

B.E. V & VI Semester

Prospectus No. 131712

संत गाडगे बाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

(Faculty of Engineering & Technology)

PROSPECTUS

Prescribed for
Four Year Degree Course
Bachelor of Engineering / Bachelor of Technology

BRANCHES

- 1) Production Engineering
- 2) Electronics & Telecommunication Engineering
- 3) Electronics Engineering
- 4) Chemical Engineering
- 5) Polymer (Plastic) Technology
- 6) Food, Pulp & Paper, Oil & Paint and Petrochemical Technology
- 7) Textile Engineering
- 8) Computer Science and Engineering
- 9) Computer Engineering.

V & VI Semester Examinations 2012-2013

**Semester Pattern
(CREDIT GRADE SYSTEM)**



2012

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Price Rs./-

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Dineshkumar Joshi
Registrar,
Sant Gadge Baba
Amravati University
Amravati - 444 602

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SANT GADGE BABA AMRAVATI UNIVERSITY

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

- (1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.
- (2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	:	Enrolment of Students.
Ordinance No. 2	:	Admission of Students
Ordinance No. 4	:	National cadet corps
Ordinance No. 6	:	Examinations in General (relevent extracts)
Ordinance No. 18/2001:		An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001.
Ordinance No. 9	:	Conduct of Examinations (relevent extracts)
Ordinance No. 10	:	Providing for Exemptions and Compartments
Ordinance No. 19	:	Admission of Candidates to Degrees.

- Ordinance No. 109 : Recording of a change of name of a University student in the records of the University.
- Ordinance No. 6 of 2008 : For improvement of Division/Grade.
- Ordinance No.19/2001 : An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dineshkumar Joshi

Registrar

Sant Gadge Baba Amravati University

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The pattern of question paper as per unit system will be broadly based on the following pattern.

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.
- (5) Each short answer type question shall Contain 4 to 8 short sub question with no internal choice.

DIRECTION

No. 31/2011

Date : 10-06-2011

Subject :- Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology.

Whereas faculty of Engineering & Technology in its meeting held on 6th June, 2011 vide Item No.39 accepted and recommended schemes of teaching & examinations of semesters III to VIII/X as per Credit Grade System of various branches in the faculty of Engineering & Technology for its implementation from the session 2011-2012 in phase wise manner,

AND

Whereas the schemes of teaching & examinations of semesters III to VIII/X as per Credit Grade System of various branches in the faculty of Engineering & Technology were accepted by the Hon'ble Vice Chancellor u/s Section 14(7) of M.U.Act, 1994 on behalf on Academic Council on 9th April, 2011,

AND

Whereas these schemes of teaching & examinations of various branches as per Credit Grade System in the faculty of Engineering & Technology are required to be regulated by the Regulation,

AND

Whereas the process of making the Regulation is likely to take some time,

AND

Whereas the schemes of various branches as per Credit Grade System in the faculty of Engineering & Technology are to be implemented from the academic session 2011-2012.

AND

Whereas syllabi of various branches in the faculty of Engineering & Technology are to be sent for printing,

Now, therefore, I, Dr. Mohan K. Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers conferred upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994 hereby direct as under :-

- 1) This Direction shall be called "Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology, Direction, 2011".
- 2) This Direction shall come into force from the date of its issuance.
- 3) Schemes of teaching and examinations of III to VIII/X semesters as per Credit Grade System of the following branches shall be as per respective Appendices appended with this Direction :-

BRANCH**Appendix No.**

1) Civil Engineering	A
2) Mechanical Engineering	B
3) Production Engineering	C
4) Electrical Engineering (Electronics & Power)	D
5) Electrical and Electronics Engineering	E
6) Electrical Engineering (Electrical & Power)	F
7) Electrical Engineering	G
8) Electronics & Telecommunications Engineering	H
9) Electronics Engineering	I
10) Instrumentation Engineering	J
11) Computer Science & Engineering	K
12) Computer Engineering	L
13) Architecture	M
14) Textile Engineering	N
15) Chemical Engineering	O
16) Chemical Technology (Polymer) (Plastic) Technology	P
17) Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology)	Q
18) Information Technology	R
19) Biomedical Engineering	S

sd/-

Dr. Mohan K. Khedkar
Vice Chancellor

DIRECTION

No. : 31 /2012

Date : 19 /07/2012

Subject :- Corrigendum to Direction No.31 of 2011

Whereas, the Direction No.31 of 2011 in respect of the Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology is in existence,

