concept of pipelining and the various hazards that arise in a pipeline and the typical solutions to the hazards.
•	To understand Concept of memory Technologies and Parallelism and Memory Hierarchies.
•	To understand Concepts of Multicore and Shared Memory Multiprocessors.

UNIT I	FUNDAMENTALS	9

Functional Units of a Digital Computer – Hardware – Software Interface –Translation from aHigh Level Language to the Hardware Language – Instruction Set Architecture – Styles andFeatures – RISC and CISC Architectures – Performance Metrics – Amdahl‘s Law – CaseStudies of ISA.

UNIT II	ARITHMETIC FOR COMPUTERS	9

Addition and Subtraction – Fast Adders – Binary Multiplication - Binary Division – Floating Point Numbers – Representation, Arithmetic Operations.

UNIT III	BASIC PROCESSING UNIT	9

Components of the Processor – Data path and Control – Execution of a Complete Instruction– Hardwired and Micro programmed Control. Instruction Level Parallelism – Basic Concepts ofPipelining – Pipelined Implementation of Data path and Control – Hazards – Structural, Dataand Control Hazards – Exception Handling.

UNIT IV	MEMORY AND I/O	9

Need for a Hierarchical Memory System – Types and Characteristics of Memories – CacheMemories – Improving Cache Performance – Virtual Memory – Memory ManagementTechniques – Associative Memories. Accessing I/O devices – Programmed Input/Output -Interrupts – Direct Memory Access.

UNIT V	ILP AND PARALLEL PROCESSING	9

Exploitation of more ILP – Dynamic Scheduling – Speculation – Multiple Issue Processors.Parallel Processing - SISD, MIMD, SIMD, SPMD and Vector Architectures – Hardware.Multithreading- Shared Memory Multiprocessors – Multicore Processors – GraphicsProcessing Units. Study of a Basic Architectural Simulator.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Identify the functional units of a computer system and their operation.
2.	Point out the various metrics of performance.
3.	Critically analyze the different types of ISA styles.
4.	Explain the data path and control path implementation of a processor.

5.	Discuss the implementations of various functional units.
6.	Point out the characteristics of the memory and I/O systems and discuss their design.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fourth Edition, Morgan Kaufmann / Elsevier, 2009.

REFERENCES:

1.	*Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.*
2.	*William Stallings, "Computer Organization and Architecture,Designing forPerformance", Sixth Edition, Pearson Education, 2003.*
3.	*John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGrawHill, 1998.*
4.	*John L. Hennessey and David A. Patterson,"Computer Architecture – A QuantitativeApproach", Morgan Kaufmann / Elsevier Publishers, Fourth Edition, 2007.*
5.	*V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education, 2004.*
6.	*Behrooz Parhami, "Computer Architecture", Oxford University Press, 2007.*

17SPC404	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	Be familiar with Different approaches for algorithm analysis.
•	Be familiar with Decrease and Conquer technique.
•	Be familiar with Greedy approach, Divide and Conquer and Dynamic Programming technique.
•	Be familiar with Backtracking and Branch and Bound technique.
•	Be familiar with Approximation and Randomized algorithms.

UNIT I	ANALYSING ALGORITHMS	9

The Role of Algorithms in Computing - Growth of Functions – Recurrences - The Substitution Method - The Recurrence Tree Method - The Master Method - Probabilistic Analysis and Randomized Algorithms – Amortized Analysis – Aggregate Analysis – Accounting Method.

UNIT II	DIVIDE AND CONQUER & GREEDY DESIGN STRATEGIES	9

Analysis of Quick Sort, Merge Sort – Quick Sort Randomized Version – Sorting in Linear Time- Lower Bounds for Sorting - Selection in Expected Linear Time - Selection in Worst case ,Linear Time – Greedy Algorithms - Elements of Greedy Strategy - Huffman Code, Dijkstra'sShortest Path Algorithm.

UNIT III	DYNAMIC PROGRAMMING AND OTHER DESIGN STRATEGIES	9

Dynamic Programming – Matrix Chain Multiplication - Elements of Dynamic programming –Longest Common Sequences – Warshall's and Floyds Algorithm – Transitive Closure - AllPairs Shortest Path Algorithm – Analysis – Backtracking – Graph Coloring Problem - Branchand Bound Strategy - Knapsack Problem.

UNIT IV	FLOW NETWORKS AND STRING MATCHING	9

Flow Networks – Ford Fulkerson Method - String Matching - Naive String Matching Algorithm– Knuth Morris Pratt Algorithm - Analysis.

UNIT V	NP PROBLEMS	9

NP-Completeness – Polynomial Time Verification – Theory of Reducibility – CircuitSatisfiability – NP - Completeness Proofs – NP Complete Problems: Vertex Cover,Hamiltonian Cycle and Traveling Salesman Problems – Approximation Algorithms – Approximation Algorithms to Vertex - Cover and Travelling Salesman Problems.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Propose the correct algorithmic strategy to solve any problem.
2.	Write algorithms for any problem based on the strategy.
3.	Analyze any given algorithm and express its complexity in asymptotic notation.
4.	Identify any problem as belonging to the class of P, NP-Complete or NP-Hard.
5.	Propose approximation algorithm for any NP problem.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	H		M	M									H		M
CO2	H	M	L	M									H		M
CO3	H		M	M									H		M
CO4	H	M	L	M									H		M
CO5	H		M	M									H		M
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Cliford Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010.
2.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of ComputerAlgorithms", Second Edition, Universities Press, 2008.

REFERENCES:	
1.	*Kenneth A. Berman and Jerome L. Paul, "Algorithms", Cengage Learning India, 2010.*
2.	*Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, "The Design and Analysis of Computer Algorithms", First Edition, Pearson Education, 2006.*

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17SPC405	JAVA ESSENTIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be familiar with the Java concepts constructor and destructor., polymorphism, overloading and
- Understand the concept of Inheritance and exception handling.
- Be known to the polymorphism and overloading, overriding concept.
- Get familiar with files and streams.
- Be known to Java GUI application methods

UNIT I	INTRODUCTION	9

Introduction to OOP – Thinking Object Oriented - Object Oriented Design. Introduction to Java –JVM - Classes and methods – Varieties of Classes – Messages, Instances and Initialization -Constructors and Destructors – Object and Class in java.lang.class - Namespaces – Scope –Method Overloading – Arrays – Type Casting - Constant Objects and Member Functions –Composition - this Pointer – Static Instances.

UNIT II	INHERITANCE AND EXCEPTION HANDLING IN JAVA	9

Package Access - Java API Packages – Inheritance - Sub Classes and Subclass Types - Replacement and Refinement – Implications of Inheritance - Exception Handling- JavaException Hierarchy - Declaring New Exception Types – Assertions - Garbage Collection andMethod finalize – String Class - Converting between Types - Inheritance – an IntuitiveDescription of Inheritance - Subclass, Subtype, and Substitutability - Forms of Inheritance, is-aand has-a rule – Multiple Inheritance .

UNIT III	POLYMORPHISM IN JAVA	9

Polymorphism - Abstract Classes and Methods - Varieties of Polymorphism - PolymorphicVariables – Overloading and Overriding – Pure Polymorphism - Polymorphic Processing,Operator instance of and Down Casting - final Methods and Classes – Clone Class - Interface –Implementation – Multithreading.

UNIT IV	FILES AND STREAMS IN JAVA	9

Files and Streams – Formatted Output - Object Concurrency - Serialization - Generic Collections- Generic Classes and Methods - Visibility and Dependency – Reflection and Introspection -Java Utility Packages and Bit Manipulation – Java Collections.

UNIT V	GUI, MULTIMEDIA AND DATABASE IN JAVA	9

GUI Components – Graphics, 2D and 3D - Introduction to Java Applets – Frameworks - Multimedia: Applets and Applications – Example Frameworks: Swing and AWT – AccessingDatabases with JDBC – Introduction to JavaFX - Case Study: ATM System, Payroll System.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Design problem solutions using Object Oriented techniques.
2.	Apply the concepts of data abstraction, encapsulation, polymorphism, overloading, andinheritance for problem solutions.
3.	Use the OOP concepts of Java appropriately in problem solving.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H	M		L		M						M		H
CO2	M	H	M		L		M						M	L	H
CO3		H	M		L		M						M		H

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

TEXT BOOKS:

1.	Timothy Budd, "An Introduction to Object-Oriented Programming", Third Edition, PearsonEducation, 2008.
2.	Paul Deitel and Harvey Deitel," Java How to Program (Early Objects)", Tenth Edition, Pearson Prentice Hall 2014.

REFERENCES:

1.	*Patrick Niemeyer, Daniel Leuck, "Learning Java", Fourth Edition, Shroff /O'Reilly, 2013.*
2.	*Joshua Bloch, "Effective Java: A Programming Language Guide", Second Edition, Pearson, 2008.*

17SPC406	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the role of objects in software process models
- To analyze the importance of use cases
- To model the system using standard design diagrams
- To design and manage object based systems
- To study standard OO patterns and their impact on testing

UNIT I INTRODUCTION **9**

Object Oriented Analysis and Design – Iterative, Evolutionary and Agile – NextGen POS system – Inception – Inception vs. Requirements – Evolutionary Requirements.

UNIT II USECASES **9**

Usecases – Other requirements – Domain Model – System Sequence Diagrams – Operation Contracts - From Requirements to Design.

UNIT III DESIGN **9**

Logical architecture and UML package diagrams – Onto Object Design – UML Interaction Diagrams – UML Class diagrams - GRASP: Designing Objects with Responsibilities – ObjectDesign Examples with GRASP – Designing for Visibility – Mapping Design to Code – TestDriven Development and Refactoring – UML Tools and UML as blueprint.

UNIT IV ELABORATION **9**

More patterns – More objects with Responsibilities – Applying GoF Design Patterns – UMLActivity Diagrams and Modeling – UML State Machine Diagrams and Modeling – RelatingUsecases – Domain Model Refinement – More SSDs and Contracts – Architectural Analysis –Logical Architecture Refinement – Package Design – More Object Design with GoF patterns –UML deployment and Component Diagrams.

UNIT V PATTERN BASED ANALYSIS AND CASE STUDY **9**

Designing a Persistence Framework with Patterns – Creational Patterns: Abstract Factory – Builder – Factory Method – Prototype – Singleton - Structural Patterns: Adapter – Bridge – Composite – Decorator – Façade – Flyweight – Proxy- Behavioral Patterns: Chain ofResponsibility – Command – Interpreter – Iterator – Mediator – Memento – Observer – State –Strategy – Template Method – Visitor - Case study: Bank ATM - Managing Object OrientedProjects - Agate Ltd – Food Co Ltd – ATM – Payroll.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Apply object oriented concepts to design.
2. Improvise on creative design using object orientation.
3. Identify and analyze evolutionary requirements to design.
4. Deploy different UML package diagrams.
5. Explain the process of OO design and its application to testing.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	H		M	L	L						M		H

CO2		M	H		M	L	L						M	L	H
CO3		M	H		M	L	M						M	L	H
CO4		M	H		M	L	M						H		M
CO5		M	H		M	L	M						H		M
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.
2.	Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison Wesley, 1995, Thirty SeventhReprint, 2009.
REFERENCES:	
1.	*Simon Bennett, Steve McRobb, Ray Farmer," Object-Oriented Systems Analysis and Design Using UML", Fourth Edition, Tata McGraw-Hill Education, 2004.*

17SPC407	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	Learn shell programming and the use of filters in the UNIX environment.
•	Be exposed to programming in C using system calls.
•	Learn to use the file system related system calls.
•	Learn to use the process creation related system calls.
•	Be exposed to inter process communication.
•	Be familiar with implementation of CPU Scheduling
•	Algorithms, page replacement algorithms and Deadlock avoidance

LIST OF EXPERIMENTS:

1. Basic UNIX commands – learning and usage.
2. Shell Programming.
3. Grep, sed, awk.
4. File system related system calls. (Learn to create, open, read, write, seek into, close files; open, read, write, search, close directories).
5. Process management – Fork, Exec (Learn to create a new process and to overlay an executable binary image on an existing process).
6. Inter-process communication between related processes using pipes.
7. Process synchronization using semaphores (Solutions to synchronization problems like producer consumer problem, dining philosophers' problem etc...).
8. Inter-process communication among unrelated processes using Shared memory.
9. Inter-process communication among unrelated processes using Message Queues.
10. CPU Scheduling algorithms.
11. Contiguous memory allocation strategies – best fit, first fit and worst fit strategies.
12. Page replacement algorithms.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Apply system calls for different purposes.
2.	Analyze and solve process synchronization problems.
3.	Use IPC for co-ordination among processes.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	M		L		L						H		M
CO2	M	H	M				L						H	M	L
CO3	M	H	M		L								H		M

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

17SPC408	CASE TOOLS LABORATORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	To learn the basics of OO analysis and design skills.
•	To be exposed to the UML design diagrams.
•	To learn to map design to code.
•	To be familiar with the various testing techniques

LIST OF EXPERIMENTS:

To develop a mini-project by following the 9 exercises listed below:

1. To develop a problem statement.
2. Identify Use Cases and develop the Use Case model.
3. Identify the conceptual classes and develop a domain model with UML Class diagram.
4. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence diagrams.
5. Draw relevant state charts and activity diagrams.
6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
7. Develop and test the Technical services layer.
8. Develop and test the Domain objects layer.
9. Develop and test the User interface layer.

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank.
3. Exam registration.
4. Stock maintenance system.
5. Online course reservation system.
6. E-ticketing.
7. Software personnel management system.
8. Credit card processing.
9. e-book management system.
10. Recruitment system.
11. Foreign trading system.
12. Conference management system.
13. BPO management system.
14. Library management system.
15. Student information system.

TOTAL : 60 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Design and implement projects using OO concepts.
2.	Use the UML analysis and design diagrams.
3.	Apply appropriate design patterns.
4.	Create code from design.

5.	Compare and contrast various testing techniques.

COURSE ARTICULATION MATRIX:

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

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

REFERENCES:

1.	*Wendy Boggs ,"Mastering UML with Rational Rose" , Sybex Publications, 2002.*
2.	*Per Kroll and Philippe Kruchen," The Rational Unified Process Made Easy: A Practitioner's Guide to the RUP" Addison Wesley, 2003.*

17SPC409	DATASTRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	Be familiar with Implementation of linear data structures.
•	Be familiar with Implementation and analysis of sorting and searching techniques.
•	Be familiar with Performing various operations of nonlinear data structures.
•	Be familiar with Implementation of dynamic memory management.
•	Be familiar with Real time application Development.

LIST OF EXPERIMENTS:

1. Array Implementation of Stack and Queue ADTs.
2. Array Implementation of List ADT.
3. Linked list Implementation of List, Stack and Queue ADTs. .(Use Inheritance).
4. Applications of List, Stack and Queue ADTs.
5. Implement lists using generic classes.
6. Implement List ADT and use operator overloading to implement functions in List ADT.
7. Implementation of Binary Trees, Traversal.
8. Implementation of Quick Sort and Merge sort (Divide and Conquer).
9. Implementation priority queues – Insert,Delete, FindMin / Max.
10. To implement the search trees - Insert, Delete, search.
11. Graph representation and traversal.
12. Prim‘s Algorithm, Kruskal‘s algorithm (Greedy Technique).
13. Hashing – any two collision resolution techniques.
14. Dikstra shortest path Algorithm(Dynamic Programming).

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Apply generic programming technique to implement any data structure.
2.	Apply appropriate search trees for an application.
3.	Use graphs in problem solving.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	M		L						H	M	
CO2	H	M	M		M		L						H	M	
CO3	H	M	M	L	M		L						H	M	

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

REFERENCES:

1. *Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", Careermonk Publications, 5th edition,2016.*

SEMESTER V

17SBS501	DISCRETE MATHEMATICS	L	T	P	C
		3	2	0	4

OBJECTIVES:

The students should be made to

•	To extend student's Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

UNIT I	LOGIC AND PROOFS	9+6

Propositional Logic – Propositional equivalences - Predicates and Quantifiers – Nested Quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II	COMBINATORICS	9+6

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT III	GRAPHS	9+6

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV	ALGEBRAIC STRUCTURES	9+6

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphisms – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V	LATTICES AND BOOLEAN ALGEBRA	9+6

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL (L : 45 + T : 30): 75 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Have knowledge of the concepts needed to test the logic of a program.
2.	Have an understanding in identifying structures on many levels.
3.	Aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
4.	Aware of the counting principles.
5.	Expose to concepts and properties of algebraic structures such as groups, rings and fields.

COURSE ARTICULATION MATRIX:

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

(L- Low, M- Moderate, H-High)	
TEXT BOOKS:	
1.	Kenneth H.Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2.	Tremblay J.P., Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Mc Graw Hill Education, New Delhi, Indian Edition, 2017.
REFERENCES:	
1.	*Ralph.P.,Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.*
2.	*Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications, 2006.*
3.	*Seymour Lipschutz, Mark Lipson, Varsha H Patil, "Discrete Mathematics", Schaum's Outlines, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, Revised 3rd Edition, 2017.*

17SPC502	EMBEDDED COMPUTING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the basic hardware and software components and their selection for embedded computing systems.
- Understand the hardware software co-design and firmware design approaches.
- Be familiar with programming concepts and embedded programming in c, c++
- Gain knowledge of programming and RTOS and apply for different applications.
- Learn various system design techniques and design methodologies.

UNIT I INTRODUCTION TO EMBEDDED PROCESSORS 9

Introduction to Embedded Computing, Issues andChallenges in Embedded system Design, Trends: SC, custom designed chips, configurablesigned chips, configurable processors and multi-core processors.Embedded processor architecture: General concepts, instruction sets, Levels inarchitecture, Functional description-hardware/software trade-off, Introduction to RISCarchitecture, Pipelining, Instruction issue and execution, Instruction formats, Addressingmodes, Data alignment and byte ordering, Introduction to VLIW and DSP processors.

UNIT II DEVICES AND BUSES FOR DEVICES NETWORK 9

I/O Devices:- Types and Examples of I/Odevices, Synchronous, Iso-synchronous and Asynchronous Communications from SerialDevices - Examples of Internal Serial-Communication Devices:- SPI, UART, Parallel PortDevices - Timer and Counting Devices – Serial Communication using: ‘I2C’, ‘USB’,‘CAN’- Advanced I/O Serial high speed buses: ISA, PCI, PCI-X, cPCI and advancedbuses.

UNIT III PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++ 9

Programming inassembly language (ALP) vs High Level Language - C Program Elements:- Macros andfunctions, Use of Date Types, Structure, Pointers, Function Calls - Concepts of EmbeddedProgramming in C++:- Objected Oriented Programming, Embedded Programming in C++,‘C’ Program compilers – Cross compiler – Optimization of memory needs.

UNIT IV REAL TIME OPERATING SYSTEMS 9

Definitions of process, tasks and threads – Inter ProcessCommunication:- Shared data problem, Use of Semaphore(s), Priority Inversion Problemand Deadlock Situations, Message Queues, Mailboxes, Pipes, Virtual (Logical) Sockets,Remote Procedure Calls (RPCs) - Operating System Services:- Goals, Structures, Kernel,Process Management, Memory Management, Device Management - Real Time OperatingSystem - RTOS Task scheduling models:- Co-operative Round Robin Scheduling, CyclicScheduling with Time Slicing.

UNIT V SYSTEM DESIGN TECHNIQUES 9

Design Methodologies, Requirement Analysis, Specification,System Analysis and Architecture Design. Design Examples:- Telephone PBX- SystemArchitecture, Ink jet printer - Hardware Design and Software Design, Personal DigitalAssistants, Set-top Boxes.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Explain the basic of embedded processors.
2.	Discuss the different input-output devices.
3.	Write the embedded programming in C & C++.
4.	Be exposed to real time operating systems.
5.	Design real time systems.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw-Hill, First reprint Oct. 2003.
2.	Wayne Wolf, "Computers as Components: Principles of Embedded Computing SystemDesign", Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001.
3.	Steve Heath, "Embedded Systems Design", Second Edition, 2003, Newnes,

REFERENCES:

1.	*David E.Simon, "An Embedded Software Primer", Pearson Education Asia, First IndianReprint 2000.*
2.	*Frank Vahid and Tony Givargis, "Embedded Systems Design – A unified Hardware/Software Introduction", John Wiley, 2002.*
3.	*Michael Barr, "Programming Embedded Systems in C and C++", O"Reilly.*
4.	*John Catsoulis, "Designing Embedded Hardware", O"Reilly.*

17SPC503	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand basics of Computer Networks and get familiar with ISO/OSI Model.
- Introduce the concepts and various modes of transmission in physical layers.
- Understand in detail the protocols in Data Link layer
- Understand in detail the protocols in Network layer
- Be familiar with various protocols in transport layer and application layer

UNIT I	INTRODUCTION	9

Evolution of Computer Networking – Layered Architecture – ISO/OSI Model – Internet Architecture (TCP/IP).

UNIT II	PHYSICAL LAYER	9

Transmission – Impairments – Bandwidth Limitations – Modulation – Frequency Spectrum – Multiplexing – Encoding Techniques – Transmission Media - Copper – Fiber – Optical – Radio (wireless) – Cable Pinouts – Crossover – Straight Through – Rollover.

UNIT III	DATA LINK LAYER	9

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

UNIT IV	NETWORK LAYER	9

Internet Protocol – IPV4 Packet Format – IP Addressing – Subnetting – Variable Length Subnet Mask(VLSM) – 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) – Router Internals – IPV6 – Quality of Service (QoS).

UNIT V	TRANSPORT LAYER AND APPLICATION LAYER	9

Transport Layer: End to End Protocols – Connectionless Transport – User Datagram Protocol (UDP) – Reliable Data Transfer – Connection Oriented Transport - Transmission Control Protocol (TCP) - Flow Control – Congestion Control – Transport Layer Alternatives (RPC) – Transport for Real Time Application.

Application Layer: Protocols – HTTP – FTP – Telnet – Email – DNS – Application Performance – Performance Metrics.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Trace the flow of information from one node to another node in the network.
2.	Develop own protocol.
3.	Choose functionalities at each layer for different applications.
4.	Evaluate the protocols in network layer from QoS perspective.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	M	H	M	M			M						H		M
CO2	M	H	M	M			L						H		M
CO3	M	H	M	M			L						H		M
CO4	M		H				L						H		M

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

TEXT BOOKS:

1. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Sixth Edition, Pearson Education, 2012.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
3. Nader F. Mir, "Computer and Communication Networks", Second Edition, Prentice Hall, 2014.

REFERENCES:

1. *William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013.*
2. *Douglas E. Comer,"Internetworking with TCP/IP (Volume I) Principles, Protocols and Architecture", Sixth Edition, Pearson Education, 2013.*
3. *Ying-Dar Lin, Ren-Hung Hwang and Fred Baker,"Computer Networks: An Open Source Approach:, McGraw Hill Publisher, 2011.*
4. *Behrouz A. Forouzan and Firouz Mosharraf, "Computer Networks a Top Down Approach", Tata McGraw-Hill, 2011.*
5. *Rich Seifert, James Edwards, "The All New Switch Book: The Complete Guide to LAN Switching Technology", Wiley Publishing Inc, 2008.*

17SPC504	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be familiar with Regular languages and Finite Automata
- Be known to Context Free Languages and Push Down Automata
- Be exposed with Turing Machines
- Be familiar with Recursively and Recursively Enumerable Languages
- To Learn with Undecidable problems.

UNIT I REGULAR LANGUAGES 11

Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon Transitions - Regular Expression – FA and Regular Expressions – Pumping Lemma for Regular Languages – Properties - Equivalence and Minimization of Automata.

UNIT II CONTEXT FREE LANGUAGES 11

Context-Free Grammar (CFG) – Derivation Trees – Ambiguity in Grammars and Languages – Equivalence of Parse Trees and Derivation – Simplification of Context-free Grammar – Chomsky Normal Form – Greibach Normal Form - Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG– Pumping Lemma for CFL – Closure Properties - Deterministic Pushdown Automata.

UNIT III TURING MACHINES 8

Turing Machines – Language of a Turing Machine – Turing Machine as a Computing Device - Techniques for TM – Modifications of Turing Machines – Two-way Infinite Tape, Equivalence of One Way Infinite Tape and Two-way Infinite Tape Turing Machines – Multi Tape Turing Machines, Non-deterministic Turing machine.

UNIT IV CHOMSKY HIERARCHY 7

Regular Grammars – Equivalence of Regular Grammar and Finite Automata - Unrestricted Grammars – Equivalence of Type 0 Grammar and Turing Machines – Context Sensitive Languages – Linear Bounded Automata – Equivalence of LBA‘s and CSG‘s.

UNIT V UNDECIDABILITY 8

A Language that is not Recursively Enumerable (RE) – An Undecidable Problem that is RE – Undecidable Problems about Turing Machine – Rice Theorem for Recursive and Recursively Enumerable Languages – Post‘s Correspondence Problem (PCP) – Modified Post Correspondence Problem.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Construct automata, regular expression for any pattern.
2. Write context free grammar for any construct.
3. Design turing machines for any language.
4. Propose computation solutions using turing machines.
5. Derive whether a problem is decidable or not.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	H				L						H		M
CO2	M	H	H		L		L						H		M

CO3	M	H	H		L		L						H		M
CO4	M	H	H		L		L						H		L
CO5	M	H	H		L		L						H		M
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:

1. John E Hopcroft and Jeffery D Ullman, "Introduction to Automata Theory, Languages and Computations", Narosa Publishing House, 2002.

REFERENCES:

1. *H.R. Lewis and C.H. Papadimitriou, "Elements of the Theory of Computation", Second Edition, Pearson Education, 2003.*
2. *J. Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill, 2003.*
3. *Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.*

17SPC505	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I INTRODUCTION **9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS **9**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.

UNIT III KNOWLEDGE REPRESENTATION **9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT IV MACHINE LEARNING **9**

Machine Learning - basic concepts, linear models, K nearest neighbors, training and testing, over fitting and under fitting, perceptrons, neural networks, logistic regression, unsupervised learning and reinforcement learning. Introduction to Deep Learning – deep generative models, deep neural networks.

UNIT V APPLICATIONS **9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robotics -Path Planning – Handwritten digit classification using deep learning.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Use appropriate search algorithms for any AI problem.
2. Represent a problem using first order and predicate logic.
3. Provide the apt agent strategy to solve a given problem.
4. Understand the fundamental issues and challenges of machine learning.
5. Design applications for NLP that uses Artificial Intelligence.

COURSE ARTICULATION MATRIX:

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

(L- Low, M- Moderate, H-High)	
TEXT BOOKS:	
1.	S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
2.	I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3.	Kevin P. Murphy, "Machine learning A Probabilistic Perspective", MIT Press, 2012.
REFERENCES:	
1.	*M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008.*
2.	*Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.*
3.	*William F. Clocksin and Christopher S. Mellish,"Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.*
4.	*David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.*
5.	*www.edx.org– Artificial Intelligence Course by Columbia University.*

17SPC507	COMPUTER NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	To learn socket programming.
•	To learn and use network commands.
•	To gain knowledge about the working of routing algorithms.
•	To use simulation tools to analyze the performance of protocols in different layers in computer networks.
•	To use simulation for implementation of error correction code

LIST OF EXPERIMENTS:

1. Chat program using TCP Sockets.
2. Simulation of HTTP protocol using TCP Sockets.
3. Simulation of DNS using UDP Sockets.
4. Simulation of Ping using Raw Sockets.
5. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute.Capture ping and traceroute PDUs using a network protocol analyzer and examine.
6. Exercise on ARP using live network.
7. Device IP address plan for a mid-size Org network using ideas of subnetting and VLSM.
8. Implement the plan on a simulated network and assign addresses using a DHCP server.
9. Study and configure functionalities of a router and switches (or by simulation).
10. Experiment to understand the concept of network address translation.
11. Simulation of Distance Vector/ Link State Routing algorithm.
12. Study of TCP/IP performance using simulation tool.
13. Performance evaluation of routing protocols using simulation tool.
14. Simulation of error correction code(CRC).

PLATFORM NEEDED

- Java / Equivalent Compiler
- Network simulator like NS2/Glomosim/OPNET/Equivalent

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Implement protocols using TCP and UDP Sockets.
2.	Compare the performance of different routing algorithms using simulation tools.
3.	Configure functionalities of router and switches.
4.	Compare the performance of different transport layer protocols.

COURSE ARTICULATION MATRIX:

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

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

17SPC508	EMBEDDED COMPUTING SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	Be familiar with Implementation of Assembly programs on ARM based Processor
•	Be able to understand theconcept of Interfacing with other devices.
•	Be familiar with Usage of Timer and Interrupt handler
•	Be familiar with Implemention of zigbee protocol

LIST OF EXPERIMENTS:

1. Study of ARM evaluation system.
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing Keyboard and LCD.
6. Interfacing EPROM and Interrupt.
7. Mail Box.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing Zigbee Protocol with ARM.
12. Reading of analog sensor data and digital sensor data over UART using 12C,SPI protocols.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Write programs in ARM for a specific write Application.
2.	Interface memory and programs related to memory operations.
3.	Interface A/D and D/A convertors with ARM system.
4.	Analyse the performance of interrupt.

COURSE ARTICULATION MATRIX:

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

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

SEMESTER VI

17SHS601	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- To emphasize into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES **10**

Morals, Values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect forothers – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga andmeditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models ofprofessional roles - Theories about right action – Self-interest – Customs and Religion – Uses ofEthical Theories.

UNIT III ENGINEERINGAS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics –A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – OccupationalCrime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES **8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Apply ethics in society and discussthe ethical issues related to engineering.
2. Realize the responsibilities and rights in thesociety.
3. Analyse the responsibilities to the society as an engineer.
4. Gain the knowledge of safety, risk analysis and all kinds of human rights.
5. Study the multinational corporations and ethics of an engineer.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								H		M	L	M	M		M
CO2								H		M	L	M	M		M
CO3								H		M	L	M	M		M

CO4								H		M	L	M	M		M
CO5								H		M	L		M		M
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:

1.	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2.	Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India,New Delhi, 2004.
3.	R. Subramanian, "Professional Ethics", OUP India, 2013.

REFERENCES:

1.	*Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.*
2.	*Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Conceptsand Cases", Cengage Learning, 2009.*
3.	*John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.*
4.	*Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.*
5.	*Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility", McGraw Hill education, India Pvt. Ltd.,New Delhi 2013.*

17SBS602	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	C
		3	2	0	4

OBJECTIVES:

- Be familiar with resource management techniques
- Learn to solve problems in linear programming and Integer programming
- Be exposed to CPM and PERT

UNIT I LINEAR PROGRAMMING 9+6

Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis.

UNIT II DUALITY AND NETWORKS 9+6

Definition of dual problem – Primal – Dual relationships – Dual simplex methods – Post optimality analysis – Transportation and assignment model - Shortest route problem.

UNIT III INTEGER PROGRAMMING 9+6

Cutting plane algorithm – Branch and bound methods, Multistage (Dynamic) programming.

UNIT IV CLASSICAL OPTIMIZATION THEORY 9+6

Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

UNIT V OBJECT SCHEDULING 9+6

Network diagram representation – Critical path method – Time charts and resource leveling – PERT.

TOTAL (L : 45 + T : 30): 75 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Solve optimization problems using simplex method.
2. Apply integer programming and linear programming to solve real-life applications.
3. Use PERT and CPM for problems in project management.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M		M		L						M	H	
CO2	H	M	M		M		L						M	H	
CO3	H	M	M		M		L						M	H	

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

TEXT BOOKS:

1. H.A. Taha, "Operations Research", 10th Edition, Pearson Education, India, 2017.

REFERENCES:

1. *Paneer Selvam, "Operations Research", 2nd Edition,Prentice Hall of India, 2004.*
2. *Anderson D.A, et.al, "Quantitative Methods for Business", 13th Edition, Cengage Learning, 2015.*
3. *Wayne Winston, "Operation Research",4th Edition, Thomson Learning, 2003.*
4. *Vohra, "Quantitative Techniques in Management", 5th Edition, Tata Mc-Graw Hill Education, New Delhi, 2017.*
5. *Anand Sarma, "Operation Research", Himalaya Publishing House, 2010.*

17SPC603	MOBILE COMMUNICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Learn basics of Mobile communication.
- Be familiar with various wireless LAN and wireless systems.
- Be familiar with basic operations of mobile network layer.
- To study the details of lower layers of mobile architectures.
- To learn to develop applications for various mobile OS.

UNIT I INTRODUCTION **9**

Introduction – Applications – Signals – Signal Propagation – Multiplexing – Modulation – Spread spectrum – MAC – SDMA – TDMA – FDMA – CDMA.

UNIT II WIRELESS LAN **9**

IEEE 802.11 - System Architecture and Protocol Architecture of IEEE 802.11 – Physical and MAC layer – MAC management – 802.11b – 802.11a – HIPERLAN – Bluetooth.

UNIT III WIRELESS SYSTEMS **9**

GSM – DECT – UMTS - Mobile AD HOC Networks - AD HOC Routing Protocols – DSDV - DSR and AODV Routing Techniques - Quality of service in Mobile Ad hoc Networks.

UNIT IV MOBILE NETWORK LAYER **11**

Mobile Internet Protocol - IP Packet Delivery - Tunneling and Encapsulation - Reverse Tunneling – DHCP - IPv6 - Security Concerns – Mobile IPv6 – Overview – Basic Operation – Header Extension – Alignment Requirements – Home Address Option – Type 2 Routing Header – Mobility Header – Mobility Options – Neighbor Discovery Messages – Procedure of Mobile IPv6 – Route Optimization – Movement Detection – Dynamic Home Agent Address Discovery – Mobile Prefix Solicitation / Advertisement – Relationship with IPsec.

UNIT V TRANSPORT LAYER AND ITS APPLICATIONS **7**

Traditional TCP – TCP Improvements for Mobile Devices – TCP over 2.5/3G Wireless Networks – Wireless Application Protocol (WAP) – Mobile Applications.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Explain the features of smart mobiles and other smart devices.
2. Develop applications for Android and iOS.
3. Explain protocols related to routing in mobile networks.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H	M		M		M						M		H
CO2	L	H	M		M		M						M		H
CO3	L	H	M		M		M						M		H

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

TEXT BOOKS:

4. Asoke K. Talukder and Roopa R Yavagal, "Mobile Computing, Technology, Application and Service Creation", Second Edition, Tata McGraw Hill, 2010.

5.	Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2003.

REFERENCES:

1.	*Jon W.Mark and Weihua Zhuang, “Wireless Communication and Networking”, Prentice Hall, 2002.*
2.	*C D M Cordeiro and D. P. Agarwal, “Adhoc and Sensor Networks: Theory and Applications”, World Scientific, 2006.*
3.	*Pei Zhang, Feng Zhao, David Tipper, Jinmei Tatuya, Keiichi Shima, Yi Qian, larry L. Peterson, Lionel M. Ni, Manjunath D, Qing Li, Joy Kuri, Anurag Kumar, Prashant Krishnamurthy, Leonidas Guibas, Vijay K. Garg, Adrian Farrel, Bruce S. Davie, “Wireless Networking Complete”, Elsevier, 2010.*

17SPC604	COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	To learn the various parsing techniques and different levels of translation
•	To learn how to obtain specific object code from source language
•	To learn how to optimize the code and schedule for optimal performance
•	To Learn how to schedule code and to be familiar with the concept of parellelism

UNIT I	FRONT END OF COMPILERS	10

The Structure of Compiler – **Lexical Analysis:** Role of Lexical Analyzer - Specification and Recognition of Tokens - **Syntax Analysis:** Top Down Parsing - Bottom up Parsing - LR Parsers: SLR – CLR – LALR.

UNIT II	INTERMEDIATE CODE GENERATION	9

Syntax Directed Definitions - Evaluation Orders for Syntax Directed Definitions – Syntax Directed Translation Schemes - **Intermediate Languages:** Syntax Tree - Three Address Code - Postfix Code-Declarations - Translation of Expressions - Type Checking - Back Patching.

UNIT III	RUN TIME AND OBJECT CODE GENERATION	9

Storage Organization – Stack Allocation Space - Access to Non local Data on the Stack - Heap Management - Issues in Code Generation - Design of Code Generator - Register Allocation and Assignment – Instruction Selection by Tree Rewriting – Optimal Code Generation for Expressions – Dynamic Programming Code Generation.

UNIT IV	CODE OPTIMIZATION	9

Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Principal Sources of Optimizations – Data Flow Analysis – Constant Propagation – Partial Redundancy Elimination – Peephole Optimizations.

UNIT V	SCHEDULING AND OPTIMIZING FOR PARALLELISM	8

Code Scheduling Constraints – Basic Block Scheduling – Global Code Scheduling - Basic Concepts in Parallelization – Parallelizing Matrix Multiplication – Iteration Spaces – Affine Array Indexes.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Design compiler phases from language specification.
2.	Design code generators for the specified machine.
3.	Apply the various optimization techniques.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	H	M	M		L						H		M
CO2		M	H	M	M		L						H		M
CO3		M	H	M	M		L						H		M

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

TEXT BOOKS:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles,

	Techniques and Tools", Second Edition, Pearson Education, 2009.
REFERENCES:	
1.	*Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.*
2.	*Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.*
3.	*Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.*
4.	*V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.*
5.	*Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993.*

17SPC605	PARALLEL AND DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	To understand the need and fundamentals of parallel computing paradigms
•	To learn the nuances of parallel algorithm design
•	To understand the programming principles in parallel computing architectures
•	To be familiar with the concept of distributed computing architectures
•	To learn few problems that are solved using parallel algorithms

UNIT I	INTRODUCTION TO PARALLEL COMPUTING	9

Scope of Parallel Computing – Parallel Programming Platforms – Implicit Parallelism – Limitations of Memory System Performance – Control Structure of Parallel Platforms – Communication Model of Parallel Platforms – Physical Organization of Parallel Platforms – Communication Costs in Parallel Machines – Impact of Process - Processor Mapping and Mapping Techniques.

UNIT II	PARALLEL ALGORITHM DESIGN	9

Preliminaries – Decomposition Techniques – Characteristics of Tasks and Interactions – Mapping Techniques for Load Balancing – Methods for Containing Interaction Overheads – Parallel Algorithm Models – Basic Communication Operations – One-to-All Broadcast and All-to-One Reduction – All-to-All Broadcast and Reduction – All-Reduce and Prefix Sum Operations – Scatter and Gather – All-to-All Personalized Communication- Circular Shift – Improving the Speed of some Communication Operations.

UNIT III	PROGRAMMING USING MESSAGE PASSING AND SHARED ADDRESS SPACE	9

Principles of Message Passing Programming – Building Blocks – Send and Receive Operations – MPI – Message Passing Interface – Topologies and Embedding – Overlapping Communication with Computation – Collective Communication and Computation Operations – Groups and Communicators – POSIX thread API – OpenMP: a Standard for Directive based Parallel Programming – Applications of Parallel Programming - Matrix-Matrix Multiplication – Solving Systems of Equations – Sorting Networks - Bubble Sort Variations – Parallel Depth First Search.

UNIT IV	DISTRIBUTED COMPUTING PARADIGM	9

Paradigms for Distributed applications – Basic algorithms in Message passing Systems – Leader Election in Rings – Mutual Exclusion in Shared Memory.

UNIT V	FAULT TOLERANT DESIGN	9

Synchronous Systems with Crash Failures – Byzantine Failures – Impossibility in Asynchronous Systems - Formal Model for Simulation – Broadcast and Multicast – Specification of a Broadcast Service – Implementing a Broadcast Service – Multicast in Groups – Distributed Shared Memory – Linearizable – Sequentially Consistent Shared Memory – Algorithms.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Apply parallel and distributed computing architectures for any given problem.
2.	Apply problem solving (analysis, design, and development) skills to distributed

	applications.
3.	Develop applications by incorporating parallel and distributed computing architectures.
4.	Develop applications by incorporating fault tolerance.
5.	Convert a sequential algorithm to a parallel one.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, "Introduction to Parallel Computing", Second Edition, Pearson Education, 2009.
2.	Haggit Attiya and Jennifer Welch, "Distributed Computing – Fundamentals, Simulations and Advanced Topics", Second Edition, Wiley, 2012.
3.	Norman Matloff, "Parallel Computing for Data Science With Examples in R, C++ and CUDA", Chapman and Hall/CRC, 2015.

REFERENCES:

1.	*Michael Quinn, "Parallel Computing - Theory and Practice", Second Edition, Tata McGraw Hill, 2002.*
2.	*Wan Fokkink, "Distributed Algorithms: An Intuitive Approach", MIT Press, 2013.*
3.	*M.L. Liu, "Distributed Computing - Principles and Applications", First Edition, Pearson Education, 2011.*

17SPC607	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
•	Understand how to work with various mobile application development frameworks.
•	Learn the basic and important design concepts and issues of development of mobile applications.
•	Understand the capabilities and limitations of mobile devices

LIST OF EXPERIMENTS:

1. Install the Android SDK and developer tools and build a test project to confirm that those tools are properly installed and configured.
2. Write a program using a Table Layout for our department data entry form, add a set of radio buttons to represent the type of departments.
3. Write a program using activity class to show different events.
4. Write a program to send user from one application to another (eg. Redirection to map).
5. Write a program to play audio files.
6. Write a program to play video files.
7. Write a program to capture image using built in camera.
8. Write a program to send SMS.
9. Write a program to convert text to speech.
10. Write a program to call a number.

PLATFORM NEEDED

- Standalone desktops with Windows or Android oriOS or Equivalent Mobile Application Development tools with appropriate emulators and debuggers.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Gain hands on experience in Android SDK.
2.	Designand developing applications in Android based devices.
3.	Design and developing deployable Android applications.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H	M		M		L						M	L	H
CO2	M	H	M		M		L						M	L	H
CO3	M	H	M		M		L						M	L	H

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

17SPC608	COMPILER LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	Be exposed to compiler writing tools.
•	Learn to implement the different Phases of compiler
•	Be familiar with control flow and data flow analysis
•	Learn simple optimization techniques
•	Learn to implement translator with input and object language.

LIST OF EXPERIMENTS:

1. Tokenizer with LEX for declarations in C language.
2. Tokenizer with LEX for assignment statement.
3. Parser with LEX and YACC to validate "for" statement.
4. Evaluation of arithmetic expression with LEX and YACC.
5. Symbol table creation from a list of declarations.
6. Syntax tree creation for control constructs.
7. Three address code generation for "assignment" statement with array references.
8. Three address code generation for "while" statement.
9. Construction of flow graph from list of three address statements.
10. Constant propagation in a flow graph.
11. Translation of three address code to assembly language with fixed number of registers.
12. Stack and heap management at run time.

PLATFORM NEEDED

- C/ C++ / Equivalent Compiler

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Implement the token recognizer from token specification.
2.	Implement the parser from the syntax specification.
3.	Implement the intermediate code generator for the specified intermediate language.
4.	Implement simple optimizations.
5.	Implement translator with specific input and object language.

COURSE ARTICULATION MATRIX:

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

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

17ZEE609	COMMUNICATION AND SOFT SKILLS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To develop their communicative competency in English with specific reference to their speaking and listening.
- To enhance their ability to communicate effectively in interviews.
- To strengthen their prospects of success in competitive examinations.
- To strengthen a good command over of the language proficiency.
- To comprehend a different types of accent and use them in their communication

UNIT I LISTENING AND SPEAKING SKILLS 12

Conversational skills (formal and informal)- group discussion – making effective presentations using computers, listening/ watching interviews, conversations, documentaries. Listening to lectures and discussions.

UNIT II READING AND WRITING SKILLS 12

Reading different genres of tests ranging from newspapers to creative writing.Writing job applications - cover letter- resume- e-mails- memos- reports. Writing abstracts- summaries and interpreting visual texts.

UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS 12

International English Language Testing System (IELTS)- Test of English as a Foreign Language (TOEFL)- Civil Service(Language related)- Verbal Ability - Articulation of Sounds- Intonation.

UNIT IV INTERVIEW SKILLS 12

Different types of Interview format- answering questions- offering information- mock interviews- Body Language.

UNIT V SOFT SKILLS 12

Motivation- emotional intelligence-Multiple intelligences- managing changes- time management-leadership straits- team work- career planning- creative and critical thinking.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Develop their communicative competency in English with specific reference to their speaking and listening.
2. Enhance their ability to communicate effectively in interviews.
3. Strengthen their prospects of success in competitive examinations.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							L		M	H	H		M	L	M
CO2							L		M	H	H		M	L	M
CO3							L		M	H	H		M	L	M

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

REFERENCES:	
1.	*Craven, Miles. "Listening Extra-A resource book of multi-level skills activities", Cambridge University Press, 2004.*
2.	*Seely, John. "The Oxford guide to writing & Speaking", New Delhi: Oxford University Press, 2004.*

SEMESTER VII

17SPC701	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the concept of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize themselves with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.
- To be able to set up a private cloud.

UNIT I INTRODUCTION **8**

Introduction - Historical Development - Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics – Cloud Deployment Models - Public, Private, Community, Hybrid Clouds - Cloud Delivery Models - IaaS, PaaS, SaaS – Open Source Private Cloud Software - Eucalyptus, Open Nebula, Open Stack.

UNIT II VIRTUALIZATION **9**

Data Center Technology - Virtualization - Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques – Virtualization and Cloud Computing – Pros and Cons of Virtualization - Implementation Levels of Virtualization - Tools and Mechanisms - Xen, VMWare, Microsoft Hyper-V.

UNIT III CLOUD COMPUTING MECHANISM **9**

Cloud Infrastructure Mechanism - Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism - Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism - Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

UNIT IV HADOOP AND MAP REDUCE **10**

Apache Hadoop – Hadoop Map Reduce – Hadoop Distributed File System- Hadoop I/O- Developing a Map Reduce Application - Map Reduce Types and Formats - Map Reduce Features– Hadoop Cluster Setup – Administering Hadoop.

UNIT V SECURITY IN THE CLOUD **9**

Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism– Encryption – Hashing - Digital Signature - Public Key Infrastructure - Identity and Access Management - Single Sign-on - Cloud Based Security Groups - Hardened Virtual Server Images.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2. Identify the architecture, infrastructure and delivery models of cloud computing.
3. Explain the core issues of cloud computing such as security, privacy and interoperability.
4. Choose the appropriate technologies, algorithms and approaches for the related issues.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	M	H	M		M		L						M		H
CO2	M	H	M		M		L						M		H
CO3	M	H	M		M		L						M		H
CO4	M	H	M		M		L						M		H

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

TEXT BOOKS:

1. Thomas Erl, Zaigham Mahood, Ricardo Puttini, "Cloud Computing, Concept, Technology and Architecture", Prentice Hall, 2013.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media, 4th Edition, 2015.

REFERENCES:

1. *Toby Velte, Anthony Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach", Tata McGraw-Hill Edition, 2010.*
2. *Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw-Hill, 2013.*
3. *Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", Universities Press, 2014.*
4. *James E Smith and Ravi Nair, "Virtual Machines", Elsevier, 2005.*
5. *John Rittinghouse and James Ransome,"Cloud Computing, Implementation, Management and Strategy", CRC Press, 2010.*

17SPC702	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand security design principles
- To learn secure programming techniques
- To understand the mathematics behind cryptography
- To know the standard algorithms used to provide confidentiality, integrity and authenticity
- To understand the security requirements in operating systems and databases
- To learn about the security applications in wireless environment.

UNIT I SECURITY DESIGN PRINCIPLES **9**

Security Goals – Secure System Design – Understanding Threats – Designing Security – Convenience and Security – Security in Software Requirements – Security by Obscurity – Secure Design Principles – Defense in Depth – Diversity in Defense – Securing the Weakest Link – Fail-Safe Stance.

UNIT II SECURE PROGRAMMING TECHNIQUES **9**

Worms and Other Malware – Buffer Overflows – Client State Manipulation – SQL Injection – Password Security – Cross Domain Security in Web Applications – Attack Patterns – Preventing XSRF – Preventing XSSI - Preventing XSS.