AND

Whereas, the schemes of teaching and examinations of III to VIII/X Semesters as per Credit Grade System for the branches Civil Engineering, Mechanical Engineering, Production Engineering, Electrical Engineering (Electronics & Power), Electrical & Electronics Engineering, Electrical Engineering (Electrical & Power), Electrical Engineering, Electronics & Telecommunication Engineering, Electronics Engineering, Instrumentation Engineering, Computer Science & Engineering, Computer Engineering, Architecture, Textile Engineering, Chemical Engineering, Chemical Technology (Polymer) (Plastic) Technology, Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology), Information Technology, Biomedical Engineering were to be implemented from the session 2011-2012 in phase wise manner by the said Direction No. 31 of 2011 as per respective Appendices i.e. Appendix A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R and S,

AND

Whereas, the Academic Council in its meeting held on 05/05/2012 vide Item No. 53 (1) A-R1, C-R-1, D-R1, E-R1, H-R1 and I-R1 has recommended the revised schemes of teaching and examinations of V to VIII/X Semesters as per Credit Grade System for the branches Production Engineering, Electronics & Telecommunications Engineering, Electronics Engineering, Computer Science & Engineering, Computer Engineering, Textile Engineering, Chemical Engineering, Chemical Technology (Polymer) (Plastic) Technology, Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology),

AND

Whereas, the revised Schemes of examinations as per Credit Grade System for the above mentioned branches in the faculty of Engineering & Technology are to be implemented from the academic session 2012-2013 in phase wise manner ,

AND

Whereas, the Schemes of teaching and examinations of above mentioned branches as per Credit System in the faculty of Engineering & Technology are required to be regulated by the Regulation,

AND

Whereas, the process of making the Regulation is likely to take some time,

AND

Whereas, the syllabi of above mentioned branches along with the revised schemes of examinations in the faculty of Engineering & Technology are to be made available for the students admitted during the Session 2012-2013,

Now, therefore, I, Dr. Mohan K. Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University, Amravati in exercise of powers conferred upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994, do hereby direct as under :-

- 1) This Direction shall be called "Corrigendum to Direction No. 31 of 2011",
- 2) This Direction shall come into force from the date of its issuance.
- 3) Revised schemes of teaching and examinations of V to VIII/X Semesters as per Credit Grade System of the following branches shall be as per respective Appendices appended with this Direction :-

BRANCH**Appendix No.**

- | | |
|---|---|
| 1) Production Engineering | A |
| 2) Electronics & Telecommunications Engineering | B |
| 3) Electronics Engineering | C |
| 4) Computer Science & Engineering | D |
| 5) Computer Engineering | E |
| 6) Textile Engineering | F |
| 7) Chemical Engineering | G |
| 8) Chemical Technology (Polymer) (Plastic) Technology | H |
| 9) Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology) | I |

sd/-

Date :- 19 /07/2012

(Mohan K. Khedkar)
Vice Chancellor

FOUR YEAR DEGREE COURSE
B.E. PRODUCTION ENGINEERING - SEMESTER PATTERN (CREDIT GRADE SYSTEM)

SEMESTER : FIFTH

APPENDIX- A

Sl. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY				PRACTICAL				
			Lecture	Tutorial	PID			DURATION OF PAPER (Hrs.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
		EXTERNAL	INTERNAL													
THEORY																
01	5PE01	DESIGN OF MACHINE ELEMENTS	3	1	-	4	4	4	80	20	100	40	-	-	-	-
02	5PE02	TOOL ENGINEERING - I	3	1	-	4	4	3	80	20	100	40	-	-	-	-
03	5PE03	MATERIAL HANDLING SYSTEMS	3	-	-	3	3	3	80	20	100	40	-	-	-	-
04	5PE04	CONTROL SYSTEMS ENGINEERING	3	1	-	4	4	3	80	20	100	40	-	-	-	-
05	5FEPE05	FREE ELECTIVE - I	3	-	-	3	3	3	80	20	100	40	-	-	-	-
06	5PE06	COMMUNICATION SKILLS	2	-	-	2	2	2	40	10	50	20	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	5PE07	DESIGN OF MACHINE ELEMENTS - Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	5PE08	TOOL ENGINEERING - I - Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	5PE09	COMMUNICATION SKILLS - Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
10	5PE10	COMPUTER APPLICATIONS IN PRODUCTION ENGINEERING - Lab.	1	-	2	3	3	-	-	-	-	-	25	25	50	25
TOTAL			18	3	8	29	26	550							200	750
													TOTAL		750	