UNIT III SYMMETRIC CIPHERS AND INTRODUCTION TO NUMBER THEORY **9**

Overview - Classical Encryption Techniques – Block Ciphers and the Data Encryption Standard – Basic Concepts in Number Theory and Finite Fields – Advanced Encryption Standard – Block Cipher Operation - Fermat‘s and Euler‘s Theory – CRT – Discrete Logarithms.

UNIT IV PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS **9**

Public Key Cryptography and RSA – Diffie-Hellman Key Exchange – Elgamal Cryptographic System – Elliptic Curve Cryptography – Cryptographic Hash Functions – Message Authentication Code - Digital Signature – Certificates.

UNIT V SECURITY APPLICATIONS **9**

Security in Operating Systems - Security in the Design of OS – Rootkit- Open Web Application Security – Wireless Network Security – Introduction to Mobile Security – Introduction to standard cryptographic module validation program – FIPS certification.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Illustrate the approaches, trade-offs in security design principles.
2. Apply number theory in public key encryption techniques.
3. Design a secure operating system.
4. Discuss the various platform security models in a mobile environment.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L	H	M		M							H		M
CO2		L	H	M	L	M							H		M

CO3		L	H	M	L	M							H		M
CO4		L	H	M	L	M							H		M
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:

1.	Neil Daswani, Christoph Kern, and Anita Kesavan, "Foundations of Security: What Every Programmer Needs to Know", Frist Edition, Apress, 2007.
2.	William Stallings, "Cryptography and Network Security: Principles and Practices", Sixth Edition, Pearson Education, 2014.

REFERENCES:

1.	*Charles P. Pfleeger, Shari Lawrence Pfleeger and Jonathan Margulies, "Security in Computing", Fifth Edition, Pearson Education, 2015.*
2.	*Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2003.*
3.	*Bruce Schneier, "Applied Cryptography Protocols, Algorithms and Source Code in C", Second Edition, John Wiley and Sons Inc., 2006.*
4.	*Matt Bishop, "Computer Security: Art and Science", First Edition, Addison Wesley, 2002.*
5.	*https://www.owasp.org/index.php/Top_10_2013.*
6.	*N. Asokan, Lucas Davi, Alexandra Dmitrienko, Stephan Heuser, Kari Kostianen, Elena Reshetova, Ahmad-Reza Sadeghi, "Mobile Platform Security", First Edition, Morgan and Claypool Publishers Series, 2014.*

17SPC706	CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	To understand SQL injection and Buffer Overflow
•	To understand cross scripting
•	To learn to implement the algorithms DES, RSA,SHA-1
•	To understand the trusted OS models
•	To learn to use tools

LIST OF EXPERIMENTS:

1. Implement the SQL injection attack.
2. Implement the Buffer Overflow attack.
3. Implement Cross Site Scripting and Prevent XSS.
4. Understanding malwares working and detection.
5. Implement Hacking windows – Windows login password.
6. Implement Hacking windows – Acessing restricted drives.
7. Implement the symmetric cryptography algorithm simplified DES algorithm.
8. Implement the public key cryptographic RSA algorithm.
9. Implement the secure hash algorithm.
10. Implement set of rules combining the secrecy controls of the Bell-La Padula with integrity controls of the Biba model.
11. Installation of rootkits and study about the variety of options.
12. Demonstrate intrusion detection system using any tool.

PLATFORM NEEDED

- C / C++ / Java or equivalent compiler
- Snort, Net Stumbler or Equivalent

TOTAL : 60 PERIODS

OUTCOMES:

On completion of this course, students will be able to

1.	Write program to perform SQL injection attack and buffer overflow attack.
2.	Write programs on cryptographic and hashing algorithm.
3.	Design trusted operating system models.
4.	Discuss various functionality of rootkit.
5.	Demonstrate the working of intrusion detection system.

COURSE ARTICULATION MATRIX:

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

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

17SPC707	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

The student should be made to:

•	Be exposed to tool kits for cloud environment.
•	Learn to run virtual machines of different configuration.
•	Learn to use Hadoop

LIST OF EXPERIMENTS:

1. Find procedure to run the virtual machine of different confiruration. Check how many virtual machines can be utilized at particular time.
2. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine
3. Install a C compiler in the virtual machine and execute a sample program.
4. Show the virtual machine migration based on the certain condition from one node to the other.
5. Find procedure to install storage controller and interact with it.
6. Find procedure to set up the one node Hadoop cluster.
7. Mount the one node Hadoop cluster using FUSE.
8. Write a program to use the API's of Hadoop to interact with it.
9. Write a wordcount program to demonstrate the use of Map and Reduce tasks

PLATFORM NEEDED

- Eucalyptus or Open Nebula or equivalent

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Use the grid and cloud tool kits.
2.	Design and implement applications on the cloud.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	M		M		L						M		H
CO2	M	H	M		M		L						M		H

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

SEMESTER VIII

17SEE803	PROJECT WORK	L	T	P	C
		0	0	12	6

OBJECTIVES:

•	To identify the problem based on societal needs
•	To interview people on societal problems that require computerization
•	To suggest creative solutions to societal problems
•	To explore possible alternative solutions
•	To estimate risk and develop a prototype

The aim of this course is to encourage the students to identify projects that help in exploring variables that promote creativity and innovation. Each student is expected to choose a real life or socially relevant problem. At the end of the project, students should be familiar with the state of art in their respective fields. They would be able to apply the concepts learnt to relevant research problems or practical applications. This course is to motivate them to learn concepts, models, frameworks, and tools that engineering graduates‘need in a world where creativity and innovation is fast becoming a pre-condition for competitive advantage.

1. Internals
    a. First Review
        i. Block Diagram of the proposed solution for a societal / creative problem
        ii. New Contribution in terms of modifications to existing algorithm or suggestion of new ones
        iii. Detailed Design of each module
        iv. Evaluation Metrics
        v. Test Cases
    b. Second Review
        i. Implementation - Justifying pros and Cons
        ii. Coding - highlighting what has been reused and what is being written
    c. Third Review
        i. Test Runs
        ii. Performance Evaluation based on Metrics
        iii. Project Documentation
2. Externals

Presentation, Viva-Voce, Report submission.

TOTAL : 180 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Analyzing professional issues, including ethical, legal and security issues, related to computing projects.
2.	Synthesizing and applying prior knowledge to designing and implementing solutions to open-ended computational problems while considering multiple realistic constraints.
3.	Practice CASE tools for solving case studies.
4.	Analyze Database, Network and Application Design methods.
5.	Design and use performance metrics to evaluate a designed system.
6.	Perform SWOT Analysis.

COURSE ARTICULATION MATRIX:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L	M	H	M	H							M		H
CO2		L	M	H	M	H							M		H
CO3		L	M	H	M	H							M		H
CO4		L	M	H	M	H							M		H
CO5		L	M	H	M	H							M		H
CO6		L	M	H	M	H							M		H
(L- Low, M- Moderate, H-High)															

PROFESSIONAL ELECTIVES

17SPE001	FUNDAMENTALS OF IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduce basic concepts andmethodologies for digital image processing,
- Introduce spatial methods for image processing, image smoothing and edge detection techniques.
- Analyze images in the frequency domain using various transforms
- Categorize various compression techniques and evaluate compression standards
- Understand 3D image representation and processing techniques.

UNIT I INTRODUCTION **9**

The image model and acquisition - image shape – sampling - intensity images - color images - range images - image capture - scanners - Statistical and spatial operations - Gray level transformations - histogram equalization - multi image operations.

UNIT II SEGMENTATION AND EDGE DETECTION **9**

Spatially dependent transformations - templates and convolution - window operations - directional smoothing - other smoothing techniques -Segmentation and Edge detection - region operations - Basic edge detection - second order detection.

UNIT III MORPHOLOGICAL OPERATIONS **9**

Crack edge detection - edge following - gradient operators - compass & Laplace operators - Morphological and other area operations - basic morphological operations - opening and closing operations, area operations - morphological transformations.

UNIT IV COMPRESSION **9**

Image compression - Types and requirements - statistical compression - spatial compression - contour coding - quantizing compression.

UNIT V 3D VISION **9**

Representation and Description - Object Recognition - 3D vision and Geometry - Digital Watermarking - Texture Analysis.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Understand image representation and modeling.
2. Apply image transformation methods.
3. Implement image processing algorithms.
4. Design of face detection and recognition algorithms.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, PHI Learning 2009.

REFERENCES:	
1.	*Milan Soanka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision", Cengage Learning.*
2.	*R.C. Gonzalez, R.E. Woods, "Digital Image Processing", Pearson Education.*

17SPE002	ADVANCED DATASTRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand and evaluate the various implementations of dictionaries.
- Introduce skip lists and their probabilistic analysis.
- Evaluate the various hashing techniques.
- Analyse the various search data structures.
- Experiment string matching algorithms.
- Construct algorithms for simple geometrical problems.

UNIT I	DICTIONARIES	8

Definition - Dictionary Abstract Data Type - Implementation of Dictionaries.

UNIT II	SKIP LISTS AND HASHING	9

Skip Lists:Need for Randomizing Data Structures and Algorithms - Search and Update Operations on Skip Lists - Probabilistic Analysis of Skip Lists - Deterministic Skip Lists Hashing: Review of Hashing - Hash Function - Collision Resolution Techniques in Hashing - Separate Chaining - Open Addressing - Linear Probing - Quadratic Probing - Double Hashing - Rehashing - Extendible Hashing.

UNIT III	TREES	10

Trees: Binary Search Trees (BST) - AVL Trees - Red Black Trees: Height of a Red Black Tree - Red Black Trees Bottom-Up Insertion - Top-Down Red Black Trees - Top-Down Deletion in Red Black Trees - Analysis of Operations - 2-3 Trees:Advantage of 2-3 trees over Binary Search Trees - Search and Update Operations on 2-3 Trees - Analysis of Operations - B-Trees:Advantage of B- trees over BSTs - Height of B-Tree - Search and Update Operations on 2-3 Trees - Analysis of Operations - Splay Trees: Splaying - Search and Update Operations on Splay Trees - Amortized Analysis of Splaying.

UNIT IV	TEXT PROCESSING	9

Text Processing:Sting Operations - Brute-Force Pattern Matching - The Boyer-Moore Algorithm - The Knuth-Morris-Pratt Algorithm - Standard Tries - Compressed Tries - Suffix Tries - The Huffman Coding Algorithm - The Longest Common Subsequence Problem (LCS) - Applying Dynamic Programming to the LCS Problem.

UNIT V	COMPUTATIONAL GEOMETRY	9

Computational Geometry:One Dimensional Range Searching - Two Dimensional Ranges Searching - Constructing a Priority Search Tree - Searching a Priority Search Tree - Priority Range Trees –Quadtrees - k-D Trees.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Understand implementation of symbol table using hashing techniques.
2. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3. Develop algorithms for text processing applications.
4. Identity suitable data structures and develop algorithms for computational geometry problems.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	L		M	H	M		L						M		H
CO2	L		M	H	M		L						M		H
CO3	L		M	H	M		L						M		H
CO4	L		M	H	M		L						M		H

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

TEXT BOOKS:

1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition, Pearson, 2004.
2.	M T Goodrich, Roberto Tamassia, "Algorithm Design", John Wiley, 2002.
3.	Venkatesan R and Lovelyn Rose S, "Data Structures", Wiley India Pvt Ltd, New Delhi, 2015.

REFERENCES:

1.	*Salaria R S, "Data Structures and Algorithms using C", Fifth Edition, Khanna Book Publishing, New Delhi, 2012.*
2.	*Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2011.*
3.	*Jean Paul Tremblay and Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill Publishing Company, New Delhi, 2012.*
4.	*Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 2011.*

17SPE003	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand and articulate the importance of Project Management in any business project.
- Approach project planning in an organized step-by-step manner.
- Carry out an evaluation and selection of projects against strategic, technical and economic criteria.
- Appraise the importance of manageable project schedule.
- Visualize and assess the state of a project.
- Formulate ways to adminster a contract from its signing to completion
- Understand the characteristics of the various team structures that can be employed.

UNIT I	INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT	9

Project Definition –- Contract Management – Activities Covered by Software Project Management, Plan, Methods and Methodologies- Ways of Categorizing Software Projects Problem with Software Projects – Setting Objectives Stakeholders- Requirements Specification, Management Control – Overview of Project Planning – Stepwise Project Planning.

UNIT II	PROJECT EVALUATION	9

Programme Management - Managing the Allocation of Resources - Strategic Programme Management - Creating a Programme - Aids to Programme Management - Benefits Management-Evaluation of Individual Projects – Technical Assessment – Cost Benefit Analysis – Cost Benefit Evaluation Techniques – Risk Evaluation –Cash Flow Forecasting –Software Effort Estimation.

UNIT III	ACTIVITY PLANNING	9

Objectives of Activity Planning – Project Schedule – Project and Activities - Sequencing and Scheduling Activities – Network Planning Models – Formulating a Network Model – Adding the Time Dimension -Forward Pass – Backward Pass –Identifying Critical Path - Activity Float – Shortening Project Duration – Identifying Critical Activities - Activity on Arrow Networks – Risk Management – Categories -Risk - Framework – Identification – Assessment – Planning – Management – Evaluating Risk to the Schedule – PERT Technique – Monte Carlo Simulation – Resource Allocation – Nature of Resources – Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths – Counting the Cost - Publishing the Resource Schedule.

UNIT IV	MONITORING AND CONTROL	9

Framework – Collecting the Data –Visualizing Progress – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Getting Project Back to Target – Change Control – Managing Contracts – Introduction – The ISO/IEC 12207 Approach –Supply process –Types of Contract – Stages in Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance.

UNIT V	MANAGING PEOPLE AND ORGANIZING TEAMS	9

Introduction – Understanding Behavior – Organizational Behavior - Selecting the Right Person for the Job – Instruction in the Best Methods – Motivation – The Oldham – Hackman Job

Characteristics Model – Working in Groups – Becoming a Team –Decision Making – Leadership – Organizational Structures – Stress – Health and Safety.	
	TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Comprehend the roles of the project manager.
2.	Identify the threats and opportunities in project management.
3.	Gain knowledge about size, effort and cost estimation techniques.
4.	Apply the techniques available to keep the project‘s aims and objectives, under control.
5.	Analyze the different approaches of non-technical problems.
6.	Appreciate the management issues like team structure, group dynamics.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Bob Hughes, Mike Cotterell, “Software Project Management”, Fourth Edition, Tata McGraw Hill, 2006.

REFERENCES:

1.	*Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.*
2.	*Royce, “Software Project Management”, Pearson Education, 1999.*
3.	*Jalote, “Software Project Management in Practice”, Pearson Education, 2002.*
4.	*Robert T. Futrell, Donald F. Shefer and Linda I. Shefer, “Quality Software Project Management”, Pearson Education, 2003.*

17SPE004	ESSENTIALS OF INFORMATION TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	Develop algorithms for user problem statements.
•	Introduce object oriented modeling using UML.
•	Understand fundamentals of object-oriented programming in Java.
•	Design ER-models to represent simple database application.
•	Ability to write SQL queries.
•	Design webpages using HTML, CSS and Javascript.
•	Illustrate how to test java code and web application.

UNIT I	FOCUS AREA 1: OBJECT ORIENTED PROGRAMMING USING JAVA	9

Problem Solving Techniques: Introduction to problem solving - Computational problem and it's classification - Logic and its types - Introduction to algorithms - Implementation of algorithms using flowchart - Searching and sorting algorithms - Introduction and classification to Data Structures - Basic Data Structures - Advanced Data Structures.

Tools: Understanding basic programming constructs using Scratch Tool - Flowcharts implementation through RAPTOR tool.

UNIT II		8

Programming Basics: Identifiers – variables - data types – operators - control structures - type conversion - casting - arrays - strings - Introduction to UML: Use case diagrams – Class diagrams.

Object Oriented Concepts fundamentals: class & object – instance variables & methods – access specifiers – reference variables – parameter passing techniques – constructors – this reference – static – command line arguments-Tools-Eclipse IDE for Java programming.

UNIT III		10

Relationships -Inheritance – types of inheritance – aggregation – association – Static Polymorphism - method overloading – constructor overloading – Dynamic polymorphism-method overriding – abstract – interface – introduction to packages - Industry Coding Standards and Best Practices – code tuning & optimization – clean code & refactoring.

UNIT IV	FOCUS AREA 2: RELATIONAL DATABASE MANAGEMENT SYSTEM	9

RDBMS: data processing – the database technology – data models- ER modeling concept – notations – converting ER diagram into relational schema - Logical database design - normalization (1NF, 2NF and 3NF).

SQL: DDL statements – DML statements – DCL statements - Joins - Sub queries – Views - Database design Issues – SQL fine tuning.

UNIT V	FOCUS AREA 3: WEB TECHNOLOGIES AND SOFTWARE ENGINEERING	9

Introduction to user interface and web technologies: web fundamentals – types web content – HTML – text formatting tags in HTML – HTML form elements - and tags - text formatting using CSS-embedded CSS, inline CSS and external CSS – JavaScript and its features

Software Engineering: Definition – role of software and software crisis – SDLC models-waterfall model, incremental model and spiral model – software testing – static & dynamic testing – types testing-unit testing, integration testing, system testing, performance testing and regression testing.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Do problem solving using algorithms.
2.	Design and test simple programs to implement object oriented concepts using Java.
3.	Document artifacts using common quality standards.
4.	Design simple data store using RDBMS concepts and implement.
5.	Know the basics of software engineering and web technology.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	M T Goodrich, Roberto Tamassia, "Algorithm Design", John Wiley, 2002.
2.	Alfred V.Aho, Ullman, Hopcroft, "Data Structures and Algorithms", Addison-wesely.
3.	Elmasri, Navathe, "Fundamentals of Database Systems", Third ed, Addison Wesley.
4.	Thomas Powell, "HTML & CSS: The Complete Reference", Fifth Edition (Complete Reference Series) Paperback.

REFERENCES:

1.	*Andrew S. Tanenbaum, "Structured Computer Organization" , PHI, 4th edition, 1999.*
2.	*John L. Hennessy, David Goldberg, David A. Patterson, "Computer Architecture: A Quantitative Approach", 2nd Edition Published by Morgan Kaufman Publishers, 1996.*
3.	*Silberschatz and Galvin, "Operating System Concepts", John Wiley & Sons,Sixth edition.*
4.	*Andrew Tanenbaum, "Modern Operating Systems", Pearson Education.*
5.	*Milan Milenkovic, "Operating Systems: concepts and design", McGraw-Hill.*
6.	*Charles Crowley, "Operating Systems: A Design-Oriented Approach".*
7.	*Dromey, R.G., "How to solve it by computers", Prentice Hall, 2005.*
8.	*Lipschutz, Seymour & G A V Pai, "Data Structures", Tata McGraw – Hill.*
9.	*Baldwin, Douglas & Scragg, Greg W., "Algorithms and Data Structures - The Science of Computing", Dreamtech.*
10.	*Kernighan, Ritchie, "ANSI C Language", Prentice Hall of India, New Delhi, 1992.*
11.	*Yashwant Kanitker, "Let Us C", Second Edition.*
12.	*Schaum series, "Programming in C", Third Edition.*
13.	*Jon Bentley, "Programming Pearls", Pearson Education publication.*
14.	*Aho, Alfred V, "Compiler Principles, Techniques and Tools",Pearson Education.*
15.	*Tharp Alan L, "File Organization and Processing", John Willey and Sons.*
16.	*Henry F Korth, Abraham Silberschatz, "Database system concepts", Second ed., McGraw-Hill International editions, Computer Science series, 1991.*
17.	*C.J.Date ,"An introduction to Database Systems", Sixth ed, Narosa Publications.*
18.	*Craig Grannel, "The Essential Guide to CSS and HTML Web Design".*

19.	*David Flanagan, "JavaScript: The Definitive Guide", 6th Edition.*
20.	*Thomas Powell, "JavaScript: The Complete Reference".*
21.	*Roger S Pressman," Software Engineering: A Beginner's Guide".*

NOTE: The Infosys Certification will be given for respective courses as per the evaluation procedures given in Annexure – I

17SPE005	DATA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	Interpret the contribution of data warehousing and data mining to the decision-support systems.
•	Differentiate between situations for applying different data-mining techniques: frequent pattern mining, association, correlation, classification, prediction, and cluster and outlier analysis.
•	Evaluate the performance of different data-mining algorithms.
•	Understand the algorithms for association rule mining.
•	Appraise the impact of big data for business decisions and strategy.
•	Introduce the challenges of text mining and web mining.

UNIT I	INTRODUCTION TO DATA MINING	9

Data Mining - KDD versus Data Mining, Stages of the Data Mining Process- Task Primitives - Data Mining Techniques - Data Mining Knowledge Representation – Data Mining Query Languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data Cleaning, Data Transformation, Feature Selection, Dimensionality Reduction, Discretization and Generating Concept Hierarchies - Mining Frequent Patterns Association- Correlation.

UNIT II	CLASSIFICATION AND PREDICTION	9

Classification and Prediction: Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

UNIT III	CLUSTERING	9

Clustering techniques – Partitioning Methods - k-means Hierarchical Methods – Distancebased Agglomerative and Divisible Clustering - Density Based Methods – Expectation Maximization - Grid Based Methods – Model Based Clustering Methods – Constraint Based Cluster Analysis – Outlier Analysis.

UNIT IV	ASSOCIATION RULE MINING	9

Association Rule Mining: Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint based Association Mining.

UNIT V	TRENDS IN DATA MINING AND BIG DATA MINING	9

Introduction to Big Data-Case Studies on Big Data Mining Tools - Apache Hadoop - Apache Mahout and R - Mining Complex Data Objects - Spatial Databases - Temporal Databases - Multimedia Databases - Time Series and Sequence Data - Text Mining – Web Mining- Applications and Trends in Data Mining.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Comprehend the various architectures and its application with data mining.
2.	Write programs for classification, clustering and association rule mining.

3.	Evaluate various mining techniques on complex data objects.
4.	Develop applications using Big Data Mining Tools.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, Third Edition, 2011.
2.	Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming", McGraw-Hill Osborne Media, First Edition, 2011.
3.	Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical Learning: with Applications in R", Springer, 2014.

REFERENCES:

1.	*Mehmed Kantardzic, "Datamining Concepts, Models, Methods, and Algorithms", Wiley Interscience, 2003.*
2.	*G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.*
3.	*K.P. Soman, ShyamDiwakar and V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.*
4.	*G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.*
5.	*Pang-Ning Tan, Michael Steinbach and Vipin Kumar," Introduction to Data Mining", Pearson Education, 2007.*

17SPE006	C # AND .NET FRAMEWORK	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Write and understand C# language constructs, syntax and semantics.
- Create, compile and run object-oriented C# programs.
- Develop reusable .NET components via interface realization and standard design patterns.
- Implementing data-query logic for databases.
- Acquire the knowledge and skills to design and develop dynamic web applications.
- Utilize the .NET framework to build distributed applications.

UNIT I **INTRODUCTION TO C#** **9**

Introducing C# - Understanding .NET - overview of C# - Literals, Variables, Data Types, Operators, checked and unchecked operators – Expressions – Branching – Looping – Methods - implicit and explicit casting – Constant – Arrays - Array Class - Array List – String - String Builder – Structure – Enumerations - boxing and unboxing.

UNIT II **OBJECT ORIENTED CONCEPTS IN C#** **9**

Class – Objects - Constructors and its types – inheritance – properties – indexers - index overloading – polymorphism - sealed class and methods – interface - abstract class - abstract and interface - operator overloading - delegates - events - errors and exception –Threading.

UNIT III **APPLICATION DEVELOPMENT ON .NET** **9**

Building windows application - Creating our own window forms with events and controls – menu creation - inheriting window forms - SDI and MDI application - Dialog Box(Modal and Modeless) - accessing data with ADO.NET – DataSet - typed dataset - Data Adapter - updating database using stored procedures - SQL Server with ADO.NET - handling exceptions - validating controls - windows application configuration.