FREE ELECTIVE - I 01) INDUSTRIAL ENGINEERING 02) INDUSTRIAL SAFETY MANAGEMENT

SEMESTER : SIXTH

Sl. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY				PRACTICAL				
			Lecture	Tutorial	PID			DURATION OF PAPER (Hrs.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
		EXTERNAL	INTERNAL													
THEORY																
01	6PE01	TOOL ENGINEERING - II	3	1	-	4	4	3	80	20	100	40	-	-	-	-
02	6PE02	METROLOGY & QUALITY CONTROL	3	1	-	4	4	3	80	20	100	40	-	-	-	-
03	6PE03	MACHINE TOOL DESIGN	4	1	-	5	5	3	80	20	100	40	-	-	-	-
04	6PE04	WORK STUDY	3	1	-	4	4	3	80	20	100	40	-	-	-	-
05	6FEPE05	FREE ELECTIVE - II	3	-	-	3	3	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	6PE06	TOOL ENGINEERING - II - Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	6PE07	METROLOGY & QUALITY CONTROL - Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	6PE08	MACHINE TOOL DESIGN - Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
10	6PE9	MINOR PROJECT (MACHINE SHOP PRACTICE)	-	-	3	3	3	-	-	-	-	-	25	25	50	25
TOTAL			16	3	9	28	25	500							200	700
													TOTAL		700	

FREE ELECTIVE - II- 01) INDUSTRIAL AUTOMATION 02) ENGINEERING ECONOMICS & ENTREPRENEURSHIP DEVELOPMENT

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor of Engineering
Branch : Electronics & Telecommunication Engineering
Semester Pattern (Credit Grade System)

APPENDIX - B

Semester : Fifth																
			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code	Subject	HOURS / WEEK			Total HOURS/WE	CREDITS	THEORY				PRACTICAL				
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY	MAX. MARKS COLLEGE	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
				EXTERNAL	INTERNAL											
THEORY																
01	5XT1	Electronic Devices & Circuits-II	4	1		5	5	3	80	20	100	40	-	-	-	-
02	5XT2	Power Electronics	4			4	4	3	80	20	100	40	-	-	-	-
03	5XT3	Control System Engineering	4	1		5	5	3	80	20	100	40	-	-	-	-
04	5XT4	Communication Engineering-II	4			4	4	3	80	20	100	40	-	-	-	-
05	5FEXT5	Free Elective- I	4			4	4	3	80	20	100	40	-	-	-	-
06	5XT6	Communication Skills	2			2	2	2	40	10	50	20				
Free Elective - I : 1. Consumer Electronics 2. Fibre Optics																
PRACTICALS / DRAWING / DESIGN																
07	5XT7	Electronic Devices & Circuits-II Lab				2	2	1	-	-	-	-	25	25	50	25
08	5XT8	Power Electronics Lab				2	2	1	-	-	-	-	25	25	50	25
09	5XT9	Communication Engineering-II Lab				2	2	1	-	-	-	-	25	25	50	25
10	5XT10	Communication Skills Lab				2	2	1					15	10	25	12
TOTAL			22	2	8	32	28				550				175	
														TOTAL	725	
Semester : Sixth																
THEORY																
01	6XT1	Digital Integrated Circuits	4			4	4	3	80	20	100	40	-	-	-	-
02	6XT2	Linear Integrated Circuits	4	1		5	5	3	80	20	100	40	-	-	-	-
03	6XT3	Introduction to Microprocessors	4	1		5	5	3	80	20	100	40	-	-	-	-
04	6XT4	Digital Communication	4			4	4	3	80	20	100	40	-	-	-	-
05	6FEXT5	Free Elective -II	4			4	4	3	80	20	100	40	-	-	-	-
Free Elective - II : 1. Introduction to Wireless Technology 2. Electronic Test Instruments - Analog and Digital.																
PRACTICALS / DRAWING / DESIGN																
06	6XT6	Integrated Circuits Lab				2	2	1	-	-	-	-	25	25	50	25
07	6XT7	Introduction to Microprocessors Lab				2	2	1	-	-	-	-	25	25	50	25
08	6XT8	Digital Communication Lab				2	2	1	-	-	-	-	25	25	50	25
TOTAL			20	2	6	28	25				500				150	
														TOTAL	650	

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor of Engineering
Branch : Electronics Engineering - Semester Pattern (Credit Grade System)

SEMESTER - FIFTH

APPENDIX - C

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WE	CREDITS	THEORY				PRACTICAL				
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY	MAX. MARKS COLLEGE	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
EXTERNAL		INTERNAL														
THEORY																
01	5XN1	Electronic Devices & Circuits-II	4	1		5	5	3	80	20	100	40	-	-	-	-
02	5XN2	Power Electronics	4			4	4	3	80	20	100	40	-	-	-	-
03	5XN3	Control System Engineering	4	1		5	5	3	80	20	100	40	-	-	-	-
04	5XN4	Communication Engineering-II	4			4	4	3	80	20	100	40	-	-	-	-
05	5FEXN5	Free Elective- I	4			4	4	3	80	20	100	40	-	-	-	-
06	5XN6	Communication Skills	2			2	2	2	40	10	50	20				
Free Elective - I : 1. Consumer Electronics 2. Fibre Optics																
PRACTICALS / DRAWING / DESIGN																
07	5XN7	Electronic Devices & Circuits-II Lab				2	2	1	-	-	-	-	25	25	50	25
08	5XN8	Power Electronics Lab				2	2	1	-	-	-	-	25	25	50	25
09	5XN9	Communication Engineering-II Lab				2	2	1	-	-	-	-	25	25	50	25
10	5XN10	Communication Skills Lab				2	2	1					15	10	25	12
TOTAL			22	2		8	32	28			550				175	
														TOTAL	725	
Semester : Sixth																
THEORY																
01	6XN1	Digital Integrated Circuits	4			4	4	3	80	20	100	40	-	-	-	-
02	6XN2	Linear Integrated Circuits	4	1		5	5	3	80	20	100	40	-	-	-	-
03	6XN3	Introduction to Microprocessors	4	1		5	5	3	80	20	100	40	-	-	-	-
04	6XN4	Radar & Television Engineering	4			4	4	3	80	20	100	40	-	-	-	-
05	6FEXN5	Free Elective -II	4			4	4	3	80	20	100	40	-	-	-	-
Free Elective - II : 1. Introduction to Wireless Technology 2. Electronic Test Instruments - Analog and Digital.																
PRACTICALS / DRAWING / DESIGN																
06	6XN6	Digital Integrated Circuits Lab				2	2	1	-	-	-	-	25	25	50	25
07	6XN7	Linear Integrated Circuits Lab				2	2	1	-	-	-	-	25	25	50	25
08	6XN8	Introduction to Microprocessors Lab				2	2	1	-	-	-	-	25	25	50	25
TOTAL			20	2		6	28	25			500				150	
														TOTAL	650	

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor of Engineering
Branch : Computer Science & Engineering- Semester Pattern (Credit Grade System)

SEMESTER : FIFTH

APPENDIX - D

Semester :FIFTH																
			TEACHING SCHEME				EXAMINATION SCHEME									
Sr. No.	Subject Code	Subject	HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY				PRACTICAL				
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
				EXTERNAL	INTERNAL											
THEORY																
01	5KS01	Data Communication	4	—	—	4	4	3	80	20	100	40	—	—	—	—
02	5KS02	File Structures & Data Processing	4	1	—	5	5	3	80	20	100	40	—	—	—	—
03	5KS03	System Software	4	—	—	4	4	3	80	20	100	40	—	—	—	—
04	5KS04	Switching Theory & Logic Design	4	1	—	5	5	3	80	20	100	40	—	—	—	—
05	5FEKS05	Free Elective I*	3	—	—	3	3	3	80	20	100	40	—	—	—	—
06	5KS06	Communication Skills	2	—	—	2	2	2	40	10	50	20	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
07	5KS07	System Software Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
08	5KS08	Switching Theory & Logic Design Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
09	5KS09	Communication Skills Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
TOTAL			21	2	6	29	26			550				150		
												TOTAL		700		

Free Elective I* (i) Data Structures & Algorithms (ii) Data Communication & Networking

Semester :SIXTH																
THEORY																
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	EXTERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
01	6KS01	Operating Systems	4	1	—	5	5	3	80	20	100	40	—	—	—	—
02	6KS02	Database Systems	4	—	—	4	4	3	80	20	100	40	—	—	—	—
03	6KS03	Computing Resources Management	4	—	—	4	4	3	80	20	100	40	—	—	—	—
04	6KS04	Computer Architecture	3	1	—	4	4	3	80	20	100	40	—	—	—	—
05	6FEKS05	Free Elective II*	3	—	—	3	3	3	80	20	100	40	—	—	—	—
06	6KS06	Professional Ethics	2	—	—	2	2	2	40	10	50	20	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
07	6KS07	Operating Systems Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
08	6KS08	Database Systems Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
09	6KS09	Computer Lab-II (Hardware Lab)	1	—	2	3	2	—	—	—	—	—	25	25	50	25
TOTAL			21	2	6	29	26			550				150		
												TOTAL		700		

Free ElectiveII* (i) Database Management System (ii) Software Project Management

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor of Engineering
Branch : Computer Engineering- Semester Pattern (Credit Grade System)
SEMESTER : FIFTH