UNIT IV **WEB BASED APPLICATION ON .NET** **9**

Programming web application with web forms - ASP.NET introduction - working with XML and .NET - Creating Virtual Directory and Web Application - session management techniques - web.config - web services - passing datasets - returning datasets from web services - handling transaction - handling exceptions - returning exceptions from SQL Server.

UNIT V **CLR AND .NET FRAMEWORK** **9**

Assemblies – Versoning – Attributes – reflection - viewing meta data - type discovery - reflection on type – marshalling - remoting- security in .NET.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. List the major elements of the .NET frame work.
2. Explain how C# fits into the .NET platform.
3. Analyze the basic structure of a C# application.
4. Debug, compile, and run a simple application.
5. Develop programs using C# on .NET.
6. Design and develop Web based applications on .NET.
7. Discuss CLR.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO	PSO

										0	1	2	1	2	3
CO1	L		H		M								H		
CO2	L	M	H		M								H		
CO3	L	M	H		M								H		
CO4	L	M	H		M								M	L	
CO5	L	M	M		M								M	L	
CO6	L	M	M		M								M	L	
CO7	L		M		M								M	L	
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:

1.	Herbert Schildt, "The Complete Reference: C# 4.0", Tata Mc Graw Hill, 2012.
2.	Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.

REFERENCES:

1.	*Andrew Troelsen, "Programming C# 2010 and the .NET 4 Platform", Fifth edition, A Press, 2010.*
2.	*Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010.*

17SPE007	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
•	Examine technology tools that can reduce paper waste and carbon footprint by user.
•	Understand how to minimize equipment disposal requirements.
•	Impart necessary skills in energy saving practices in their use of hardware
•	Demonstratethe application of the principles and practices of Green IT with case studies
•	Manage improved environmental sustainability.

UNIT I	FUNDAMENTALS	9

Green IT Fundamentals - Business, IT, and the Environment – Benefits of a Green Data Centre - Green Computing - Carbon Foot Print, Scoop on Power – Green IT Strategies - Drivers, Dimensions, and Goals – Environmentally Responsible Business - Policies - Practices and Metrics.

UNIT II	GREEN ASSETS AND MODELING	9

Green Assets - Buildings -Data Centers – Networks – Devices - Computer and Earth Friendly peripherals - Greening Mobile devices – Green Business Process Management - Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems - Design and Development Models.

UNIT III	GRID FRAMEWORK	9

Virtualizing of IT Systems – Role of Electric Utilities, Telecommuting, Teleconferencing and Teleporting – Materials Recycling – Best Ways for Green PC – Green Data Center – Green Grid Framework - Optimizing Computer Power Management, Seamless Sharing Across Systems-Collaborating and Cloud Computing, Virtual Presence.

UNIT IV	GREEN COMPLIANCE	9

Socio-Cultural Aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance -Protocols, Standards, And Audits – Emergent Carbon Issues - Technologies and Future. Best Ways to Make Computer Greener.

UNIT V	GREEN INITIATIVES WITH IT AND CASE STUDIES	9

Green Initiative Drivers and Benefits with IT - Resources and Offerings to Assist Green Initiatives - Green Initiative Strategy with IT - Green Initiative Planning with IT - Green Initiative Implementation with IT - Green Initiative Assessment with IT - The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Explain the necessity of Green IT.
2.	Outline methodologies for creating Green Assets and their management.
3.	Appreciate the use of Grid in Green IT.
4.	Develop case studies related to Environmentally Responsible Business Strategies.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. Bhuvan Unhelkar, "Green IT Strategies and Applications using Environmental Intelligence", CRC Press, June 2011.
2. Carl Speshocky, "Empowering Green Initiatives with IT", John Wiley and Sons, 2010.

REFERENCES:

1. *Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journey", Shoff IBM rebook, 2011.*
2. *John Lamb, "The Greening of IT", Pearson Education, 2009.*
3. *Jason Harris, "Green Computing and Green IT- Best Practices on Regulations and Industry", Lulu.com, 2008.*
4. *Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.*

17SPE008	AGILE SOFTWARE DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	Examine the principles and practices associated with each of the agile development methods: Lean, Scrum, eXtreme Programming, Feature-driven development
•	Provide knowledge on how to manage a project using Scrum framework
•	Apply agile practices such as test-driven development, standup meetings, and pair programming to their software engineering practices.
•	Ability to identify and address most common problems encountered in adopting Agile methods.
•	Compare agile software development to traditional software development models.

UNIT I	FUNDAMENTALS OF AGILE	9

The Genesis of Agile - Introduction and background - Agile Manifesto and Principles - Overview of Scrum - Extreme Programming - Feature Driven development - Lean Software Development - Agile project management - Design and development practices in Agile projects - Test Driven Development - Continuous Integration – Refactoring - Pair Programming - Simple Design - User Stories - Agile Testing - Agile Tools.

UNIT II	AGILE SCRUM FRAMEWORK	9

Introduction to Scrum - Project phases - Agile Estimation - Planning game - Product backlog - Sprint backlog - Iteration planning - User story definition - Characteristics and content of user stories - Acceptance tests and Verifying stories - Project velocity - Burn down chart - Sprint planning and retrospective - Daily scrum - Scrum roles – Product Owner - Scrum Master - Scrum Team - Scrum case study - Tools for Agile project management.

UNIT III	AGILE TESTING	9

The Agile lifecycle and its impact on testing - Test-Driven Development (TDD) - xUnit framework and tools for TDD - Testing user stories - acceptance tests and scenarios - Planning and managing testing cycle - Exploratory testing - Risk based testing - Regression tests - Test Automation - Tools to support the Agile tester.

UNIT IV	AGILE SOFTWARE DESIGN AND DEVELOPMENT	10

Agile design practices - Role of design Principles including Single Responsibility Principle - Open Closed Principle - Liskov Substitution Principle - Interface Segregation Principles - Dependency Inversion Principle in Agile Design - Need and significance of Refactoring - Refactoring Techniques - Continuous Integration - Automated build tools - Version control.

UNIT V	INDUSTRY TRENDS	8

Market scenario and adoption of Agile - Agile ALM - Roles in an Agile project - Agile applicability - Agile in Distributed teams - Business benefits - Challenges in Agile - Risks and Mitigation - Agile projects on Cloud - Balancing Agility with Discipline - Agile rapid development technologies.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Understand the background and driving forces for taking an Agile approach to software development.
2.	Understand the business value of adopting Agile approaches.

3.	Understand the Agile development practices.
4.	Drive development with unit tests using Test Driven Development.
5.	Apply design principles and refactoring to achieve Agility.
6.	Deploy automated build tools, version control and continuous integration.
7.	Perform testing activities within an Agile project.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	The courseware including PowerPoint slides is available for the course. Following websites provides articles/ freely downloadable eBook on Agile Software Development: www.it-ebooks.info/tag/agile , http://martinfowler.com/agile.html

REFERENCES:

1.	*Ken Schawber, Mike Beedle, "Agile Software Development with Scrum" , Pearson2008.(Unit I,II)*
2.	*Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 2002. (Unit III)*
3.	*Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and Agile Teams", Addison Wesley, 2008. (Unit IV)*
4.	*Alistair Cockburn, "Agile Software Development: The Cooperative Game", Addison Wesley, 2006.(Unit I)*
5.	*Mike Cohn ,"User Stories Applied: For Agile Software" , Addison Wesley, 2004. (Unit II)*

NOTE: The Infosys Certification will be given for respective courses as per the evaluation procedures given in Annexure - I

17SPE009	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Compare and contrast conventional networking approaches and SDN.
- Discuss the basic concepts and architecture of SDN.
- Analyse the implementation of SDN through Open Flow Switches.
- Evaluate the pros and cons of applying SDN in WAN and data centers.
- Program a sample SDN for a given task.
- Configure an example service using SDN and NFV.
- Introduce the different SDN frameworks in practice.

UNIT I INTRODUCTION **9**

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes.

UNIT II OPEN FLOW AND SDN CONTROLLERS **9**

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

UNIT III DATA CENTERS **9**

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE.

UNIT IV SDN PROGRAMMING **9**

Programming SDNs - Northbound Application Programming Interface - Current Languages and Tools - Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks – Concepts - Implementation and Applications.

UNIT V SDN **9**

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Critically analyze and appreciate the evolution of software defined networks.
2. Point out the various components of SDN and their uses.
3. Explain the use of SDN in the current networking scenario.
4. Design and develop various applications of SDN.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.

2.	Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", First Edition, Morgan Kaufmann, 2014.

REFERENCES:	
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.*

17SPE010	SOCIAL NETWORKS ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Apply knowledge for current web development in the era of Social Web
- Develop a model for integrating data for knowledge representation
- Apply the tools and an algorithm for mining in social networks
- Examine the human behavior and trust disputes of social networks
- Apply visualization technique in Social network

UNIT I	INTRODUCTION	9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis -Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II	MODELING AGGREGATING AND KNOWLEDGE REPRESENTATION	9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontologylanguages for the Semantic Web: Resource Description Framework - Web Ontology Language -Modelling and aggregating social network data: State-of-the-art in network data representation -Ontological representation of social individuals - Ontological representation of social relationships -Aggregating and reasoning with social network data - Advanced representations.

UNIT III	EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities insocial networks - Definition of community - Evaluating communities - Methods for communitydetection and mining - Applications of community mining algorithms - Tools for detecting communitiessocial network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

UNIT IV	PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES	9

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context – Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation – Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V	VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	9

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to

1.	Develop semantic web related applications.
2.	Represent knowledge using ontology.
3.	Predict human behaviour in social web and related communities.
4.	Visualize social networks.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2.	Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer,2010.
3.	Guandong Xu, Yanchun Zhang, Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.

REFERENCES:

1.	*Dion Goh, Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.*
2.	*Max Chevalier, Christine Julien, Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.*
3.	*John G. Breslin, "Alexander Passant and Stefan Decker, The Social Semantic Web", Springer,2009.*

17SPE011	PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Enable the students to understand the fundamentals of Pattern recognition.
- Understand the pattern classification algorithm for a pattern recognition problem, properly implement the algorithm.
- Enrich the student's knowledge with non linear and linear classification along with its applications.
- Undersatand the techniques of feature generation and template matching
- Be familiar with Support Vector Machines and Clustering Approaches

UNIT I INTRODUCTION TO CLASSIFICATION 9

Classifiers Based on Bayes Decision Theory: Introduction - Bayes Decision Theory - Discriminant Functions and Decision Surfaces - Bayesian Classification for Normal Distributions -Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation - Maximum a Posteriori Probability Estimation - Bayesian Inference - Maximum Entropy Estimation - Mixture Models - Nonparametric Estimation - The Naive-Bayes Classifier - The Nearest Neighbor Rule - Bayesian Networks.

UNIT II NON LINEAR CLASSIFICATION 9

Non Linear Classifiers: The XOR Problem - The Two-Layer Perceptron - Three Layer Perceptrons - Algorithms Based on Exact Classification of the Training Set - The Backpropagation Algorithm - Variations on the Backpropagation Theme - The Cost Function Choice - Choice of the Network Size - A Simulation Example - Networks with Weight Sharing - Generalized Linear Classifiers - Capacity of the *l*-Dimensional Space in Linear Dichotomies - Polynomial Classifiers -Radial Basis Function Networks - Universal Approximators.
Support Vector Machines: The nonlinear Case - Decision Trees - Combining Classifiers - The Boosting Aprroach to Combine Classifiers.

UNIT III LINEAR CLASSIFICATION 9

Linear Classifiers: Linear Discriminant Functions and Decision Hyperplanes - The Perceptron Algorithm - Least Squares Methods - Mean Square Estimation Revisited: Logistic Discrimination - Support Vector Machines
Feature Selection: Preprocessing - Feature Selection Based on Statistical Hypothesis Testing - The Receiver Operating Characterisitcs (ROC) Curve - Class Separability Measures - Feature Subset selection - Optimal Feature Generation - Neural Networks and Feature Generation / Selection - The Bayesian Information Criterion.

UNIT IV FEATURE GENERATION AND TEMPLATE MATCHING 9

Feature Generation: Linear Transforms -Regional Features - Features for Shape and Size Characterization - Typical Features for Speech and Audio Classification
Template Matching: Introduction - Similarity Measures Based on Optimal Path Searching Techniques - Measures Based on Correlations - Deformable Template Models.

UNIT V CLUSTERING ALGORITHM 9

Context Dependent Classification: Markov Chain Models - Hidden Markov Models
Clustering Algorithms: Clustering Algorithms Based on Graph Theory - Competitive Learning Algorithms- Supervised Learning Vector Quantization.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Determine classifiers for pattern recognition.
2.	Analyze feature selection and dimensionality reduction techniques.
3.	Apply MC and HMM models.
4.	Classify the data objects and develop template matching module to recognize the patterns.
5.	Apply unsupervised learning algorithms to data objects.
6.	Analyze clustering algorithms.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	S Theodoridis, K Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009.
2.	Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

REFERENCES:

1.	*C Bishop, "Pattern Recognition and Machine Learning", Springer 2006.*
2.	*Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.*

17SPE012	BUILDING ENTERPRISE APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Exposed to essentials of building enterprise applications.
- Exposed to analysis of enterprise application and business process modeling.
- Learn to design high quality enterprise applications.
- Learn to develop enterprise applications.
- Be familiar with the approaches of testing enterprise application

UNIT I INTRODUCTION TO ENTERPRISE APPLICATION **9**

Introduction to enterprise applications and their types - software engineering methodologies - life cycle of raising an enterprise application - introduction to skills required to build an enterprise application - key determinants of successful enterprise applications and measuring the success of enterprise applications.

UNIT II INCEPTING ENTERPRISE APPLICATION AND BUSINESS PROCESS MODELING **8**

Inception of enterprise applications - enterprise analysis - business modeling - requirements elicitation - use case modeling - prototyping - non-functional requirements - requirements validation - planning and estimation.

UNIT III ENTERPRISE ARCHITECTURE AND DESIGNING ENTERPRISE APPLICATION **10**

Concept of architecture - views and viewpoints - enterprise architecture - logical architecture - technical architecture – design - different technical layers - best practices - data architecture and design – relational - XML and other structured data representations - Infrastructure architecture and design elements – Networking - Internetworking and Communication Protocols - IT Hardware and Software – Middleware - Policies for Infrastructure Management - Deployment Strategy - Documentation of application architecture and design.

UNIT IV CONSTRUCTING ENTERPRISE APPLICATION **9**

Construction readiness of enterprise applications - defining a construction plan - defining a package structure - setting up a configuration management plan - setting up a development environment - introduction to the concept of Software Construction Maps - construction of technical solutions layers - methodologies of code review - static code analysis - build and testing - dynamic code analysis – code profiling and code coverage.

UNIT V TESTING AND ROLLING OUT ENTERPRISE APPLICATION **9**

Types and methods of testing an enterprise application - testing levels and approaches - testing environments - integration testing - performance testing -penetration testing - usability testing - globalization testing and interface testing - user acceptance testing - rolling out an enterprise application.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Familiarize with concept of Enterprise Analysis and Business Modeling.

3.	Understand requirements validation, planning and estimation.
4.	Design and document the application architecture.
5.	Understand the importance of application framework and designing other application components.
6.	Construct and develop different solution layers.
7.	Perform Code review, Code analysis, build process.
8.	Understand different testing involved with enterprise application and the process of rolling out an enterprise application.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Anubhav Pradhan, Satheesha B. Nanjappa, Senthil K. Nallasamy, Veerakumar Esakimuthu,"Raising Enterprise Applications", John Wiley.
2.	Brett McLaughlin, "Building Java Enterprise Applications", O'Reilly Media.

REFERENCES:

1.	*"Software Requirements: Styles & Techniques", Addison-Wesley Professional.*
2.	*"Software Systems Requirements Engineering: In Practice", McGraw-Hill/Osborne Media.*
3.	*"Managing Software Requirements: A Use Case Approach", 2/e , Pearson.*
4.	*"Software Architecture: A Case Based Approach", Pearson.*
5.	*"Designing Enterprise Applications with the J2EE Platform" (PDF available at-http://java.sun.com/blueprints/guidelines/designing_enterprise_applications_2e/.*
6.	*"Software Testing", 2/e, Pearson.*
7.	*"Software Testing Principles and Practices", Oxford University Press.*

NOTE: The Infosys Certification will be given for respective courses as per the evaluation procedures given in Annexure - I

17SPE013	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

•	To learn the concept of speech processing in NLP.
•	To understand the morphological fundamentals of various words and word forms in NLP
•	Be familiar with the theories of parsing in NLP.
•	To understand the role of semantics and pragmatics
•	Exposed to representations of semantics and applications of natural language processing.

UNIT I	SOUND	9

Biology of Speech Processing - Place and Manner of Articulation - Word Boundary Detection - Argmax based computations - HMM and Speech Recognition.

UNIT II	WORDS AND WORD FORMS	9

Morphology fundamentals - Morphological Diversity of Indian Languages - Morphology Paradigms - Finite State Machine Based Morphology - Automatic Morphology Learning - Shallow Parsing - Named Entities - Maximum Entropy Models - Random Fields.

UNIT III	STRUCTURES	9

Theories of Parsing, Parsing Algorithms - Robust and Scalable Parsing on Noisy Text as in Web documents - Hybrid of Rule Based and Probabilistic Parsing - Scope Ambiguity and Attachment Ambiguity resolution.

UNIT IV	MEANING	9

Lexical Knowledge Networks, Wordnet Theory - Indian Language Wordnets and Multilingual Dictionaries - Semantic Roles - Word Sense Disambiguation - WSD and Multilinguality – Metaphors – Coreferences.

UNIT V	WEB 2.0 APPLICATIONS	9

Sentiment Analysis - Text Entailment - Robust and Scalable Machine Translation - Question Answering in Multilingual Setting - Cross Lingual Information Retrieval (CLIR).

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Compare and contrast approaches to natural language processing.
2.	Comprehend and analyze the various elements of speech processing.
3.	Design and develop machine learning techniques in the area of NLP.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	H	M			L						M		H
CO2	L	M	H	M			L						M		H
CO3	L	M	H	M			L						M		H

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

TEXT BOOKS:

1.	Jurafsky, Dan, Martin, James, "Speech and Language Processing", 2nd Edition, Prentice Hall, 2008.
2.	Manning, Christopher, Heinrich, Schutze, "Foundations of Statistical Natural Language

	Processing", MIT Press, 1999.

REFERENCES:	
1.	*Allen James, "Natural Language Understanding", 2nd edition, Benjamin Cumming, 1995.*
2.	*Charniack, Eugene, "Statistical Language Learning", MIT Press, 1993.*

17SPE014	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the theoretical basis behind the standard models of IR
- Understand the difficulty of representing and retrieving documents, images, speech
- Understand the standard methods for Web indexing and searching
- Understand how techniques of web retrivel is established using search engine architecture in IR
- Be familiar with Parallel and Distributed IR along with its applications.

UNIT I INTRODUCTION **9**

Information Retrieval – Early Developments – The IR Problem – The User‘s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II MODELING AND RETRIEVAL EVALUATION **9**

IR models – Classic Information Retrieval – Alternative Set Theoretic Models – Alternative Algebraic Models – Alternative Probabilistic Models – Other Models – Hypertext Models – Web based Models – Retrieval Evaluation – Cranfield Paradigm – Retrieval Metrics – Reference Collections – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback – Clicks – Implicit Feedback Through Local Analysis – Global Analysis – Documents: Languages & Properties – Queries - Languages & Properties.

UNIT III TEXT CLASSIFICATION, INDEXING AND SEARCHING **9**

A Characterization of Text Classification – Unsupervised Algorithms – Supervised Algorithms – Feature Selection or Dimensionality Reduction – Evaluation metrics – Organizing the classes – Indexing and Searching – Inverted Indexes –Signature Files – Suffix Trees & Suffix Arrays – Sequential Searching – Multi-dimensional Indexing.

UNIT IV WEB RETRIEVAL AND CRAWLING **9**

The Web – Search Engine Architectures – Search Engine Ranking – Managing Web Data – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation - Structured Text Retrieval.

UNIT V TYPES OF IR AND APPLICATIONS **9**

Parallel and Distributed IR –Data Partitioning – Parallel IR – Cluster-based IR – Distributed IR - Multimedia Information Retrieval – Challenges – Content Based Image Retrieval – Audio and Music Retrieval – Retrieving and Browsing Video – Fusion Models – Segmentation – Compression - Enterprise Search –Tasks – Architecture of Enterprise Search Systems – Enterprise Search Evaluation - Library Systems – Digital Libraries.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Use an open source search engine framework and explore its capabilities.
2.	Represent documents in different ways and discuss its effect on similarity.
3.	Do calculatioins and on search.

4.	Design and implement an innovative feature in a search engine.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press Books, 2011.
2.	Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack,"Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2010.

REFERENCES:

1.	*C. Manning, P. Raghavan, H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.*
2.	*Bruce Croft, Donald Metzle, Trevor Strohman, "Search Engines: Information Retrieval in Practice", First Edition, Addison Wesley, 2009.*

17SPE015	GPU ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of parallelism with GPU
- To know programming for various GPU paradigms
- To understand the programming issues in GPUs
- To learn various algorithmson GPUs
- To introduce different GPU programming models

UNIT I GPU ARCHITECTURE **9**

Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview – Threads – Blocks – Grids – Warps - Scheduling - Memory Handling with CUDA - Shared Memory - Global Memory - Constant Memory and Texture Memory.

UNIT II GPU PROGRAMMING **9**

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications - Problem Decomposition - Memory Considerations – Transfers - Thread Usage - Resource Contentions - Self-tuning Applications.

UNIT III PROGRAMMING ISSUES **9**

Common Problems - CUDA Error Handling - Parallel Programming Issues – Synchronization - Algorithmic Issues - Finding and Avoiding Errors.

UNIT IV ALGORITHMS ON GPU **9**

Parallel Patterns – Convolution - Prefix Sum - Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster - CUDA Dynamic Parallelism.

UNIT V OTHER GPU PROGRAMMING MODELS **9**

Introducing OpenCL - OpenACC - Thrust.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Describe GPU Architecture.
2. Write programs using CUDA.
3. Implement algorithms in GPUs to get maximum occupancy and throughput.
4. Program in any heterogeneous programming model.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. Nicholas Wilt, "CUDA Handbook: A Comprehensive Guide to GPU Programming", Addison - Wesley, 2013.
2. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors - A Hands-on Approach", Second Edition, Morgan Kaufmann, 2012.

REFERENCES:	
1.	*Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)", First Edition, Morgan Kaufmann, 2012.*
2.	*Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General Purpose GPU Programming", Addison - Wesley, 2010.*
3.	*http://www.nvidia.com/object/cuda_home_new.html*

17SPE016	BUSINESS INTELLIGENCE AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be exposed with the basic rudiments of business intelligence system
- To know the basics of data integration
- Understand the modeling aspects behind business intelligence
- To learn the basics of enterprise reporting
- Be exposed with different data analysis tools and techniques

UNIT I **INTRODUCTION TO BUSINESS INTELLIGENCE** **4**

Introduction to OLTP and OLAP - BI Definitions & Concepts - Business Applications of BI - BI Framework - Role of Data Warehousing in BI - BI Infrastructure Components – BI Process - BI Technology - BI Roles & Responsibilities.

UNIT II **BASICS OF DATA INTEGRATION** **12**

Concepts of data integration need and advantages of using data integration - introduction to common data integration approaches - introduction to ETL using SSIS - Introduction to data quality - data profiling concepts and applications.

UNIT III **INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING** **6**

Introduction to data and dimension modeling - multidimensional data model - ER Modeling vs. Multi-dimensional modeling - concepts of dimensions - facts - cubes - attribute – hierarchies - star and snowflake schema - introduction to business metrics and KPIs - creating cubes using SSAS.

UNIT IV **BASICS OF ENTERPRISE REPORTING** **12**

Introduction to enterprise reporting - concepts of dashboards - balanced scorecards - introduction to SSRS Architecture - enterprise reporting using SSRS.

UNIT V **CASE STUDIES** **11**

The assignments for the course can include the following.