APPENDIX - E

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
EXTERNAL	INTERNAL															
THEORY																
01	5KE01	Data Communication	4	—	—	4	4	3	80	20	100	40	—	—	—	—
02	5KE02	File Structures & Data Processing	4	1	—	5	5	3	80	20	100	40	—	—	—	—
03	5KE03	System Software	4	—	—	4	4	3	80	20	100	40	—	—	—	—
04	5KE04	Switching Theory & Logic Design	4	1	—	5	5	3	80	20	100	40	—	—	—	—
05	5FEKE05	Free Elective I*	3	—	—	3	3	3	80	20	100	40	—	—	—	—
06	5KE06	Communication Skills	2	—	—	2	2	2	40	10	50	20	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
07	5KE07	System Software Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
08	5KE08	Switching Theory & Logic Design Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
09	5KE09	Communication Skills Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
TOTAL			21	2	6	29	26			550					150	
												TOTAL		700		

Free Elective I* (i) Web Technologies (ii) Object Oriented Programming

Semester :SIXTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
EXTERNAL	INTERNAL															
THEORY																
01	6KE01	Operating Systems	4	1	—	5	5	3	80	20	100	40	—	—	—	—
02	6KE02	Database Systems	4	—	—	4	4	3	80	20	100	40	—	—	—	—
03	6KE03	Computing Resources Management	4	—	—	4	4	3	80	20	100	40	—	—	—	—
04	6KE04	Computer Architecture	3	1	—	4	4	3	80	20	100	40	—	—	—	—
05	6FEKE05	Free Elective II*	3	—	—	3	3	3	80	20	100	40	—	—	—	—
06	6KE06	Professional Ethics	2	—	—	2	2	2	40	10	50	20	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
07	6KE07	Operating Systems Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
08	6KE08	Database Systems Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
09	6KE09	Computer Lab-II (Hardware Lab)	1	—	2	3	2	—	—	—	—	—	25	25	50	25
TOTAL			21	2	6	29	26			550					150	
												TOTAL		700		

Free Elective II* (i) Java Programming (ii) Expert Systems

Note : Students will have to opt the free electives offered from other courses of their College / Institution / University Department

**Four Year Degree Course in
Bachelor Textile Engineering - Semester Pattern (Credit Grade System)**

SEMESTER : FIFTH

APPENDIX - F

		TEACHING SCHEME					EXAMINATION SCHEME									
Sr. No.	Subject Code	Subject	HOURS / WEEK			CREDITS	THEORY				PRACTICAL					
			Lecture	Tutorial	P/T		TOTAL HOURS/WEEK	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
				EXTERNAL	INTERNAL											
THEORY																
01	5 TX 01	Yarn Manufacturing -III	3	1	-	4	4	3	80	20	100	40	-	-	-	-
02	5 TX 02	Fabric Manufacturing-III	3	1	-	4	4	3	80	20	100	40	-	-	-	-
03	5 TX 03	Textile Testing-I	3	1	-	4	4	3	80	20	100	40	-	-	-	-
04	5 TX 04	Textile Costing and Economics	3	1	-	4	4	3	80	20	100	40	-	-	-	-
05	5FETX05	Free Elective-I	3	-	-	3	3	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
06	5 TX 06	Minor Project-I	-	-	2	2	2	-	-	-	-	-	-	50	50	25
07	5 TX 07	Yarn Manufacturing -III- Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	5 TX 08	Fabric Manufacturing-III- Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	5 TX 09	Textile Testing-I- Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
TOTAL			15	4	8	27	24	500							200	
												TOTAL		700		

Free Elective-I:- (i) Technical Textiles (ii) Fashion & Clothing Science

Semester : Sixth

		TEACHING SCHEME					EXAMINATION SCHEME									
Sr. No.	Subject Code	Subject	HOURS / WEEK			CREDITS	THEORY				PRACTICAL					
			Lecture	Tutorial	P/T		TOTAL HOURS/WEEK	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
				EXTERNAL	INTERNAL											
THEORY																
01	6 TX 01	Fabric Structure	3	1	-	4	4	3	80	20	100	40	-	-	-	-
02	6 TX 02	Advanced Yarn Manufacturing Technology	3	1	-	4	4	3	80	20	100	40	-	-	-	-
03	6 TX 03	Textile Testing-II	3	-	-	3	3	3	80	20	100	40	-	-	-	-
04	6 TX 04	Apparel Merchandising	3	-	-	3	3	3	80	20	100	40	-	-	-	-
05	6FETX05	Free Elective-II	3	-	-	3	3	3	80	20	100	40	-	-	-	-
06	6 TX 06	Communication Skill	2	-	-	2	2	2	40	10	50	20	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	6 TX 07	Minor Project-II	-	-	2	2	4	-	-	-	-	-	25	25	50	25
08	6 TX 08	Fabric Structure- Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	6 TX 09	Advanced Yarn Manufacturing Technology- Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
10	6 TX 10	Textile Testing-II- Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
11	6 TX 11	Communication Skill-Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
TOTAL			17	2	10	29	27	550							250	
												TOTAL		800		

Free Elective-II:- (i) Computer Aided Textile & Fashion designing (ii) Fashion Technology

- * Notes : 1) Student has to undergo inplant training for 15 days in any textile manufacturing unit
2) Students will have to opt the free electives offered from other courses of their College / Institution / University Department

Four Year Degree Course in Bachelor of Engineering
Branch : Chemical Engineering - Semester Pattern (Credit Grade System)

SEMESTER - FIFTH

APPENDIX - G

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK				CREDITS	THEORY				PRACTICAL				
			Lecture	Tutorial	PD	Total HOURS/WEEK		DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
EXTERNAL	INTERNAL															
THEORY																
01	5CH01	Heat Transfer	4	-	-	4	4	3	80	20	100	40	-	-	-	-
02	5CH02	Chemical Engineering Process-I (Inorganic Chemical Technology)	4	-	-	4	4	3	80	20	100	40	-	-	-	-
03	5CH03	Economics & Management	4	-	-	4	4	3	80	20	100	40	-	-	-	-
04	5CH04	Material Science & Engineering	3	1	-	4	4	3	80	20	100	40	-	-	-	-
05	5FECH05	Free Elective-I	3	-	-	3	3	3	80	20	100	40				
06	5CH06	Communication Skills	2	-	-	2	2	2	40	10	50	20	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	5CH07	Heat Transfer-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	5CH08	Material Science & Engineering-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	5CH09	Communication Skill-s- Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
TOTAL			20	1	6	27	24	550							150	
TOTAL																
700																

Free Elective-I 1) Air Pollution Control 2) Risk & Safety Management in Industries.

Semester : Sixth																
THEORY																
Sr. No.	Subject Code	Subject	Lecture	Tutorial	PD	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	EXTERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
01	6CH01	Chemical Engineering Operation - II (Mass Transfer - I)	3	1	-	4	4	3	80	20	100	40	-	-	-	-
02	6CH02	Chemical Engineering Process-II (Organic Chemical Technology)	4	-	-	4	4	3	80	20	100	40	-	-	-	-
03	6CH03	Computer Programming & Applications	3	1	-	4	4	3	80	20	100	40	-	-	-	-
04	6CH04	Process Equipment Design & Drawing	4	-	-	4	4	3	80	20	100	40	-	-	-	-
05	6FECH05	Free Elective II	3	-	-	3	3	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
06	6CH06	Chemical Engineering Operation - II (Mass Transfer - I)-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
07	6CH07	Computer Programming & Applications-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	6CH08	Minor Project	-	-	2	2	4	-	-	-	-	-	25	25	50	25
TOTAL			17	2	6	25	25	500							150	
TOTAL																
650																

Free Elective-I 1) Renewable Energy Sources 2) Water Technology

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor Technology
Branch : Polymer (Plastic) Technology Semester Pattern (Credit Grade System)

Semester : FIFTH

APPENDIX - H

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY				PRACTICAL				
			Lecture	Tutorial	PID			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
EXTERNAL	INTERNAL															
THEORY																
01	5PP01	Heat Transfer	4	-	-	4	4	3	80	20	100	40	-	-	-	-
02	5PP02	Polymer Materials	4	-	-	4	4	3	80	20	100	40	-	-	-	-
03	5PP03	Engineering Plastics & Speciality Polymers	3	1	-	4	4	3	80	20	100	40	-	-	-	-
04	5PP04	Instrumentation & Control	3	1	-	4	4	3	80	20	100	40	-	-	-	-
05	5FEPP05	Free Elective-I	3	-	-	3	3	3	80	20	100	40	-	-	-	-
06	5PP06	Communication Skill	2	-	-	2	2	2	40	10	50	20	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	5PP07	Heat Transfer-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	5PP08	Polymer Materials-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	5PP09	Instrumentation & Control-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
10	5PP10	Communication Skill-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
		TOTAL	19	2	8	29	25				550				200	
													TOTAL		750	