1. Seminars from the topics related to Business Intelligence space
2. Relevant lab exercises to get exposure to BI concepts & tool

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Differentiate between Transaction Processing and Analytical applications and describe the need for Business Intelligence.
2.	Demonstrate understanding of technology and processes associated with Business Intelligence framework.
3.	Demonstrate understanding of Data Warehouse implementation methodology and project life cycle.
4.	Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.
5.	Design an enterprise dashboard that depicts the key performance indicators which helps in decision making.
6.	Demonstrate application of concepts in Microsoft BI suite.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. R.N. Prasad, Seema Acharya, "Fundamentals of Business Analytics ".

REFERENCES:

1. *David Loshin, "Business Intelligence ".*
2. *Mike Biere, "Business intelligence for the enterprise".*
3. *Larissa Terpeluk Moss, Shaku Atre, "Business intelligence roadmap".*
4. *Cindi Howson, "Successful Business Intelligence: Secrets to making Killer BI Applications".*
5. *Brain, Larson, "Delivering business intelligence with Microsoft SQL server 2008".*
6. *Lynn Langit, "Foundations of SQL Server 2005 Business Intelligence ".*
7. *Stephen Few,"Information dashboard design ".*

NOTE: The Infosys Certification will be given for respective courses as per the evaluation procedures given in Annexure - I

17SPE017	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Learn the concepts of Iot
- To get exposed to various Iot Protocols
- To understand the resource management techniques in Iot
- Be known to Iot Application development concepts
- To analyse Web of Things versus Internet of Things

UNIT I INTRODUCTION **9**

Definition – Foundations – Challenges and Issues - Identification – Security - Components in internet of things -Control Units – Sensors – Communication modules –Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks –Mobile Internet – Wired Communication-IoT Platform Overview-Raspberry pi-Arduino boards.

UNIT II IOT PROTOCOLS **9**

Protocol Standardization for IoT - M2M and WSN Protocols - SCADA and RFID Protocols - Issues with Iot Standardization – Protocols –IEEE 802.15.4 - BACnet Protocol - Zigbee Architecture - Network layer – APS Layer – Security.

UNIT III RESOURCE MANAGEMENT **9**

Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object – Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.

UNIT IV IOT APPLICATION DEVELOPMENT **9**

IoT applications in home – infrastructures - security-Industries - IoT electronic equipments - Use of Big Data and Visualization in IoT - Industry 4.0 concepts - Sensors and sensor Node – Interfacing using Raspberry Pi/Arduino - Web Enabled Constrained Devices.

UNIT V WEB OF THINGS **9**

Web of Things versus Internet of Things - Architecture Standardization for WoT- Platform Middleware for WoT - WoT Portals and Business Intelligence - Cloud of Things:Grid/SOA and Cloud Computing - Cloud Standards – Cloud of Things Architecture - Open Source e-Health sensor platform.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Identify the components of IoT.
2. Analyze various protocols of IoT.
3. Design portable IoT using appropriate boards.
4. Develop schemes for the applications of IOT in real time scenarios.
5. Design business intelligence and information Security for WoT.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M		H	M		L						M		H
CO2	L	M		H	M								M		H

CO3	L		M	H	M								M		H
CO4	L		M	H	M		L						M		H
CO5	L		M	H	M		L						M		H
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.
2.	Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective", CRC Press 2012.

REFERENCES:	
1.	*Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.*
2.	*Dieter Uckelmann, Mark Harrison, "Architecting the Internet of Things", Springer 2011.*
3.	*Luigi Atzori, Antonio Lera, Giacomo Morabito, "The Internet of Things: A Survey", Journal on Networks, Elsevier Publications, October, 2010.*
4.	*http://www.theinternetofthings.eu/what-is-the-internet-of-things*

17SPE018	GAME THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be familiar with the process of game design and development
- To learn the processes, mechanics, issues in game design
- To understand the architecture of game programming
- To know about game engine development, modeling, techniques and frameworks

UNIT I INTRODUCTION **9**

Elements of Game Play – Artificial Intelligence – Getting Input from the Player - Sprite Programming – Sprite Animation - Multithreading – Importance of Game Design – Game Loop.

UNIT II 3D GRAPHICS FOR GAME PROGRAMMING **9**

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces.

UNIT III GAME DESIGN PRINCIPLES **9**

Character Development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding, Case study : Tetris.

UNIT IV GAMING ENGINE DESIGN **9**

Renderers, Software Rendering, Hardware Rendering, and Controller Based Animation, Spatial Sorting, Level of Detail, Collision Detection, Standard Objects, and Physics, Case study : The Sims.

UNIT V GAME DEVELOPMENT **9**

Developing 2D and 3D Interactive Games Using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle Games, Single Player Games, Multi-Player Games. Case study: Mine craft.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Develop game programming skills and create interactive games

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		M	H	H		M						M	L	H

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

TEXT BOOKS:

1. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real Time Computer Graphics", Second Edition, Morgan Kaufmann, 2010.
2. Jung Hyun Han, "3D Graphics for Game Programming", First Edition, Chapman and Hall/CRC, 2011.
3. Ernest Adams, Andrew Rollings, "Fundamentals of Game Design", Third Edition, Pearson Education, 2014.

REFERENCES:

1. *Jonathan S. Harbour,"Beginning Game Programming", Course Technology, Third Edition PTR, 2009.*
2. *Scott Rogers, "Level Up: The Guide to Great Video Game Design", First Edition, Wiley,*

	2010.
3.	*Jim Thompson, Barnaby Berbank-Green, Nic Cusworth, "Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer", First Edition, Wiley, 2008.*

17SPE019	OPEN SOURCE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about Open source operating systems
- To explore on open source databases
- To acquire the knowledge of open source programming languages
- To get introduces to Python programming constructs
- To explore on open source tools and techniques

UNIT I INTRODUCTION **9**

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources – Application of Open Sources - Open source operating systems – LINUX - Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux.

UNIT II OPEN SOURCE DATABASE **9**

MySQL - Introduction – Setting up account – Starting - terminating and writing your own SQL programs – Record selection Technology – Working with strings – Date and Time – Sorting Query Results – Generating Summary – Working with metadata – Using sequences – MySQL and Web.

UNIT III OPEN SOURCE PROGRAMMING LANGUAGES **9**

PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails – Debugging and error handling – Security – Templates.

UNIT IV PYTHON **9**

Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

UNIT V OPEN SOURCE TOOLS AND TECHNIQUES **9**

Web Server - Apache Web server – Working with Web Server – Configuring and Using apache web services MDA - Introduction to MDA – Genesis of MDA – Meta Object Facility – UML – UML Profiles – MDA Applications.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Describe open source systemsand databases.
2. Write programs using open source programming languages.
3. Implement programs using python.
4. Working and configuring web server.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L	M	H	M		L						L	L	H
CO2		L	M	H	M		L						L		H
CO3		M	M	H			L						L		M

CO4		M	M	H	M		L						L	L	M
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Remy Card, Eric Dumas, Frank Mevel, "The Linux Kernel Book", Wiley Publications, 2003.
2.	Steve Suchring, "MySQL Bible", John Wiley, 2002.
3.	Rasmus Lerdorf, Levin Tatroe, "Programming PHP", O'Reilly, 2002.
4.	Wesley J. Chun, "Core Phython Programming", Prentice Hall, 2001.
5.	Stephen J. Mellor, Marc Balces, "Executable UMS: A foundation for MDA", AddisonWesley, 2002.

REFERENCES:	
1.	*Peter Wainwright, "Professional Apache", Wrox Press, 2002.*

17SPE020	BIG DATA AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the competitive advantages of big data analytics
- To understand the big data frameworks
- To learn data analysis methods
- To gain knowledge on Hadoop related tools such as MongoDB,HBase, Cassandra, Pig and Hive for big data analytics
- To learn about Jasper Reports

UNIT I INTRODUCTION TO BIG DATA 8

Digital Data: Types of Digital Data - Structured - Sources of structured data - Ease with Structured data - Semi-Structured - Sources of semi-structured data - Unstructured - Sources of unstructured data - Issues with terminology - Dealing with unstructured data.
Introduction to Big Data: Characteristics of data - Challenges with big data - Big data stack.

UNIT II HADOOP 10

Technology Landscape:Big Data Analytics - Analytics 1.0, Analytics 2.0, Analytics 3.0 - Traditional BI vs. Big Data Environment - Big Data technology Landscape - NoSQL Databases - NoSQL Vs. RDBMS- New SQL - Hadoop - Hadoop 1.0 vs. Hadoop 2.0 - Data Science is multi-disciplinary - Data Scientist - Your new best friend.

Introduction to Hadoop: Introducing Hadoop - Why not RDBMS - Distributed Computing Challenges - A Brief History of Hadoop - Hadoop Overview - Hadoop Components - High Level Architecture of Hadoop - Hadoop Distributed File System -HDFS Architecture - Daemons Related to HDFS - Working with HDFS Command - Special Features of Hadoop - Processing Data With Hadoop - Introduction - How Map Reduce Works - Map Reduce Example - Word Count Example using Java - Managing Resources and Applications with YARN - Introduction - Limitation of Hadoop 1.0 - Hadoop 2: HDFS - Hadoop 2: YARN - Interacting with Hadoop EcoSystem - Hive - Pig - HBASE - Sqoop - Business Intelligence on Hadoop.

UNIT III MONGO DB, CASSANDRA, HIVE 11

Mongo DB:Recap of NoSQL databases - MongoDB – CRUD - MongoDB- Arrays, Java Scripts, Cursors, Map Reduce Programming, Aggregations.
Cassandra:Cassandra- CQLSH - CRUD, Counter, List, Set, Map, Tracing.
Introduction to Hive:Introduction to Hive - The Problem -Solution - Hive Use Case - Data Growth - Schema Flexibility and Evolution - Extensibility - What is Hive - History of Hive and Recent Releases of Hive - Hive Features - Hive Integration and Work Flow - Hive Data Units - Hive Architecture - Hive Primitive Data Types and Collection Types - Hive File Formats - Hive Query Language - Statements - DDL - DML - Hive Partitions, Bucketing, Views, Sub query, joins, Hive User Defined Function - Aggregations in Hive, Aggregations in Hive, Serialization and Deserialization, - Hive Analytic Functions.

UNIT IV PIG 10

Introduction to Pig:Introducing Pig - History and Anatomy of Pig - Pig on Hadoop - Pig Features - Pig Philosophy - Word count example using Pig - Use Case for Pig - Pig Primitive Data Types , Collection Types and NULL - Pig Latin Overview - Pig Latin Grammar - Comments, Keywords, Identifiers - Case sensitivity in Pig - Common Operators in Pig - Pig Statements - LOAD - STORE - DUMP - Interactive Shell - GRUNT - FILTER - SORT - GROUP BY - ORDER BY - JOIN - LIMIT - Pig Latin Script - Local Mode - Map Reduce

Mode - Running Pig Script - Working with -Field - Tuple - Bag - User Defined Function - Parameters in Pig.

UNIT V	**JASPER REPORT**	**6**

Introduction to Jasper Report:Introduction to Jasper Report using Jasper Soft Studio - Reporting using MongoDB - Reporting using Cassandra.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Know the concepts of big data.
2. Describe about hadoop.
3. Have Knowledge on MongoDB and Cassandra.
4. Explain the concepts on pig and jasper studio.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. The courseware (PowerPoint and notes) is available for the course.

REFERENCES:

1. *David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.*
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, Chris Eaton, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill, 2011.*
5. *Frank J. Ohlhorst, "Big Data Analytics",1st Edition, Wiley, 2012.*
6. *Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Media,2017 , second edition.*
7. *Kristina Chodorow, "MongoDB: The Definitive Guide", 2nd Edition O'Reilly Media, 2013.*
8. *Tim Berglund, Matthew McCullough, "Mastering Cassandra for Architects", O'Reilly Media, 2012.*
9. *Alan Gates, Daniel Dai, "Programming Pig", O'Reilly Media, 2016.*

NOTE: The Infosys Certification will be given for respective courses as per the evaluation procedures given in Annexure - I

17SPE021	MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability based learning techniques
- To be known to evolutionary models of machine learning
- To understand graphical models of machine learning algorithms

UNIT I INTRODUCTION **9**

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II LINEAR MODELS **9**

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT III TREE AND PROBABILISTIC MODELS **9**

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

UNIT IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS **9**

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring - - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.

UNIT V GRAPHICAL MODELS **9**

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods-Introduction to Machine Learning Tools – Lime – Tensor Flow – Apache Mahout – Apache Spark.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Distinguish between supervised, unsupervised and semi-supervised learning.
2.	Apply the apt machine learning strategy for any given problem.
3.	Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.
4.	Design systems that use the appropriate graph models of machine learning.

5.	Modify existing machine learning algorithms to improve classification efficiency.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2.	Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013.

REFERENCES:

1.	*Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.*
2.	*Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014.*
3.	*Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014.*

17SPE022	GEOGRAPHICAL INFORMATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamentals and components of geographic information system.
- Be known to details of data classification and map projections.
- To provide details of various geoprocessing tools.
- To have a thorough understanding of editing features in GIS
- To Learn the applications of geographical information systems.

UNIT I INTRODUCTION TO GIS 9

Brief History of GIS- Types of Maps - Elements of Cartography.

UNIT II MAP PROJECTIONS 9

Data Classification - Map Projections - Reading Metadata - Understanding Census Data & Geometry - Accessing Census Data.

UNIT III GEOPROCESSING TOOLS 9

Interpreting Census Variables - Charts & Graphs for Data Display- Geoprocessing Tools - Buffers, Clips, Unions- Address Mapping - Location-based Services- Geocoding.

UNIT IV EDITING FEATURES 9

Editing features - Point, Line, and Polygon -Rubbersheeting & Georeferencing - Web mapping – QGIS - Additional platforms and software- Google Fusion Tables and/QGIS - Raster Data - Decision Support Methods with Rasters.

UNIT V APPLICATIONS OF GIS 9

GPS Data Collection–FieldSurveys – GPS - Aerial Imagery - Creating Metadata-Applications of GIS.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Describe graphical information system.
2. Know about geocoding.
3. Explain the basic concepts of web mapping and QGIS.
4. Know the applications of GIS.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. Cote, Paul,"Raster GIS Fundamentals", 2008.
2. Kent, Robert B., Richard E. Klosterman,"GIS and Mapping: Pitfalls for Planners", Journal of the American Planning Association.2000. 66: 2, 189-198.
3. Maantay, Julie, John Ziegler, "GIS for the Urban Environment", Redlands, CA:Esri Press, 2006.

4.	Peters, Alan H., Heather MacDonald, "Unlocking the Census with GIS", Redlands, CA:EsriPress, 2004.
5.	Schlossberg, Marc. "GIS, the US Census and Neighbourhood Scale Analysis", Planning, Practice & Research. 2003, 18(2-3): 213-217.

REFERENCES:

1.	*Longley, Paul A, et al, Eds. "Geographical Information Systems and Science (2nd Ed)", Hoboken,NJ: John Wiley & Sons, 2005.*
2.	*Monmonier, Mark, "Drawing the Line",New York: Henry Holt and Co, 1995.*
3.	*US Census Bureau, "A Compass for Understanding and Using American Community Survey Data:What General Users Need to Know (Issued October 2008)", Washington, DC: US CensusBureau, 2010.*
4.	*Peterson, Gretchen,"Colors for Maps", 2011.*

17SPE023	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn XML fundamentals
- Be familiar with the web services technology elements for realizing SOA
- Understand the key principles behind SOA
- Be exposed to build applications based on XML.
- Learn the various web service standards

UNIT I XML TECHNOLOGY **9**

XML – XML and Web - Name Spaces – XML Document Structure - Structuring with Schemas and DTD - Modeling Databases in XML – XQuery.

UNIT II SOA BASICS **9**

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 WEB SERVICES **9**

SOA and Web Services – Web Services Protocol Stack – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service Level Interaction patterns – XML and Web Services - Enterprise Service Bus - .NET and J2EE Interoperability.

UNIT IV WS TECHNOLOGIES AND STANDARDS **9**

Web Services Technologies - JAX-RPC, JAX-WS - Web Service Standards – WS-RM, WS-Addressing, WS-Policy - Service Orchestration and Choreography – Composition Standards – BPEL - Service Oriented Analysis and Design.

UNIT V XML AND WS SECURITY **9**

XML Security Overview – Canonicalization – XML Security Framework – XML Encryption – XML Signature – XKMS Structure - Web Services Security - XACML - WS-Security.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Design and develop real work applications using the concepts of SOA and Web services.
2. Comprehend approaches for providing security for XML documents as well as messages exchanged among Web Services.
3. Develop an application using .NET and J2EE enterprise technology.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H	M	H		L						M		H
CO2	M		H	M	L		L						M		H
CO3	M		H	M	L		L						M		H

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

TEXT BOOKS:

1. Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2008. (Unit 1 and 3)
2. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”,

	Pearson Education, 2005. (Unit 2, 3, 4, and 5)
3.	James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", Elsevier, 2011.

REFERENCES:	
1.	*Frank P. Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002. (Unit 5)*
2.	*Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Addison Wesley, 2005.*
3.	*Mark O' Neill, et al., "Web Services Security", Tata McGraw-Hill Edition, 2003.*
4.	*Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004.*

17SPE024	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	To give students knowledge of soft computing theories fundamentals,
•	To learn the fundamentals of non-traditional technologies and approaches to solving hard real-world problems.
•	To learn and apply artificial neural networks, fuzzy sets and fuzzy logic, and genetic algorithms in problem solving and use of heuristics based on human experience
•	To introduce the ideas of fuzzy sets, fuzzy logic and to become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
•	To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.

UNIT I	NEURAL NETWORKS -I	9

Introduction and Architecture – Neuron - Nerve Structure and Synapse - Artificial Neuron and its Model - Activation Functions - Neural Network Architecture - Single Layer and Multilayer Feed Forward Networks - Recurrent Networks - Various Learning Techniques -Perception and Convergence Rule - Auto-Associative and Hetro-Associative Memory.

UNIT II	NEURAL NETWORKS -II	9

Back Propagation Networks – Architecture - Perceptron Model – Solution - Single Layer Artificial Neural Network - Multilayer Perception Model - Back Propagation Learning Methods - Effect of Learning Rule Co-Efficient - Back Propagation Algorithm - Factors Affecting Back Propagation Training - Applications.

UNIT III	FUZZY LOGIC -I	9

Basic Concepts of Fuzzy Logic - Fuzzy Sets and Crisp Sets -Fuzzy Set Theory and Operations - Properties of Fuzzy Sets - Fuzzy and Crisp Relations - Fuzzy to Crisp Conversion.

UNIT IV	FUZZY LOGIC -II	9

Fuzzy Membership Rules - Membership Functions - Interference in Fuzzy Logic - Fuzzy If-Then Rules - Fuzzy Implications and Fuzzy Algorithms - Fuzzifications and Defuzzificataions - Fuzzy Controller - Industrial Applications.

UNIT V	GENETIC ALGORITHM	9

Basic Concepts - Working Principle - Procedures of GA - Flow Chart of GA - Genetic Representations - Encoding - Initialization and Selection - Genetic Operators - Mutation - Generational Cycle - Applications.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Awake the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
2.	Acquire knowledge of soft computing theories fundamentals and so they will be able to design program systems using approaches of these theories for solving various real-world problems.
3.	Try and integrate the knowledge of neural networks, fuzzy logic, genetic algorithms, probabilistic reasoning, rough sets, chaos, hybrid approaches (combinations of neural networks, fuzzy logic and genetic algorithms).

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H	M	M	L		L						M		H
CO2	L	H	M	M	L		L						M		H
CO3		H	M	M	L		L						M		H

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

TEXT BOOKS:

1. S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India, 2003.
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2005.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley India, 2010.

REFERENCES:

1. *J.S.R. Jang, C.T. Sun, E. Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education, 2004.*
2. *S.Y.Kung,"Digital Neural Network", Prentice Hall International, 1993.*
3. *Aliev.R.A, Aliev, R.R, "Soft Computing and its Application", World Scientific Publishing Company, 2001.*
4. *Wulfram Gerstner, Wenner Kristler, "Spiking Neural Networks", Cambridge University Press.*
5. *Bart Kosko, "Neural Networks and Fuzzy Systems: Dynamical Systems Application to Machine Intelligence", Prentice Hall, 1992.*
6. *Siman Haykin, "Neural Networks", Prentice Hall of India, 1999.*

17SPE025	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn to create web pages and web applications using HTML
- Understand the method of adding client side behavior to HTML pages using Javascripts
- Be familiar with servlet programming
- Learn web development using PHP
- Understand how DB connectivity is establish with various front wnd web application development tools

UNIT I INTRODUCTION TO HTML 9

HTML- List – Tables – Images – Forms – Frames - Cascading Style sheets - XML- Document type definition - XML Schemas -Document Object model.

UNIT II JAVA SCRIPT 9

Java Script -Control statements – Functions – Arrays – Objects – Events - Dynamic HTML with Java Script - Ajax.

UNIT III SERVLETS 9

Web servers – IIS (XAMPP, LAMPP) and Tomcat Servers - Java Web Technologies – Servlets - JavaServer Pages - Java Server Faces - Web Technologies in Netbeans - Building a Web Application in Netbeans - JSF Components - Session Tracking - Cookies.

UNIT IV PHP 9

PHP – Basics - String Processing and Regular Expressions - Form Processing and Business Logic -Using Cookies - Dynamic Content - Operator Precedence Chart.

UNIT V DATABASE CONNECTIVITY 9

Database Connectivity with MySQL – Servlets – JSP - PHP - Case Studies- Student information system - Health Management System.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Design and develop client side scripting techniques.
2. Build real world applications using client side and server side scripting languages.
3. Design and develop an e-Governance application using web technology.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M		L		M						M		H
CO2		M	M		L		M						M		H
CO3		M	M		L		M						M		H

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

TEXT BOOKS:

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet & World Wide Web How to Program”, Deitel series, 5th edition, 2012.
2. Jason Gilmore,”Beginning PHP and MySQL From Novice to Professional”, 4th Edition, Apress Publications, 2010.

REFERENCES:

1.	*Robert W. Sebesta, "Programming with World Wide Web", Pearson, 4th edition, 2008.*
2.	*David William Barron, "The World of Scripting Languages", Wiley Publications, 2000.*

17SPE026	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	ToUnderstand the basic 2D and 3D Graphics viewing pipeline that includes, Modeling, manipulation and rendering along with advanced Graphics for visual realism
•	To Learn the various shanding models and Visible Surface Detection methods
•	To be introduced to OpenGL programming
•	To Understand basic elements of multimedia and to learn the theory behind data compression
•	To get hands on different Multimedia Applications

UNIT I INTRODUCTION TO GRAPHICS 9

2G:Coordinate Systems - Graphics Apis and Hardware – Display Technologies – Output Primitives – Line, Circle - Attributes of Output Primitives – 2D Geometric Transformations -2D Viewing – Line, Polygon Clipping Algorithms.
3D Modeling and Viewing:3D Object representations – Polygonal Mesh Modeling – Bezier Curves and B-Splines - Transformations –3D Viewing.

UNIT II ANIMATION 9

Rendering: Color Models - Rendering - Shading Models – Flat shading and Smooth Shading – Visible Surface Detection - Adding Textures and Shadows. Ray Tracing, Volume Rendering
Fractals and Animation: Fractals and Self Similarity – Peano Curves – Mandelbrot Sets – Julia Sets – Random Fractals, Data Structures for Graphics - Graphics File Formats, Animation, Virtual Reality.

UNIT III OPENGL 9

Graphics programming with OpenGL: Drawing 3D Scenes - Removal of Hidden Faces - Using Shading Models - Colors And Light - Adding Texture and Shadows - Applying a Ray Tracer - Understanding 3D Modeling and Animation Tools like 3D Studio Max – Maya - Blender.