Free Elective-I 1) Polymer Science and Technology 2) Rubber Technology

Semester : Sixth																
THEORY																
Sr. No.	Subject Code	Subject	Lecture	Tutorial	PID	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	EXTERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
01	6PP01	Chemical Engineering Operation-II (Mass Transfer)	3	1	-	4	4	3	80	20	100	40	-	-	-	-
02	6PP02	Elastomer Technology	3	1	-	4	4	3	80	20	100	40	-	-	-	-
03	6PP03	Computer Programming & Applications	3	1	-	4	4	3	80	20	100	40	-	-	-	-
04	6PP04	Polymer Engineering Thermodynamics	3	-	-	3	3	3	80	20	100	40	-	-	-	-
05	6FEPP05	Free Elective-II	3	-	-	3	3	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
06	6PP06	Chemical Engineering Operation-II (Mass Transfer)-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
07	6PP07	Elastomer Technology-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	6PP08	Computer Programming & Applications-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	6PP09	Minor Project	-	-	2	2	4	-	-	-	-	-	25	25	50	25
		TOTAL	15	3	8	26	25				500				200	
													TOTAL		700	

Free Elective-II 1) Polymeric Materials 2) Paint and Surface Technology

Note : Students will have to opt the free electives offered from other courses of their College / Institution / University Department

Four Year Degree Course in Bachelor of Technology

Branch : Food, Pulp & Paper, Oil & Paint and Petrochemical Technology - Semester Pattern (Credit Grade System)

Semester : FIFTH

APPENDIX - I

Sr. No.	Subject Code	Subject	TEACHING SCHEME				EXAMINATION SCHEME										
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY				PRACTICAL					
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS	
		EXTERNAL	INTERNAL														
THEORY Semester : Fifth																	
01	5 CT 01	Heat Transfer	3	--	--	3	3	3	80	20	100	40	--	--	--	--	
02	5 CT 02	Mechanical Operations	3	--	--	3	3	3	80	20	100	40	--	--	--	--	
03	5 CT 03	Chemical Engineering Thermodynamics	3	--	--	3	3	3	80	20	100	40	--	--	--	--	
04	5 FT 04	Food Technology - II	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
	5 PT 04	Pulp & Paper Technology -II	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
	5 OT 04	Oil & Paint Technology -II	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
	5 PC 04	Petrochemical Technology - II	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
05	5 FECT 05	Free Elective - I	3	--	--	3	3	3	80	20	100	40	--	--	--	--	
06	5 CT 06	Communication Skills	2	--	--	2	2	2	40	10	50	20	--	--	--	--	
PRACTICALS / DRAWING / DESIGN																	
07	5 CT 07	Heat Transfer -Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
08	5 CT 08	Mechanical Operation-Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
09	5 CT 09	Chemical Engineering Thermodynamics-Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
10	5 FT 10	Food Technology - II-Lab	--	--	4	4	2	--	--	--	--	--	25	25	50	25	
	5 PT 10	Pulp & Paper Technology -II-Lab	--	--	4	4	2	--	--	--	--	--	25	25	50	25	
	5 OT 10	Oil & Paint Technology -II-Lab	--	--	4	4	2	--	--	--	--	--	25	25	50	25	
	5 PC 10	Petrochemical Technology - II-Lab	--	--	4	4	2	--	--	--	--	--	25	25	50	25	
11	5 CT 11	Communication Skills-Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
TOTAL			17	1	12	30	25	--	--	--	550	--	--	25	25	50	25
													TOTAL		200		
													TOTAL		750		
Free Elective - I : 1) Environmental Impact : Risk Assessment and Management 2) Economics and Management																	
THEORY Semester - Sixth																	
01	6 CT 01	Process Equipment - Design & Drawing	4	--	--	4	4	3	80	20	100	40	--	--	--	--	
02	6 CT 02	Computer Programming & Applications	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
03	6 CT 03	Instrumentation & Control	4	--	--	4	4	3	80	20	100	40	--	--	--	--	
04	6 FT 04	Food Technology -III	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
	6 PT 04	Pulp & Paper Technology -III	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
	6 OT 04	Oil & Paint Technology -III	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
	6 PC 04	Petrochemical Technology -III	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
05	6 FECT 05	Free Elective - II	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
PRACTICALS / DRAWING / DESIGN																	
06	6 CT 06	Process Equipment Design & Drawing-Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
07	6 CT 07	Instrumentation & Control-Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
08	6 CT 08	Computer Programming & Application-Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
09	6 CT 09	Minor Project	--	--	2	2	2	--	--	--	--	--	25	25	50	25	
TOTAL			17	3	8	28	25	--	--	--	500	--	--	25	25	50	25
													TOTAL		200		
													TOTAL		700		
Free Elective - II : 1) Introduction to Membrane Technology 2) Renewable Energy Sources 3) Chemical Technology																	
Note : Students will have to opt the free electives offered from other courses of their College / Institution / University Department																	