UNIT IV MULTIMEDIA 9

Basic Elements:Creation – Editing – Design – Usage – Tools and Hardware – File Formats for Text, Image / Graphics, Audio, Video, Animation - Color Models - Multimedia Data Structures - KD Trees – R Trees.
Data Compression:Text Compression – RLE – Huffman – Arithmetic - Dictionary Based - Image Compression – JPEG, JPEG 2000, JPEG – LS, Audio Compression – PCM - ADPCM - LPC, MPEG Audio, Video Compression – MPEG – 1,2,4 .

UNIT V APPLICATIONS 9

Multimedia Applications: Multimedia Databases – Content Based Information Retrieval - Multimedia Communications - Multimedia Information Sharing and Retrieval – Applications – Social Media Sharing - Online Social Networking - Virtual Reality - Multimedia for Portable Devices - Collaborative Multimedia Applications.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Devise, solve, demonstrate 2D applications of computer graphics and devise, solve and demonstrate 3D modeling, transformations and projections.

2.	Appreciate advanced 3D Graphics that leads to visual realism and perceive knowledge on fractal theory, color models, Animation.
3.	Do programming in OpenGL for drawing basic 3D scenes and add realism.
4.	A grasp on basic elements of multimedia and to learn the theory behind data compression both lossless and lossy.
5.	Implement multimedia applications.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", Fourth Edition, Pearson / Prentice Hall, 2010.
2.	Francis S Hill, Jr., Stephen M Kelley,"Computer Graphics Using OpenGL", Third Edition, Prentice Hall, 2007.
3.	Ze - Nian Li, Mark S Drew, Jiangchuan Liu, "Fundamentals of Multimedia", Second Edition, Springer, 2014.

REFERENCES:

1.	*Peter Shirley, "Fundamentals of Computer Graphics", Third Edition, A K Peters, 2009.*
2.	*Shalini Govil Pai, "Principles of Computer Graphics Theory and Practice Using OpenGL and Maya", Springer, 2004.*
3.	*Parag Havaldar and Gerard Medioni, "Multimedia Systems - Algorithms, Standards and Industry Practices", Course Technology, Cengage Learning, 2010.*
4.	*Nigel Chapman and Jenny Chapman, "Digital Multimedia", Third Edition, Wiley, 2009.*
5.	*Ralf Steinmetz and Klara Nahrstedt, "Multimedia Computing, Communications and Applications", First Edition, Pearson 2005.*
6.	*www.webstyleguide.com*

OPEN ELECTIVES

CSE:

17SOE001	PROGRAMMING IN C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get introduced to bacis of C++ programming
- To be familiar with OOPS concepts
- To understand the concept of Inheritance and its types
- To understand the concept of Polymorphism
- To be familiar with templates and file handling concepts

UNIT I BASIC C++ PROGRAMMING **9**

C++ Programming features –Data types, Variables and Arrays – Operators - Pointers – References – Functions - String Handling.

UNIT II OOPS CONCEPTS **9**

Data Abstraction - Encapsulation - Class - Object – Constructors - Destructors - Static Members – Constant Members – Member Functions - Friend Functions- Role of this pointer – Storage Classes – Copy Constructor.

UNIT III INHERITANCE **9**

Inheritance –Types of Inheritance –public, protected and private inheritance – Method Overriding – Abstract and Concrete Class – Virtual Class - Virtual Functions - Dynamic Memory Allocation - Nested Classes.

UNIT IV POLYMORPHISM **9**

Polymorphism – Compile Time and Run Time Polymorphisms – Function Overloading – Operators Overloading – Dynamic Binding – Exception Handling.

UNIT V ADVANCED OOPS FEATURES **9**

Standard Libraries - Generic Programming - Templates – Class Template - Function Template – Iterators – Function Adaptors – Allocators - File Handling concepts.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Have the knowledge about the concepts of object oriented programming language.
2. Know the various concepts related to inheritance and polymorphism.
3. Describe about the concepts of templates and error handling.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		H	M	H		M						H		L
CO2		L	H	M	H		M						H		M
CO3		L	H	M	H		M						H		L

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

TEXT BOOKS:

1. Bjarne Stroustrup, “The C++ Programming Language”, 3rd edition, Pearson Education, 2007.
2. K R Venugopal, Rajkumar Buyya, “Mastering C++”, 2nd Edition, McGraw Hill

	Education, 2013.

REFERENCES:	
1.	*Ira Pohl, "Object Oriented Programming using C++", 2nd edition, Pearson Education, 1997.*
2.	*Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill Education, 2003.*

17SOE002	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To get introduced to fundamentals of java programming
- To be familiar with concepts of classes and objects in java
- To understand how information hiding and reusability is implemented in java
- To understand the concept of exception, concurrency and streams
- To be familiar with graphical programming using applets

UNIT I FUNDAMENTALS OF JAVA **7**

Java Buzzwords- Overview of Java- Data types, Variables and Arrays - Simple types- Scoping rules Automatic Type Conversion- Type Casting and Arrays- Operators - Operators Precedence & Associativity – Expression- Control Statements- Comparison of C++ and Java- Entry point for Java Programs.

UNIT II CLASSES AND OBJECTS **11**

Introducing Classes - Class fundamentals- Declaring objects- Assigning object reference variable- Methods & Method Signatures- Method retuning Values- Method with parameters – Constructors- Default Constructor Parameterized constructor- this keyword- Garbage Collector- finalize() method- Overloading methods and constructors- Using object as parameters- returning object in methods – recursion- Access control- static and final keyword- Nested and Inner classes- Command Line argument- String and String Buffer class.

UNIT III INFORMATION HIDING AND REUSABILITY **9**

Inheritance - basics- Using super- Method Overriding- Constructor call- Dynamic method dispatch Abstract class- Using final with inheritance - Packages - Default Package- Path & Class Path Environment Variables- Package level access- Importing Packages – Interface - Multiple Inheritance in Java- Extending interface- Wrapper class.

UNIT IV EXCEPTION, CONCURRENCY NAD STREAMS **9**

Exception Handling mechanism - I/O Basics - Byte stream & Character Stream- Getting user input- Reading console input & Writing console output- Reading and Writing files- Threading – Thread class & Runnable Interface- Inter Thread Communication- Synchronized keyword- Deadlock.

UNIT V GRAPHICAL PROGRAMMING **9**

Applet Basics – methods – creation - designing and examples - Event handling- event classes - Event listener interfaces - AWT classes - working with frames - AWT controls-layout manager - user interface components –Swings – JDBC Connectivity – Introduction to JavaFX.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Differentiate between Java and other OOPs languages.
2. Develop programs using classes and objects.
3. Implement multi threading.
4. Design a page using applet.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		H		M	M							H		M
CO2	L		H		M	M							H		M

CO3			H		M	M		L					H		M
CO4			H		M	M		L					H		M
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Patric Naughton & Herbert Schildt, "The Complete Reference Java 2", Tata Mcgraw Hill, New Delhi, 2001, 4th Edition.
2.	Bruce Eckel, "Thinking in Java", Pearson Eduction Asia, 2000, 2nd Edition.

REFERENCES:	
1.	*Deitel & Deitel, "Java How to Program", Prentice Hall, 2002, 5th Edition.*
2.	*Ken Arnold & James Gosling, "The Java Programming Language", 2000, AWL.*
3.	*Peter Haggar, "Practical Java: Programming Language Guide", Addison Wesley Pub Co. 2000, 1st Edition.*

17SOE003	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Understand the basic of Python Programming
- To Learn about string in Python
- To be introduced to Classes in python
- To Understand basic concepts on files.
- To get hands on XML and serialization

UNIT I INTRODUCTION TO PYTHON 9

Function Declaration - Import - Objects - Indenting as Requirement - Exceptions - Unbound Variables - Case Sensitive - Scripts - Native Data Types - Booleans - Numbers - Lists - Tuples - Sets - Dictionaries - Comprehensions - List Comprehensions - Dictionary Comprehensions - Set Comprehensions.

UNIT II STRING 9

Strings - Unicode - Formatting - String Methods - Bytes - Encoding - Regular Expressions - Verbose - Case Studies.

UNIT III CLASSES 9

Closures - List of Functions - List of Patterns - File of Patterns - Generators - Defining Classes - Instantiating Classes - Instance Variables - Iterators – Itertools - Assert - Generator Expressions.

UNIT IV FILES 9

Reading and Writing Text Files - Binary Files - Stream Objects - Standard Input, Output and Error.

UNIT V XML AND SERIALIZATION 9

XML - Atom Feed - Parsing HTML - Searching for Nodes - html - Generation - Serializing Objects - Pickle Files - Versions - Debugging - Serializing to JSON.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Understand the concepts of object oriented programming.
2. Use generators and iterators.
3. Develop test cases and handle refactoring.
4. Use objects to program over the web.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1. Mark Pilgrim, “Dive into Python 3”, Apress, 2009.
2. John V. Guttag, “Introduction to Computation and Programming using Python”,Prentice Hall of India, 2014.

REFERENCES:

1.	*Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", Fifth Edition, O'Reilly, Shroff Publishers and Distributors, 2013.*
2.	*Allen Downey, Jeffrey Elkner, Chris Meyers, "How to Think Like a Computer Scientist - Learning with Python", Green Tea Press, 2002.*

17SOE004	WEB DESIGNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Learn about basics of websites and get introduced to HTML 5, CSS 3, WEB 2.0
- To understand client side programming using java script
- To Learn about java servlets and DB connectivity
- To Learn web development using PHP and XML
- To Get Introduced to AJAX and web services

UNIT I WEBSITES BASICS, HTML 5, CSS 3, WEB 2.0 **9**

Web 2.0: Basics-RIA Rich Internet Applications – Collaborations tools – Understanding websites and web servers: Understanding Internet – Difference between websites and web server- Internet technologies Overview –Understanding the difference between internet and intranet.
HTML and CSS: HTML 5.0 , XHTML, CSS 3.

UNIT II CLIENT SIDE PROGRAMMING **9**

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript.
VB Script: VB Script programming – Forms – Scripting Object.

UNIT III SERVLETS AND JSP **9**

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies-Installing and Configuring Apache Tomcat Web Server.Database Connectivity: JDBC perspectives, JDBC program example.
JSP: Understanding Java Server Pages-JSP Standard Tag Library(JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV PHP AND XML **9**

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Connecting to Database – Using Cookies-Regular Expressions.
XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V INTRODUCTION TO AJAX AND WEB SERVICES **9**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods.
Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP – Introduction to modern tools / framework – AngloJS – Jquery.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Create a basic website using HTML and Cascading Style Sheets.
2.	Design and implement dynamic web page with validation using JavaScript objects and VB Script objects and by applying different event handling mechanisms.
3.	Design rich client presentation using AJAX.
4.	Design and implement simple web page in PHP, and to present data in XML format.
5.	Design and implement server side programs using Servlets and JSP.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:

1.	Deitel and Deitel, Nieto, "Internet and World Wide Web – How to Program", Prentice Hall, 5th Edition, 2011.
2.	Herbert Schildt, "Java-The Complete Reference", Eighth Edition, Mc Graw Hill Professional, 2011.

REFERENCES:

1.	*Stephen Wynkoop,John Burke "Running a Perfect Website", QUE, 2nd Edition,1999.*
2.	*Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.*
3.	*Jeffrey C, Jackson, "Web Technologies- A Computer Science Perspective", Pearson Education, 2011.*
4.	*Paul Dietel, Harvey Deitel, "Java How to Program", 8th Edition Prentice Hall of India.*
5.	*Gopalan N.P., Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.*
6.	*Mahesh P. Matha, "Core Java A Comprehensive Study", Prentice Hall of India, 2011.*
7.	*Uttam K.Roy, "Web Technologies", Oxford University Press, 2011.*

17SOE005	ANDROID APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand how to work with various mobile application development frameworks.
- Learn how UI for mobile application development is done for Android
- Know the tools used in android application development
- Learn the basic and important design concepts and issues of development of mobile applications.
- Understand the process of android application development

UNIT I INTRODUCTION **9**

Mobile Applications – Characteristics and Benefits – Frameworks and Tools – Introduction to Java – Classes and Objects – Inheritance – Packages and Interfaces – Strings – I/O – Event handling.

UNIT II USER INTERFACE **9**

Generic UI Development – Multimodal and Multichannel UI – Designing the right UI– Introduction to XML –XML basics – Attributes – DTD - XML schema – Screen Elements and Layouts.

UNIT III TOOLS **9**

Google Android Platform – Android Application Architecture – Android Studio – Android Widgets and Menus – Event handling – Packaging and Deployment - Apple iPhone Platform.

UNIT IV APPLICATION DESIGN **9**

Memory Management – Design patterns for limited memory – Work flow for Application Development – Techniques for composing Applications – Intents and Services – Fragments – Graphics – Animation.

UNIT V APPLICATION DEVELOPMENT **9**

Storing and Retrieving data – Communication via the Web – Notification and Alarms – Telephony – Location based services – Apps with Firebase Real Time Database – Project on respective Discipline.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Design and implement the user interfaces for mobile applications.
2. Design the mobile applications that are aware of the resource constraints of mobile devices.
3. Develop advanced mobile applications that access the databases and the web.
4. Develop useful mobile applications in the current scenario using Google Android Studio.

COURSE ARTICULATION MATRIX:

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

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

TEXT BOOKS:	
1.	Jeff Friesen, “Learn Java for Android Development: Java 8 and Android”, 5th Edition Paperback – 2014.
2.	Share Conder, Lauren Darcey, "Android Wireless Application Development" Pearson 3 rd Edition.

REFERENCES:	
1.	*Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, “Programming Android”, O"Reilly, 2011.*
2.	*Jeff Mcherter, Scott Gowell, “Professional mobile Application Development”, paperback,2012, Wiley India Private Limited.*
3.	*Reto Meier, Wrox Wiley, “Professional Android 2 Application Development”, 2010.*
4.	*Alasdair Allan, “iPhone Programming”, O"Reilly, 2010.*
5.	*Wei-Meng Lee, “Beginning iPhone SDK Programming with Objective-C”, Wrox Wiley, 2010.*
6.	*Stefan Poslad, “Ubiquitous Computing: Smart Devices, Environments and interactions”, Wiley, 2009.*
7.	*Bear Cachil, “iOS in Practise”, Paperback, 2012.*
8.	*Markus Jakobsson, “Mobile Authentication: Problems and Solutions”, (SpringerBriefs in Computer Science), Paperback, 2012.*
9.	*Paula Beer, Carl Simmons, “Android App Development for Young Adults & The Rest of US”, Paperback, 2015.*
10.	*Luc Bros., “Oracle Mobile Application Framework Developer Guide: Build Multiplatform Enterprise Mobile Apps”, Paperback, 2014.*
11.	*Herbert Schildt, “Java: The Complete Reference”, Ninth Edition –The McGraw-Hill, 2014.*
12.	*Heather Williamson, “XML: The Complete Reference”, The McGraw-Hill, 2001.*
13.	*Tim Duckett, Apress, “Pro iOS Table VIews: for iPhone, iPad and IPod Touch”, Paperback,2012.*
14.	*Joe COnway, Aaron Hilegass, Christian Keur, “iOS Programming: The Big Nerd Ranch Guide”, Paperback, 2014.*

ECE

17LOE001	REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To expose the students to the fundamentals of Real Time systems
- To teach the fundamentals of Scheduling and features of programming Languages
- To study the data management system for real time
- To introduce the fundamentals of real time communication
- To teach the different algorithms and techniques used for real time systems

UNIT I	INTRODUCTION	9

Introduction – Issues in Real Time Computing – Structure of a Real Time System – Task classes – Task Assignment and Scheduling – Task assignment – Mode changes and Fault Tolerant Scheduling.

UNIT II	PROGRAMMING LANGUAGES AND TOOLS	9

Programming Languages and Tools – Desired language characteristics – Data typing – Control structures – Multitasking – Low level programming – Task Scheduling – Timing Specifications – Programming Environments – Run – time support.

UNIT III	REAL TIME DATABASES	9

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

UNIT IV	FAULT TOLERANCE AND RELIABILTY	9

Real – Time Communication – Fault Tolerance Techniques – Fault Types – Fault Detection. Fault Error containment Redundancy – Data Diversity – Reversal Checks – Integrated Failure handling.

UNIT V	EVALUATION TECHNIQUES	9

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy – Software error models. Clock Synchronization – Clock, A Nonfault – Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

	TOTAL : 45 PERIODS

OUTCOMES	
1.	Understand the basics of the real time systems.
2.	Analyse the programming languages and tools.
3.	Remember the real time database.
4.	Evaluate real time communication between devices
5.	Evaluate different fault tolerant techniques.

TEXT BOOKS:	
1.	C.M. Krishna, Kang G. Shin, "Real – Time Systems", McGraw – Hill International Editions, 1997.
2.	Rajib Mall, "Real-time systems: theory and practice", Pearson Education, 2007
3.	Peter D.Lawrence, "Real Time Micro Computer System Design – An Introduction", McGraw Hill, 1988.

REFERENCES:	
1.	*Stuart Bennett, "Real Time Computer Control – An Introduction", Prentice Hall of India, 1998.*
2.	*S.T. Allworth and R.N.Zobel, "Introduction to real time software design", Macmillan, 2nd Edition, 1987.*
3.	*R.J.A Buhur, D.L Bailey, "An Introduction to Real – Time Systems", Prentice – Hall International, 1999.*
4.	*Philip.A.Laplante, "Real Time System Design and Analysis", Prentice Hall of India, 3rd Edition, April 2004*

17LOE002	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the overview of sensor networks.
- Learn the different types of sensor networks architecture.
- Be familiar with networking sensors
- Be exposing to the infrastructure establishment in sensor networks.
- Learn the platforms and tools of wireless sensor networks.

UNIT I	OVERVIEW OF WIRELESS SENSOR NETWORKS	9

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II	ARCHITECTURES	9

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 SENSORS	9

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks- 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

Topology Control , Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V	SENSOR NETWORK PLATFORMS AND TOOLS	9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

	TOTAL : 45 PERIODS

OUTCOMES:

- Understand the concepts of wireless sensor networks
- Analyze the architecture of sensor networks
- Understand the protocols for wireless sensor networks with respect to some protocol design issues

•	Analyse the infrastructure establishment in Sensor networks.
•	Analyze the sensor network platforms and tools.
TEXT BOOKS:	
1.	Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
2.	Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
REFERENCES:	
1.	*Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, And Applications", John Wiley, 2007.*
2.	*Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003*

17LOE003	INDUSTRIAL AUTOMATION AND ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the evolution of robotics
- To study the dynamics and kinematics
- To learn the various actuators
- To learn the various sensors
- To understand the automation

UNIT I	INTRODUCTION TO ROBOTICS AND AUTOMATION	9

Robotics**:** History of Robotics, Applications of Robotics, Current Research in Robotics, General Structure of Robotic Mechanical Systems, Classification of Robots based on coordinate system, Classification of Robotics, Overview of robot subsystems, Components of Robot system-Manipulator, Controller, Power conversion unit etc, Specifications of robot. Commercially available Software Packages for Robot Simulation

UNIT II	KINEMATICS AND DYNAMICS	12

Kinematics**:** Homogeneous co-ordinate vector operations, Workspace , Forward Kinematics - forward solutions- Link coordinate frames, D-H matrix, Inverse Kinematics - Existence and Uniqueness of Solutions, Analytical Approaches - Reduction of Inverse Kinematics to Sub-problems, **Dynamics**: Newton's equation, Euler equations, Dynamic Modeling of Robotic Manipulators - Two DOF Planar Robot with Two Revolute Joints, Generalized Coordinates and Speeds, Velocities, Partial Velocities, Accelerations, Generalized Inertia Forces, Generalized Active Forces, Equations of Motion, Special Issues in Kane's Method

UNIT III	MECHANISMS ACTUATORS AND SENSORS	9

Some Popular **Mechanisms** - Four-bar Mechanism, Slider-crank Mechanism, Rack and Pinion, Cams and Cranks, Gear and Gear Trains, System Features, Kinematics and Kinetics, Serial Robots, Parallel Robots, Mechanical Structure, Joint Mechanisms.

Actuators: Electromagnetic Actuators, Fluid Power Actuators. Different types of grippers - Compressed Air, Vacuum, Hydraulic Fluid Power, Electrical Power & other methods of gripping. DC Motors, Stepper Motors, Servo Motor, Controlling of these motors.

UNIT IV	SENSORS	7

Sensors: Encoders - Rotary and Linear Incremental Encoders, Tachometer, Quadrature Encoders, Absolute Encoders. Analog Displacement Sensors, Force and Tactile Sensors, Ultrasonic Transponder, Accelerometers, Gyroscopes , proximity sensors, Infrared Sensors, touch slip sensor, laser range finder, Vision-based Sensors, Color-tracking Sensors, Sensor

Mounting Arrangement, Reading the Pulses in a Computer, Design of the Circuitry		
UNIT V	**AUTOMATION**	**8**
Structure of Automatic Industrial Systems, Relationship between the Robot Intelligence and the Product, Productivity of a Manufacturing Process, Kinematics and Control of Automatic Machines, Feedback Sensors, Transporting Devices, Feeding and Orientation Devices, Automatic Assembling, Inspection Systems, Welding _ Automation.		
		TOTAL : 45 PERIODS

OUTCOMES:

•	Understand the basic concepts of working of robot
•	Analyze the function of sensors in the robot
•	Apply program to use a robot for a typical application
•	Analyze Robots in different applications
•	Study the basic needs of automation of robots

TEXT BOOKS:

1.	Bruno Siciliano, Oussama Khatib (Eds.), _"Springer Handbook of Robotics"_, 2008,.
2.	Jorge Angeles, _"Fundamentals of Robotic Mechanical Systems Theory, Methods, and Algorithms"_ Second Edition, 2003, Springer-Verlag New York, Inc.,
3.	Edwin Wise, _"Robotics Demystified_", 2005, The McGraw-Hill Companies,

REFERENCES:

1.	*Thomas R. Kurfess, _"Robotics And Automation Handbook"_, CRC Press, 2004,*
2.	*_Robotics: "Appin Knowledge Solutions (Firm)"_, Infinity Science Press , 2007,*
3.	*J. Norberto Pires, Altino Loureiro and Gunnar Bölmsjo, _"Welding Robots - Technology, System Issues and Applications"_, Springer-Verlag 2006,*
4.	*J.G Proakis, "Digital Communication", 4th Edition, Tata Mc Graw Hill Company, 2001.*

17LOE004	PRINCIPLES OF VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the fabrication process of CMOS
- To understand the electrical properties of circuits
- To Study the design of combinational and sequential circuit
- To learn the testing of CMOS
- Analyse the verilog HDL

UNIT I	CMOS TECHNOLOGY	9

A brief History-MOS transistor, Ideal I-V characteristics, C-V characteristics, Non ideal IV effects, DC transfer characteristics - CMOS technologies, Layout design Rules, CMOS process enhancements, Technology related CAD issues, Manufacturing issues

UNIT II	CIRCUIT CHARACTERIZATION AND SIMULATION	9

Delay estimation, Logical effort and Transistor sizing, Power dissipation, Interconnect, Design margin, Reliability, Scaling- SPICE tutorial, Device models, Device characterization, Circuit characterization, Interconnect simulation

UNIT III	COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN	9

Circuit families –Low power logic design – comparison of circuit families – Sequencing static circuits, circuit design of latches and flip flops, Static sequencing element methodology- sequencing dynamic circuits – synchronizers

UNIT IV	CMOS TESTING	9

Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test – Design for testability – Boundary scan

UNIT V	SPECIFICATION USING VERILOG HDL	9

Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural gate level switch level modeling, Behavioral and RTL modeling, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop.

TOTAL : 45 PERIODS

OUTCOMES:

•	Understand the basics of CMOS circuits.
•	To understand the CMOS process technology.
•	To understand the concepts of designing VLSI subsystems.
•	Analyze the techniques of chip design using programmable devices.
•	Remember digital system using hardware description language.
TEXT BOOKS:	
1.	Weste and Harris: "CMOS VLSI DESIGN", (Third edition) Pearson Education, 2005
2.	J.Bhasker: "Verilog HDL primer", BS publication,2001
REFERENCES:	
1.	*Uyemura J.P: "Introduction to VLSI circuits and systems", Wiley 2002.*
2.	*D.A Pucknell & K.Eshraghian ,"Basic VLSI Design", Third edition, PHI, 2003*
3.	*M.J.S.Smith: "Application specific integrated circuits", Pearson Education, 1997*
4.	*Ciletti "Advanced Digital Design with the Verilog HDL", Prentice Hall of India, 2003*

17LOE005	APPLIED ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe the basic principles of electronics
- Identify the electronic components and their various applications on board
- Trace and analyze the electronic circuits
- Analyse the telecommunication systems
- To study the concepts of PIC microcontroller

UNIT I	ANALOG CIRCUITS	9

Overview on semiconductors, diodes, transistor switches, capacitors, fields and inductors – BJT amplifiers, JFET amplifiers, MOSFET amplifiers.

UNIT II	APPLICATION OF ANALOG CIRCUITS	9

Operational amplifiers, application of op-amps, active filters, 555 timer and oscillators – power amplifiers – power supplies.

UNIT III	DIGITAL CIRCUITS	9

Overview on logical circuits, logical operations, combinational and sequential circuits – display devices – converter circuits.

UNIT IV	ELECTRONIC COMMUNICATION SYSTEMS	9

Audio and video systems – noise – telecommunications – cable transmission, optical transmission – electronic control systems – process control systems.

UNIT V	MICROPROCESSORS AND MICROCONTROLLER	9

Input and output - microprocessors and programming - sensors and interfacing - The PIC microcontroller - circuit simulation – circuit construction.

TOTAL : 45 PERIODS

OUTCOMES:

- Acquires knowledge for building, testing and modifying simple circuits to complex circuits.
- Acquires the basic knowledge of electronics.
- Gains knowledge about the microprocessor and microcontroller.
- Understand the communication systems

•	Study the applications of electronic circuits
TEXT BOOKS:	
1.	Owen Bishop, “Electronics – Circuits and Systems”, 3 rd Edition, Newnes, 2010.
2.	Michael Tooley B A, “Electronic Circuits: Fundamentals and Applications”, 3 rd Edition, Newnes, 2006.
REFERENCES:	
1.	*John B.Peatman ,” Design with PIC Microcontrollers”, Prentice Hall, 1998.*

17LOE006	WIRELESS NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn the design of the wireless networks
- Understand the concepts of wireless networks layer
- To study the wireless protocols with TCP enhancement
- Analyse the wireless wide area network
- Understand the concepts of wireless networks and next generation networks

UNIT I	WIRELESS LAN	9

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

UNIT II	MOBILE NETWORK LAYER	9

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing.

UNIT III	MOBILE TRANSPORT LAYER	9

TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission.

UNIT IV	WIRELESS WIDE AREA NETWORK	9

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

UNIT V	4G NETWORKS	9

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Acquires knowledge about the latest 3G/4G and WiMAX networks and its architecture.

•	Understand the wireless network environment for any application using latest wireless protocols and standards.
•	Apply different types of applications for smart phones and mobile devices with latest network strategies.
•	Remember the concepts of networks layers and its applications.
•	Study the concepts and applications of WAN
TEXT BOOKS:	
1.	Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.(Unit I,II,III)
2.	Vijay Garg , “Wireless Communications and networking”, First Edition, Elsevier 2007.(Unit IV,V)
REFERENCES:	
1.	*Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, “3G Evolution HSPA and LTE for Mobile Broadband”, Second Edition, Academic Press, 2008.*
2.	*Anurag Kumar, D.Manjunath, Joy kuri, “Wireless Networking”, First Edition, Elsevier 2011.*
3.	*Simon Haykin , Michael Moher, David Koilpillai, “Modern Wireless Communications”, First Edition, Pearson Education 2013*

EEE:

17EOE001	MATLAB PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study basics of MATLAB programming
- To introduce MATLAB Functions and File processing
- To impart knowledge on MATLAB programming techniques
- To enable the students to plot the functions using MATLAB
- To develop skill in simple engineering applications development with MATLAB

UNIT I	INTRODUCTION	9

Basics of MATLAB programming–Variables and Arrays – initializing variables in MATLAB – Multidimensional Arrays – Sub arrays – Special Values–Displaying Output Data – Data Files – Scalar and Array Operations – Hierarchy of Operations.

UNIT II	FUNCTIONS & FILES	9

Built-in MATLAB Functions – Elementary Mathematical Functions – User Defined Functions – Binary I/O Functions – Advanced Function Programming – Introduction to MATLAB File Processing –, File Opening and Closing, Working with Data Files.

UNIT III	PROGRAMMING TECHNIQUES	9

Program Design and Development–Relational Operators and Logical Variables–Logical Operators and Functions–Conditional Statements–Loops–The Switch Structure–Debugging MAT LAB Program.

UNIT IV	PLOTTING OF FUNCTIONS	9

XY plotting functions– Subplots and Overlay plots–Plots With Error Bars– Special Plot types– Polar Plot– Interactive plotting– Putting Multiple Plots on the Same Page– Function Discovery– Regression– 3-D plots–Mesh and Surface Plots – Examples of MATLAB Applications– Problems-GUI.

UNIT V	ENGINEERING APPLICATIONS	9

Numerical Differentiation in single variable,: Higher derivatives, multiple variables, Newton-Cotes integration formulae, MATLAB functions for integration, Linear algebra in MATLAB, Gauss Elimination, LU decomposition and partial pivoting, Iterative methods: Gauss Siedel, Special Matrices: Tri- diagonal matrix algorithm- Engineering Applications-Optimization.

TOTAL :45 PERIODS

OUTCOMES: After successful completion of the course students able to

1.	Articulate importance of MATLAB software's in research by simulation work.
2.	Understand the Basics of MATLAB programming tools, functions and files that are essential in solving engineering problems.
3.	In-depth knowledge of providing programming techniques and plotting of functions.
4.	Understand the loops and Debugging of MATLAB programs.
5.	Understand the writing of programs & simulation in MATLAB for engineering problems.

TEXT BOOKS:

1.	Amos Gilat, “MATLAB An Introduction With Applications”, Wiley Publication, 6th edition, 2016.
2.	Rudra Pratap, “MATLAB 7”, Oxford University Press,2006.
3.	R.K. Bansal, A.K. Goel, “MATLAB and Its Applications In Engineering”, Dorling kindeslay Pvt. Lt, India, 2009.
REFERENCES:	
1.	*Stephen j. Chapman,"MATLAB programming for engineers ", FifthEducation,United States of America, 2015.*
2.	*Otto S.R, Denier J.P.,"An introduction to programming and numerical methods in MATLAB ", Springer verlag London limited,2005.*

17EOE002	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce Different types of Renewable Energy Sources
- To educate the students on principle of solar energy
- To educate the students on wind energy conversion systems
- To educate the students on biomass energy and cogeneration systems
- To impart knowledge on tidal energy and geothermal energy

UNIT I	INTRODUCTION	9

Energy Conservation and Energy Efficiency – Needs and Advantages, Different types of Renewable Energy Sources - Energy Resources Availability in World –Environmental aspects of energy utilization – Energy Conservation Act 2003 - Statistical Report on Renewable energy scenario in India - Applications.

UNIT II	SOLAR ENERGY	9

Solar Flat plate and concentrating collectors – Solar heating and cooling techniques –Solar desalination – Solar Pond – Solar cooker – Solar Drying – Solar pumping – Solar thermal power plant – Solar photo voltaic conversion – Solar cells – PV applications.

UNIT III	WIND ENERGY	9

Wind energy estimation in World and in India – Types of wind energy systems –Performance of Wind energy System– Details of wind turbine generator – Safety and Environmental Aspects.

UNIT IV	BIOMASS ENERGY	9

Biomass direct combustion – Biomass gasifier – Biomass: Types – Advantages &Drawbacks - Biogas plant – Ethanol production – Bio diesel – Cogeneration: steam turbine cogeneration systems, gas turbine cogeneration systems, reciprocating IC engine cogeneration systems, combined cycle cogeneration systems – Applications of Cogeneration in utility sector – Biomass applications.

UNIT V	OTHER RENEWABLE ENERGY SOURCES	9

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro –Geothermal energy – Fuel cell systems - Stirling Engines.

TOTAL :45 PERIODS

OUTCOMES:	After successful completion of the course students able to
1.	Understand about Solar Energy.
2.	Understand about Wind Energy.
3.	Understand about BioMass Energy.
4.	Understand about all renewable Energy Sources.

REFERENCES:

1.	*G.D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 1999.*
2.	*S.P. Sukhatme, "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.*
3.	*G.N. Tiwari, "Solar Energy – Fundamentals Design, Modelling and applications", Narosa Publishing House, New Delhi, 2002.*

17EOE003	ENERGY MANAGEMENT AND AUDITING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the forms of energy, energy auditing types and roles of energy managers
- To impart knowledge on energy costing and importance of power factor in energy cost
- to study metering for energy management & power quality analyses
- To educate the students on different lighting systems
- To study energy economics techniques

UNIT I	INTRODUCTION	9

Types & Forms of Energy - Primary / Secondary Energy Sources –EC Act 2003 – Energy Auditing: Types, Classifications, Deliverables, Barriers – Benchmarking - Roles & Responsibility of Energy Managers.

UNIT II	ENERGY COSTING, MONITORING &TARGETING	9

Data & Information Analysis – Cost / Energy Share Diagram – Data Graphing – Electricity Billing : Components & Costs – kVA – Need & Control – Determination of kVA demand & Consumption –Time of Day Tariff – Power Factor Basics – Penalty Concept for PF – PF Correction – Wheeling and Banking - Demand Side Management – comparison on unit cost of power cost from various sources – steam cost from different sources.

UNIT III	METERING FOR ENERGY MANAGEMENT & POWER QUALITY ANALYSES	9

Instruments Used in Energy systems: Load and power factor measuring equipment, Wattmeter, Flue gas analysis, Temperature and thermal loss measurements, Air quality analysis-Relationships between parameters-Units of measure-Typical cost factors- Utility meters – Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements – Net metering - Metering techniques and practical examples.

UNIT IV	LIGHTING SYSTEMS & COGENERATION	9

Concept of lighting systems - The task and the working space - Light sources - Ballasts - Luminaries - Lighting controls - Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques - Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

UNIT V	ECONOMICS	9

Energy Economics – Depreciation - Financial Analysis Techniques – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing – ESCO concept – CUSUM Technique – ESCO Concept – ESCO Contracts.

TOTAL : 45 PERIODS

OUTCOMES: After successful completion of the course students able to

1.	Analyse the energy data of industries.
2.	Can carry out energy accounting and balancing.

3.	Can suggest methodologies for energy saving.
4.	Design Lighting systems.
5.	Explain the concepts of Energy Economics.
TEXT BOOKS:	
1.	Energy Manager Training Manual (4Volumes) available at www.Energymanager training.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India. 2004.
2.	Amit K. Tyagi, "Handbook on Energy Audits and Management", TERI, 2003.
3.	Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, "Guide to Energy Managemen", Fifth Edition, The Fairmont Press, Inc., 2006.
REFERENCES:	
1.	*L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation", Hemisphere Publ, Washington, 1988.*
2.	*Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford,1981.*
3.	*Eastop T.D & Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, ISBN-0-582-03184, 1990.*
4.	*WC Turner;"Energy Management Handbook", Seventh Edition, (Fairmont Press Inc., 2007).*

17EOE004	SMARTGRID	L	T	P	T
		3	0	0	3

OBJECTIVES:

- To introduce the architecture of smart grid
- To study the smart grid communications and its measurement techniques
- To educate the students on load flow analysis in smart grid
- To impart knowledge on voltage stability in smart grid
- To introduce grid integration for renewable energy souces

UNIT I	SMART GRID ARCHITECTURE	9

Introduction – Comparison of Power grid with Smart grid – power system enhancement – communication and standards - General View of the Smart Grid Market Drivers - Stakeholder Roles and Function - Measures - Representative Architecture - Functions of Smart Grid Components-Wholesale energy market in smart grid-smart vehicles in smart grid.

UNIT II	SMART GRID COMMUNICATIONS AND ITS MEASUREMENT TECHNIQUES	9

Communication and Measurement - Monitoring, Phasor Measurement Unit (PMU), Smart Meters, Wide area monitoring systems (WAMS)- Advanced metering infrastructure- GIS and Google Mapping Tools.

UNIT III	LOAD FLOW ANALYSIS IN SMART GRID	9

Introduction to Load Flow Studies - Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods - Load Flow State of the Art: Classical, Extended Formulations, and Algorithms –Load flow for smart grid design-Contingencies studies for smart grid.

UNIT IV	SMART GRID STABILITY	9

Voltage Stability Analysis Tools – Voltage Stability Assessment Techniques-Voltage Stability Indexing-Application and Implementation Plan of Voltage Stability in smart grid-Angle stability assessment in smart grid-Approach of smart grid to State Estimation-Energy management in smart grid.

UNIT V	GRID INTEGRATION WITH RENEWABLE ENERGY	9

Renewable Energy Resources-Sustainable Energy Options for the Smart Grid-Penetration and Variability Issues Associated with Sustainable Energy Technology-Demand Response Issues-Electric Vehicles and Plug-in Hybrids-PHEV Technology-Environmental Implications-Storage Technologies-Grid integration issues of renewable energy sources.

TOTAL :45 PERIODS

OUTCOMES:	After successful completion of the course students able to
1.	Explain the concepts and design of Smart grid.
2.	Explain the various communication and measurement technologies in smart grid.
3.	Perform load flow in smart grid.
4.	Analyze the stability of smart grid.
5.	Integrate the renewable energy resources and storages with smart grid.

TEXT BOOKS:

1. Stuart Borlase“Smart Grid: Infrastructure,Technologyand Solutions”, CRCPress2012.

2.	JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, "Smart Grid: Technologyand Applications",Wiley2012.
REFERENCES:	
1.	*VehbiC.Güngör,DilanSahin,TaskinKocak,SalihErgüt,ConcettinaBuccella,CarloCecati, and Gerhard P. Hancke, "Smart Grid Technologies: CommunicationTechnologiesandStandards",IEEETransactionsOn Industrial Informatics, Vol.7,No.4, November2011.*
2.	*Xi Fang,SatyajayantMisra, Guoliang Xue,andDejunYang"Smart Grid – TheNewand ImprovedPowerGrid: ASurvey",IEEETransactiononSmart Grids,vol.14,2012.*

MECH:

17MOE001	DISASTER MANAGEMENT AND MITIGATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- Prevention is to reduce the risk of being affected by a disaster.
- To illustrate different options for disaster prevention and emergency management.

UNIT I INTRODUCTION TO DISASTER **9**

Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster-Dimensions & Scope of Disaster Management - India's Key Hazards –Vulnerabilities - National disaster management framework - Disaster Management Cycle.

UNIT II NATURAL DISASTER **9**

Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT III ANTHROPOGENIC DISASTER **9**

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

UNIT IV APPROACHES IN DISASTER MANAGEMENT **9**

Pre-disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan -Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief – Assessment surveys. Post Disaster stage – Rehabilitation - Social Aspect - Economic Aspectand Environmental Aspect.

UNIT V DISASTER MITIGATION **9**

Meteorological observatory - Seismological observatory - Hydrology Laboratory and Industrial Safety inspectorate. Technology in Disaster Management -Emergency Management Systems (EMS) in the Disaster Management Cycle -Remote Sensing and Geographic Information Systems (GIS) in Disaster Management.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Understand basic concepts of disaster and hazards.
2.	Understand the various natural disasters.
3.	Understand the various manmade disasters.
4.	Understand the disaster management principles.
5.	Understandthe modern techniques used in disaster mitigation andmanagement.

TEXT BOOKS:

1.	Sharma.S.R, **"Disaster management",** A P H Publishers, 2011.
2.	Gupta.H.K, **"Disaster Management",** University Press, India, 2003.
3.	D. B. N. Moorthy, **"Disaster Management: Text and Case studies",**Deep and Deep Publications, 2007.

REFERENCES:	
1.	*VenuGopal Rao. K, "**Geoinformatics for Disaster Management",** ManglamPublishers and Distributors, 2010.*
2.	*Singh. R. B, **"Natural Hazards and Disaster Management: Vulnerability andMitigation",** Rawat Publications, 2006.*
3.	*Gupta. M. C, **"Manuals on Natural Disaster management in India",** NationalCentre for Disaster Management, IIPA, New Delhi, 2001.*
4.	*Rajan Kumar Sahoo, Tilotama Senapati, **"Management and Mitigation of Natural Disasters"**, Regal Publication, 2013.*
5.	*Palanivel K., Saravanavel J., Gunasekaran S., **"Disaster Management"**, Allied Publishers Pvt. Ltd., 2015*

17MOE002	ENVIRONMENTAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- To develop a strategy for the improvement of quality of life;
- To prevent and solve environmental problems;
- To warn threats and identify opportunities;

UNIT I	NATURE AND SCOPE OF ENVIRONMENTAL PROBLEMS	9

Environment and sustainable development – Natural and human environmental disturbances – Global warming –acid rain – ozone depletion – effects and control - climate change conventions – Kyoto protocol – India‘s efforts for Environmental protection – Public policy and role of NGO‘s

UNIT II	WATER POLLUTION AND CONTROL	9

Fresh water and its pollution – Natural processes – sources and pollutants – pollution due to industrial, agricultural and municipal wastes – effects on streams - limitations of disposal by dilution – BOD consideration in streams – Oxygen Sag Curve – Strategies for sustainable water management: Water management – Marine environment and its management – Water acts.

UNIT III	AIR AND NOISE POLLUTION	9

Pollutant emissions - sources and sink – effects of air pollution on human health, vegetation and climate– Global effects – prevention and control of air pollution – Control of particulates – Air pollution survey sand sampling – Air quality monitoring - Air Act – Management of air pollution – Sound level – Effect of noise on people – Environmental noise control- noise pollution rules 2000.

UNIT IV	SOLID WASTE MANAGEMENT AND SOIL POLLUTION	9

Sources – Characteristics – Quantities – Collection methods – Processing and disposal techniques – Onsite Handling, storage and processing – sanitary landfill – Incineration and pyrolysis – Composting – aerobic and anaerobic of compositing – Recycling and reuse of solid wastes – Hazardous wastes – Definition – Sources & types only – Integrated system for waste management – The Basel convention Land use and degradation – Management problems – strategies for sustainable land management – soil pollution –wetland conservation.

UNIT V	ENVIRONMENTAL MANAGEMENT SYSTEM	9

Terminology – installation and common motives of EMS – Environmental standards – ISO 14000 (Series) – basicprinciples – Environmental Audit – Environmental Impact assessment - Trade rules and environmental protection– Practices For Waste Minimisation And Cleaner Production.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Understand the concept of sustainable development, climate change and roles of NGO’s.
2.	Understand the sources and management of Water pollution.
3.	Understand the causes of Air and Noise pollution and various management techniques.
4.	Understand solid waste and environmental protection legislations.
5.	Understand the various Environmental Standards.

TEXT BOOKS:

1.	N.K.Uberoi, **“Environmental Management”,** Excel Books, New Delhi(2006).

2.	Mallick A., **"Environmental Science and Management",** 1st Edition, Viva Books, 2014.
3.	Prakash Talwar, **"Environmental Management",**Isha Books,2006.
REFERENCES:	
1.	*S. Vigneahwaran,M.Sundaravadivel and D.S.Chaudhary,**"EnvironmentalManagement"**, SCITECH Publications(India) Pvt.Ltd, Chennai & Hyderabad (2004).*
2.	*Mackenzie Davis, David Cornwell., "**Introduction to Environmental Engineering"**, 4th Edition, McGraw-Hill Companies Incorporated, 2008.*
3.	*Mary K. Theodore, Louis Theodore, "**Introduction to Environmental Management**",1st Edition, CRC Press, 2009.*
4.	*P.S. Bhushana Rao., **"Environment Management"**, Deep & Deep Publishers, 2007.*
5.	*T.V Ramachandra,Vijay Kulkarni, **"Environmental Management",** TERI Press New Delhi, 2009.*

17MOE003	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- Develop composites and structures in this material that are high-performance, cost-effective and ecological
- Basic principles of composite effects, interactions at an interface, the properties

UNIT I	INTRODUCTION TO REINFORCEMENT AND MATRIX INTERFACE	12

Reinforcement – Fibres – Glass fibre, Aramid fibre, Carbon fibre, boron fibre – Fabrication – Properties – Applications – Comparison of fibres – Particulate and whisker reinforcements. Matrix materials – Properties.Wettability – Effect of surface roughness – Interfacial bonding – Methods for measuring bond strength.

UNIT II	POLYMER MATRIX COMPOSITES	8

Types – Processing – Thermal matrix composites – Hand layup and spray technique, filament winding, Pultrution, resin transfer moulding, autoclave moulding – Thermoplastic matrix composites – Injection moulding, film stacking – Diaphragm forming – Thermoplastic tape laying. Glass fibre/polymer interface. Mechanical properties – Fracture. Applications.

UNIT III	METAL MATRIX COMPOSITES	8

Types. Important metallic matrices. Processing – Solid state, liquid state, deposition, insitu. Sic fibre / Titanium interface. Mechanical properties. Applications.

UNIT IV	CERAMIC MATRIX COMPOSITES	8

Ceramic matrix materials – Processing – Hot pressing, liquid infiltration technique, Lanxide process, insitu chemical reaction techniques – CVD, CVI, sol-gel process. Interface in CMCs. Mechanical properties – Thermal shock resistance – Applications.

UNIT V	GEOMETRICAL ASPECTS, FATIGUE AND CREEP IN COMPOSITE MATERIALS	9

Unidirectional laminas – Volume fraction and weight fraction – Woven roving, in-plane random fibres – Fibre length and fibre orientation distribution – Voids – Fibre orientation during flow.

Fatigue – S-N curves – Fatigue behaviours of CMCs – Fatigue of particle and whisker reinforced composites – Hybrid composites – Thermal fatigue – Creep.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Analyse the fiber reinforced Laminate for optimum design.
2.	Understand the concepts of Polymer Matrix Composites.
3.	Understand the different Metal Matrix Composites properties and manufacturing process.
4.	Understand the different Ceramic Matrix Compositesproperties.
5.	Apply Fatigue and creep theory to study and analyse the Mechanical behaviour of Composites.

TEXT BOOKS:

1.	Krishnan K Chawla, "**Composite Materials Science and Engineering**", Springer, 2001.
2.	Mathews F L and Rawlings R D, **"Composite Materials: Engineering and Science",** CRC Press and Woodhead Publishing Limited, 2002.
3.	Derek Hull, "**An introduction to Composite Materials**", Cambridge Univ. Press, 1988.

REFERENCES:	
1.	***"Handbook of Composites"*** *– American Society of Metals, 1990*
2.	*Gibson, R.F., "**Principles of Composite Material Mechanics",** Second Edition, McGraw-Hill, CRC press in progress, 1994.*
3.	*1. Autar K. Kaw, **"Mechanics of Composite Materials",** Second Edition, CRC Press,2006*
4.	*Halpin, J.C**., "Primer on Composite Materials, Analysis",** Technomic Publishing Co., 1984.*
5.	*Mallick, P.K. and Newman, S., **"Composite Materials Technology: Processes and Properties"**, Hansen Publisher, Munish, 1990.*

17MOE004	RENEWABLE ENERGY SOURCES AND TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- Enable understanding of renewable energy in the broadest terms
- Review the issues affecting effective deployment of renewable energy systems.
- Provide an over view of the different renewable energy technologies

and their applications

UNIT I	INTRODUCTION	9

World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Environment - Economy - Energy and Sustainable Development, Energy planning. Reserves of Energy resources, Renewable energy resources - potentials -achievements – applications. Technical and social implications, issues in grid integration of power from renewable energy sources, Comparison between different Renewable energy sources.

UNIT II	SOLAR ENERGY	9

Basic concepts, Solar radiation , Measurement, Solar thermal systems ,Flat plate and concentrating collectors, Solar passive space, Solar heating and cooling techniques, Solar desalination, Solar dryers, Solar furnaces, Solar pumping, Solar greenhouse, Solar thermal electric power plant, Photo-voltaics, p-n junctions. Solar cells, PV systems, Standalone, Grid connected solar power satellite, Calculation of energy through photovoltaic power generation, Hybrid systems, Solar Engines: Stirling, Brayton engines.

UNIT III	WIND ENERGY	9

Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Windmill rotors, Horizontal axis and Vertical axis rotors, Determination of torque coefficient, Induction type generators, Working principle of wind power plant and Site selection.

UNIT V	BIOMASS ENERGY	9

Biomass – usable forms- composition- fuel properties – applications, Biomassresources, Biomass conversion technologies - direction combustion - pyrolysis –gasification -anaerobic digestion, Bio-ethanol and Biodiesel Production -Economics - Recent developments.Energy farming, Biogas technology – Domestic biogas plants, Community and institutional biogas plants – design consideration –applications.

UNIT V	OTHER RENEWABLE ENERGY SOURCES	9

Tidal energy – Wave energy – Open and closed OTEC Cycles – small hydro –Geothermal energy – Social and environmental aspects.Fuel cell technology -types, principle of operation – applications.Hydrogen energy production – Storage– transportation – utilization.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Emphasis the current energy status and role of renewable energy sources.
2.	Understand the concepts of various aspects of Solar energy and utilization.
3.	Understand the various aspects of Wind energy and utilization.
4.	Familiarize various aspects of Biomass energy and utilization.
5.	Understand various other renewable energy sources.

TEXT BOOKS:

1.	Ashok Desai V, **"Non-Conventional Energy**", Wiley Eastern Ltd, 1990
2.	Mittal K.M, **"Non-Conventional Energy Systems"**, Wheeler Publishing Co. Ltd, 1997.
3.	Ramesh R, Kurnar K.U, **"Renewable Energy Technologies"**, Narosa Publishing House, New Delhi, 1997.
REFERENCES:	
1.	*Freris, L.L, **"Wind Energy Conversion systems",** Prentice Hall, UK, 1990*
2.	*Veziroglu.T.N, **"Alternative Energy Sources"**, Vol 5 and 6, McGraw-Hill, 1978.*
3.	*S.P. Sukhatme, **"Solar Energy"**, Tata McGraw Hill, New Delhi, 1997.*
4.	*Kothari P, K C Singal and Rakesh Ranjan, "**Renewable Energy Sources and Emerging Technologies"**, PHI Pvt. Ltd.,New Delhi, 2008.*
5.	*G.D. Rai, **"Non Conventional Energy Sources",** Khanna Publishers, New Delhi, 1999.*

17MOE005	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- Protecting the intellectual property rights of individuals or companies, IP law encourages economic growth.
- Treating intellectual property as largely equal to physical property, it impresses upon economic culture the importance and sanctity of creativity and innovation
- Allowing the owners of intellectual property to capitalize on what they create, provides financial incentives for new, creative ideas.

UNIT I	INTRODUCTION	9

Background and Concepts - Brief History of - Institutions - Investing in Knowledge-Market Failures in Knowledge - IP, Public Sponsorship & Prize - IP Law Basics Meansof IP Protection - Patents - Copyrights - Trade Secrets - Others - IP and Antitrust Property.

UNIT II	THE IMPACTS OF IP ON THE PLANT/SEED INDUSTRY	9

The logic of IP - Patenting vs. Company Secrets - Plant Patent Timeline EmpiricalEvidence in Plants: A Puzzle - Optimal Design of IP - Scarce Ideas vs.Non-scarce ideas - Policy Levers in IP Design - Breadth - Length - Required InventiveSteps - Optimal Size of Reward and Structure - Entry Cost Regime HorizontalCompetitionRegime- Economic Effects of Exemptions.

UNIT III	PROTECTING CUMULATIVE INNOVATIONS	9

Three Types of Cumulativeness - Basic v. Applied Research - Research Tool QualityLadders - Policy Levers and Prospecting - Open Source.

UNIT IV	LITIGATION AND ENFORCEMENT	9

Litigation and Enforcement - Remedies for Infringement - How they matter Enforcementof IP by Technical Means - Limited Sharing of Copyrighted Works TechnologyTransfer, Diffusion, and Adoption - Networks and Network Effects Conceptsand Issues - Direct vs. Indirect Network Effects - Physical Networks BusinessStrategies- System Competition vs. Standard Competition

UNIT V	INNOVATION TODAY	9

A Private-Public Partnership - University Innovation - Government Grant Process MixedPrivate-Public Incentives - Innovation in the Global Economy – WhoPatents and Where - Trade Policy and Treaties - Paris Convention, BerneConvention, TRIPS - PCT and WIPO - National Treatment and Efficient Protection -Harmonization - Externalities and International Cooperation

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Understand the basics of intellectual property.
2.	Understand the impacts of IP on Plants/Seed industry
3.	Understand protecting methods of innovations.
4.	Understand the concept of litigation and enforcement.
5.	Learn Various treaties and acts on Innovation.

TEXT BOOKS:

1.	Christopher May, Susan K. Sell, **"Intellectual Property Rights",** Lynne Rienner Publishers. 2005
2.	N. K. Acharya,**"Text Book on Intellectual Property Rights"** Asia Law House, 2010.
3.	2. R Radhakrishnan and S. Balasubramanian, **"Intellectual Property Rights: Text and Cases"**, First Edition, Excel books New Delhi, 2008

REFERENCES:	
1.	*Subbaram, N. R. "**Handbook Of Indian Patent Law And Practice**", S. Viswanathan Printers And Publishers Pvt. Ltd., 1998.*
2.	*N.S. Gopalakrishnan & T.G. Agitha, **"Principles Of Intellectual Property**". 2nd Edition, Eastern Book Company, 2014.*
3.	***3.** Tanya Frances Aplin, Jennifer Davis, **"Intellectual Property Law: Text, Cases and Materials",** 3rd Edition, Oxford University Press, 2017.*
4.	*4. Neeraj Pandey, Khushdeep Dharni, **"Intellectual Property Rights",** PHI Learning, 2014.*
5.	*5. Rachna Singh Puri, Arvind Viswanathan**, "Practical Approach to Intellectual Property Rights",** I. K. International Publishing House Pvt. Ltd. Delhi 2009.*

17MOE006	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- To make the students understand the basic concepts of managerial economics.
- To make the students understand the basics of demand, supply and related concepts.
- To make the students understand various production and cost concepts.

UNIT I	INTRODUCTION	9

Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis.

UNIT II	DEMAND & SUPPLY ANALYSIS	9

Demand - Types of demand - Determinants of demand - Demand function – Demand elasticity –Demand forecasting - Supply – Determinants of supply - Supply function - Supply elasticity.

UNIT III	PRODUCTION AND COST ANALYSIS	9

Production function - Returns to scale - Production optimization - Least cost input - Isoquants – Managerial uses of production function.
Cost Concepts- Cost function - Determinants of cost - Short run and Long run cost curves Cost Output Decision - Estimation of Cost.

UNIT IV	PRICING	9

Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.

UNIT V	CAPITAL BUDGETING	9

Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Understand the basics of managerial economics and decisions.
2.	Understand the concepts of demand and supply.
3.	Understand various functions of production and cost analysis concepts.
4.	Understand various pricing techniques.
5.	Understand the concept of capital budgeting.

TEXT BOOKS:

1.	R. Kesavan, C.Elanchezhian, T. Sunder selvin, **"Engineering Economics And Financial Accounting"**, laxmi publications (p) Ltd. First edition, 2005.
2.	M. Kasi Reddy, S. Saraswathy, **"Managerial Economics and Financial Accounting", Prentice Hall of India Private Limited,2007.**
3.	McGuigan, Moyer and Harris, **'Managerial Economics**; Applications, Strategy and Tactics', Thomson South Western, 10th Edition, 2005.

REFERENCES:

1.	*Salvatore Dominick, '**Managerial Economics in a global economy**'. Thomson South Western, 4th Edition, 2001.*
2.	*Prasanna Chandra. '**Fundamentals of Financial Management**', Tata Mcgraw Hill*

	Publishing Ltd., 4th edition, 2005.
3.	*N. Samuelson. Paul A and Nordhaus W.D**., 'Economics'**, Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.*
4.	*Paresh Shah, '**Basic Financial Accounting for Management**', Oxford University Press, N ew Delhi, 2007.*
5.	*6. R. Panneerselvam, "**Engineering Economics**", PHI Learning PVT. Ltd. Delhi. 2013.*

17MOE007	MATERIAL CHARACTERIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- To provide an introduction to materials characterization and its importance.
- To discuss different types of characterization techniques and their uses.
- To review the topic of crystal structure and how structures can be determined using diffraction methods

UNIT I	METALLOGRAPHIC TECHNIQUES	9

Macro examination – applications, Metallurgical microscope – principle, construction and working, metallographic specimen preparation, optic properties – Magnification, numerical aperture, resolving power, depth of focus, depth of field, different light sources lenses aberrations and their remedial measures, various illumination techniques-bright field , dark field, phase contrast polarized light illuminations, interference microscopy, high temperature microscopy, quantitative metallography – Image analysis.

UNIT II	X-RAY DIFFRACTION TECHNIQUES	9

Crystallography basics, reciprocal lattice, X-ray generation, absorption edges, characteristic spectrum, Bragg's law, Diffraction methods – Laue, rotating crystal and powder methods. Stereographic projection. Intensity of diffracted beams – structure factor calculations and other factors. Cameras - Laue, Debye-Scherer cameras, Seeman – Bohlin focusing cameras. Diffractometer – General feature and optics, proportional, Scintillating and Geiger counters

UNIT III	ANALYSIS OF X-RAY DIFFRACTION	9

Line broadening, particle size, crystallite size, Precise parameter measurement, Phase identification, phase quantification, Phase diagram determination X-ray diffraction application in the determination of crystal structure, lattice parameter, residual stress – quantitative phase estimation, ASTM catalogue of Materials identification.

UNIT IV	ELECTRON MICROSCOPY	9

Construction and operation of Transmission electron microscope – Diffraction effects and image formation, specimen preparation techniques, Selected Area Electron Diffraction, electron-specimen interactions, Construction, modes of operation and application of Scanning electron microscope, Electron probe micro analysis, basics of Field ion microscopy (FIB), Scanning Tunneling Microscope (STM) and Atomic Force Microscope(AFM).

UNIT V	CHEMICAL AND ADVANCED THERMAL ANALYSIS	9

Surface chemical composition- Mass spectroscopy and X-ray emission spectroscopy (Principle and limitations) – Energy Dispersive Spectroscopy- Wave Dispersive Spectroscopy- Quadrapole mass spectrometer. Electron spectroscopy for chemical analysis (ESCA), Ultraviolet Photo Electron Spectroscopy (UPS), X ray Photoelectron Spectroscopy (XPS), Auger Electron Spectroscopy (AES), Electron Energy Analysers, Secondary ion mass spectrometry – Applications. Unit meshes of five types of surface nets – diffraction from di-periodic structures using electron, Low Energy Electron Diffraction (LEED), Reflection High Energy Electron Diffraction (RHEED)-TGA.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Understand principles of various metallographic techniques**.**
2.	Understand X-ray diffraction techniques.
3.	Analyse X-ray diffraction techniques.
4.	Understand the working principles of various electron microscopic techniques.

5.	Understand the principles of different chemical and advanced thermal analysis methods.
TEXT BOOKS:	
1.	Cullity, B. D.,"**Elements of X-ray diffraction",** 3rd Edition, Addison-Wesley Company Inc., New York, 2000.
2.	Phillips V A, **"Modern Metallographic Techniques and their Applications"**, Wiley Eastern India Ltd.,1971.
3.	Khangaonkar P R **"An Introduction to Material Characterization",**Penram INTL. Publishing(INDIA) Pvt. Ltd., First edition (2008)
REFERENCES:	
1.	*Brandon D. G, "**Modern Techniques in Metallography"**, Von Nostrand Inc. NJ, USA,1986.*
2.	*Thomas G., **"Transmission electron microscopy of metals",** John Wiley, 1996.*
3.	*Weinberg, F., **"Tools and Techniques in Physical Metallurgy"**, Volume I & II, Marcel and Decker, 1970.*
4.	*Haines, P.J.**," Principles of Thermal Analysis and Calorimetry",** Royal Society of Chemistry (RSC), Cambridge, 2002.*
5.	*D. A. Skoog, F. James Leary and T. A. Nieman, **"Principles of Instrumental Analysis"**, Fifth Edition, Saunders Publishing Co., 1998.*

17MOE008	GLOBAL WARMING AND CLIMATE CHANGE	L	T	P	C
		3	0	0	3

OBJECTIVES:

Upon completion of this course, the students will be able

- To develop the familiarity and knowledge of the issue of global warming and related issues
- To make the aware of the challenges and obstacles that are faced when addressing global warming
- encourage to develop ideas and solutions to global warming

UNIT I	EARTH'S CLIMATE SYSTEM	9

Role of ozone in environment-ozone layer-ozone depleting gases - Green House Effect, Radiative Effects of Greenhouse Gases - The Hydrological Cycle - Green House Gases and Global Warming – Carbon Cycle.

UNIT II	ATMOSPHERE AND ITS COMPONENTS	9

Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere-Composition - Atmospheric stability-Temperature profile of the atmosphere - Lapse rates –Temperature inversion-effects of inversion on pollution dispersion.

UNIT III	IMPACTS OF CLIMATE CHANGE	9

Causes of Climate change : Change of Temperature in the environment - Melting of ice Pole-sea level rise-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	OBSERVED CHANGES AND ITS CAUSES	9

Climate change and Carbon credits- Initiatives in India - Kyoto Protocol-Intergovernmental Panel on 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 .

UNIT V	CLIMATE CHANGE AND MITIGATION MEASURES	9

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 - Adaptation funding-Key Mitigation Technologies – 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.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Understandthe earth's climate system.
2.	Understand the various layers and composition of earth atmosphere.
3.	Understand the impacts of Climate Change on various sectors.
4.	Know various observed climate changes and its causes.
5.	Understand the concept of mitigation measures against global warming.

TEXT BOOKS:

1.	Dash Sushil Kumar,**"*Climate Change – An Indian Perspective*"**, Cambridge

	University Press (India Pvt. Ltd), 2007.
2.	J. Houghton, **"Global Warming The Complete Briefing"**,Cambridge Univ. press,2015.
3.	7. Jerry Silver, **"Global Warming and Climate Change Demystified",**McGraw-Hill,2008.
REFERENCES:	
1.	*Watson, Robert T., Marufu C. Zinyowera, and Richard H. Moss.* ***"Impacts, adaptations and mitigation of climate change: scientific-technical analyses****. 1996.*
2.	*J.M. Wallace and P.V. Hobbs,****"Atmospheric Science"****, Elsevier / AcademicPress 2006.*
3.	*Jan C. van Dam, Impacts of* ***"Climate Change and Climate Variability on Hydrological Regimes",*** *Cambridge University Press, 2003.*
4.	*T. M. Letcher* ***"Climate Change:Observed impacts on planet Earth",****Elsevier, 2015*
5.	***8.*** *Farmer, G. Thomas, Cook****, John,"Climate Change Science: A Modern Synthesis",****Springer Netherlands, 2013.*

ONE CREDIT COURSES

17SOC001	TOOLS FOR MACHINE LEARNING	L	T	P	C
		3	0	0	1

OBJECTIVES:

- To gain knowledge on basics of R programming
- To learn about functions, lists, packages in R programming
- To get introduced to the basics of WEKA

UNIT I	INTRODUCTION TO R	5

R Overview - R Installation - R Basic Syntax - R datatypes - R Variables , constants and Vectors - R operators - R Conditional Statements.

UNIT II	R PROGRAMMING	5

R Functions - R lists - R Arrays - R packages - R Programming Excel and Binary Files - R Object oriented - R Strings - R Date and Time - R Input and Output.

UNIT III	INTRODUCTION TO WEKA	5

Introduction – Interface - Data Format - ARRF File format - Pre-processing - Building Classifiers – Clustering.

TOTAL : 15PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Know the basic concepts of R programming.
2.	Apply object oriented concepts to real time applications.
3.	Understand the WEKA tool.

REFERENCES:

1.	*R Tool- w3schools.in.*
2.	*2. Bostjan Kaluza "Instant WEKA".*

17SOC002	MICROSOFT OFFICE SUITE	L	T	P	C
		3	0	0	1

OBJECTIVES:

- To be familiar with the working of MS WORD
- To understand the features Of MS EXCEL
- To learn about basics of creating presentations using microsoft power point tool

UNIT I MS WORD **5**

Introduction to Microsoft XP Basics and the Internet - Introduction to Microsoft Word 2013 - Working with Documents and the Keyboard -Navigating Through a Word Document - Basic Text Editing - Text Formatting - Paragraph Formatting- More Ways to Format Text and Paragraphs - Style Formatting - Page Formatting – Templates -Working With Graphics and Pictures – Tables - Desktop Publishing - Long Documents - Technical Documents - Mail Merge - Proofing, Printing, and Publishing - Comparing, Merging, and Protecting Documents - Customizing and Expanding Word.

UNIT II MS EXCEL **5**

Introduction to MS Excel 2013 - Navigating Excel 2013 - Worksheets and Workbooks - Entering Information into MS Excel 2013 -Introduction to Working with Cells, Rows, and Columns - Formatting Data and Cells - Formatting Rows and Columns - Editing Cells, Rows, Columns, and Worksheets - Introduction to Formulas and Calculations - Working with Formulas and Functions - Maintaining Worksheets - The What-If Analysis - Adding Images and Graphics - Charts and Diagrams - Creating Data Lists - Managing Data - Pivot Tables and Charts - Printing Worksheets and Workbooks – Templates - Protecting, Saving, and Sharing Workbooks.

UNIT III MS POWERPOINT **5**

Introduction to Microsoft Power Point 2013- The Basics of Creating Presentations - Applying Themes and Layouts to Slides - Working with Objects - Entering, Editing, and Formatting Text - Working in Outline View - Proofing Presentations - Inserting Pictures, Graphics, Shapes, and Other Things - Inserting Tables into Presentations - Charts and SmartArt - Adding Sound and Video - Adding Transitions and Animation - Master Slides - Printing and Running Slide Shows - Saving, Sharing, and Exporting Presentations.

TOTAL : 15 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Create document, formatting, inserting tables,mail merging using MS-word.
2. Format rows and columns, calculations, working with formulas, inserting chats and diagrams, protecting worksheets using MS-Excel.
3. Prepare slides, applying themes, inserting picture, adding sound effects, animation etc using MS-Powerpoint.

REFERENCES:

1. *Beth Melton, Mark Dodge and Echo Swinword, "Microsoft Office Professional 2013 Step by Step".*

17SOC003	PROJECT USING ARDUINO	L	T	P	C
		3	0	0	1

OBJECTIVES:

- Be familiar with the basics of arduino
- Learn about digital and analog inputs
- Understand the controlling of servo motor with joy stick-indexing

UNIT I	INTRODUCTION TO ARDUINO	5

Arduino: Introduction-Understanding electronics elements (Resistors, Capacitors, Transistors, Relays etc.)-LEDs-Blinking of ODD and EVEN states of LEDs- Traffic Light System-Serial Monitoring-Controlling of LEDs from Computers-Reading analog and digital inputs.

UNIT II	DIGITAL AND ANALOG INPUTS	5

Digital Inputs: Controlling LED using push button-Switching ON a relay.

Analog Inputs: Controlling a DC Motor and PWM -Changing the brightness of LEDs using potentiometers-LCD Displays-Displaying a Message in LCD Screen- Screen Navigation on LCD-Displaying the room temperature using LM 35 temperature sensor.

UNIT III	SERVO MOTORS	5

Servo Motors: Controlling Servo Motor with Joy Stick-Indexing of Servo Motor-Direction Control of Servo Motor-Synchronizing 2 Servo Motors.

TOTAL : 15 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Know the working principles of arduino system,
2.	Understand the usage of temperature sensor.
3.	Analyze the applications of servo motor.

REFERENCES:

1.	*Simon Monk, "Programming Arduino".*
2.	*Brian Evans, "Beginning Arduino Programming.*

17SOC004	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	1

OBJECTIVES:	
•	To get introduced to advanced methods and tools of project management
•	To learn about various risk management techniques
•	To obtain knowlwdge about organizational and human aspects in Project Organizations

UNIT I	INTRODUCTION TO CPM/PERT TOOLS	5

Introduce advanced methods and tools of project management: CPM/PERT - Design Structure Matrix - System Dynamic.

UNIT II	RISK MANAGEMENT	5

Critical Chain - Discrete Event Simulation - Earned Value Management - Understand realistic application of methods (strengths, limitations) and strategic issues - Industry Examples (interspersed) - Case Studies - Risk Management - Real Options in Projects.

UNIT III	PROJECT ORGANIZATION	5

Obtain an appreciation for organizational and human aspects in - Project Organizations - Program Management - managing multiple projects in parallel -Obtain an appreciation for organizational and human aspects in - Project Organizations - Program Management - managing multiple projects in parallel.

TOTAL : 15 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Understand the CPM/PERT tools.
2.	Apply the risk management to various kinds of projects.
3.	Manage multiple projects simultaneously.

REFERENCES:	
1.	*Bob Hughes and Mike Cotterell, "Software Project Management".*

17SOC005	LINUX ADMINISTRATION	L	T	P	C
		3	0	0	1

OBJECTIVES:

- To understand the basics of Linux
- To Learn about various Filesystem Types
- To be familiar with User File Management

UNIT I	INTRODUCTION TO OPEN SOURCE	5

UNIX, Linux and Open Source-Duties of the System Administrator-Super users and the Root Login-Sharing Superuser Privileges with Others (su and sudo Commands)-TCP/IP Networking Fundamentals-Online Help.

UNIT II	FILE SYSTEM	5

Filesystem Types-Conventional Directory Structure-Mounting a File System-The /etc/fstab File-Special Files (Device Files)-I nodes-Hard File Links-Soft File Links-Creating New File Systems with mkfs-The lost+found Directory-Repairing File Systems with fsck-The Journaling Attribute-File and Disk Management Tools.

UNIT III	USER MANAGEMENT	5

Setting Policies -User File Management -The /etc/passwd file - The /etc/shadow file -The /etc/group file -The /etc/gshadow file -Adding Users -Modifying User Accounts - Deleting User Accounts -Working with Groups -Setting User Environments -Login Configuration File-Backup Concepts and Strategies -User Backups with the tar Command -System Backup Options -The xfsdump and xfsrestore Commands.

TOTAL : 15 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Work on the open source systems.
2. Manage file systems in the open source.
3. Administrate user environments.

REFERENCES:

1. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley "UNIX and Linux System Administration Handbook".

17SOC006	NETWORK SIMULATION TOOLS	L	T	P	C
		3	0	0	1

OBJECTIVES:

- To get introduced to simulation of computer networks
- To be familiar with the implementation of event simulation
- To learn about mobile adhoc networks

UNIT I INTRODUCTION TO SIMULATION TOOLS

Simulation of computer networks – Computer networks and Layering concepts – System modeling – basics of computer network simulator – Time depended simulation – Example – a Single Channel Queuing system.

UNIT II IMPLEMENTATION OF EVENT SIMULATION

Introduction to Network simulator – Basic Architecture – Installation – Directories and Covention – Running NS2 Simulator – Linkage between OTcl and C++ in NS2-Implementation of discrete event Simulation in NS2 – NS2 Simulation concept – Event and Handlers – Scheduler – Simulator – Network Objects : Creation, Configuration , Packet Forwarding – Node as Router.

UNIT III MOBILE ADHOC NETWORKS

Link and Buffer Management – Packet, Packet header and Header Format – Data Payload – Customizing packets – TCP – UDP-Wireless mobile adhoc networks – Developing new module – Post simulation processing , Debugging , tracing and result compilation – Case study.

TOTAL : 15 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Know the concepts of network simulator.
2. Install NS2, working on the simulation environment, implement discrete event simulation.
3. Define packet format, developing new module in the wireless adhoc networks.

REFERENCES:

1. *Ekram Hossain and Teerawat Issariyakul, "Introduction to Network Simulator NS2.*