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
PRODUCTION ENGINEERING EXAM.
SEMESTER PATTERN (C. G. S.)
FIFTH SEMESTER**

SPE01 DESIGN OF MACHINE ELEMENTS

Lecture : 04 Hrs/ w

Tutorial : 01 Hrs/ w

Credits : 05

Internal Assessments: 20

University Exam: 80

Theory Paper (Hrs.) : 04

Course Objectives:

- To study the different types load considerations and design aspects of various machine members.
- Develop and evaluate alternatives for mechanical systems.
- To synergize forces, moments, torques, stress and strength information.
- To develop ability to analyze, design and/or select machine elements - with attention to safety, reliability, and societal and fiscal aspects.
- Design shafting and specify appropriate keys and couplings.
- Design springs, common welded and bolted connections.

SECTION-A

UNIT-I : Introduction to M/c design, Design procedure, factors affecting M/c design, types of stresses in machine members compound stresses, theories of material failure. Factor of safety, properties and selections of material, designation of material as per I.S.I.; elementary ideas of inertia and thermal stresses. Design of levers and threaded fastness. (12)

UNIT- II: Design of Joints: Pin, Cotter, Knuckle, etc., Riveted and Welded joints. (12)

SECTION-B

UNIT III: 1. Design procedure for parts subjected to alternating, shock and impact loads. Stress concentration, Endurance limit.
2. Design of Helical, leaf and spiral spring.
3. Design of Keys and Splines. (12)

UNIT-IV: 1. Design of pressure vessels and pipes.
2. Design of shafts, spindle and coupling.
3. Design of columns and frames with direct and eccentric loading. (12)

TEXT BOOKS :

1. Design of Machine Elements, V. B. Bhandari, 3 Ed. (Tata McGraw-Hill Publishing Company Ltd.)
ISBN: 9780070681798
2. Mechanical Engineering design, J. E. Shigley, Mitchell, 3 Ed.(McGraw-Hill Publishing Co. Ltd)
ISBN:9780071441633

3. Elements of Machine Design, N. C. Pandya and C. S. Shaha, 15 Ed., (Charotar Publishing House)
ISBN:81-85-594-42-2
4. A Text Book of Machine Design, R. S. Khurmi, (S. Chand) ISBN: 8121925371
5. Machine Design, R. K. Jain, (Khanna Publishers.)

REFERENCE BOOKS

1. Machine Tool Design, N. K. Mehta, (Tata McGraw-Hill Publishing Company Ltd.)
2. Design Data Books : a) Shivalkar, Kulkarni b) K.Mahadevan c) N.R.Chakrabarti
3. Design of Machine Elements, Dbrovalsky (MIR Publisher)
4. Design of Machine Elements by M. F. Spoots, T.E.Shoup 4 Ed. (PHI) ISBN: 0-87-692-177-2
5. Computer Aided Analysis and Design of Machine Elements by Dukki Patti, Rao, Bhat , (New Age, Delhi)
6. CMTI Machine Tool Design Handbook (TMH)
7. Machine Design by Black and Adams (McGraw-Hill Publishing Company Ltd)

5PE02 TOOL ENGINEERING –I

Lecture : 03 Hrs/ w

Tutorial : 01 Hrs/ w

Credits : 04

Course Objectives:

Internal Assessments: 20

University Exam: 80

Theory Paper (Hrs.) : 03

- To meet the requirements of industry in the fields of tool design and manufacturing
- To train students in designing different tools like Single point Tool, Circular and Flat form tool, drill, reamer and broach.
- Student should have the basic knowledge of metal cutting process (machining). Economics of Machining.

SECTION-A

UNIT-I : Mechanics of metal cutting : Common features of machining processes. Basic wedge action of cutting tools, mechanism of chip formation; type of chips. Concept of cutting speed, feed, depth of cut, shear angle, velocity relation, shear strain. Merchant theory of metal cutting, cutting forces and power, metal removal rate, energy consideration in metal cutting. (8)

UNIT-II: Single point cutting tool : Classification, systems of nomenclature, design of single point tool, cutting speeds, feeds and tool angles, chip breakers, form tools, classification, design

of flat & circular form tool, clamping arrangement of form tools.

(7)

- UNIT-III:i) Drills:** Types, geometry of twist drill, cutting variables, and chip formation, forces and torque in drilling.
- ii) Milling cutters :** Conventional & climb milling, types of cutters, geometry of plain milling cutter, face milling cutter, machining process and cutting variables, force acting on plain milling cutter. Design considerations in milling cutter.
- iii) Reamers:** Types, tool geometry, tolerance, design considerations. (7)

SECTION-B

- UNIT-IV: Broaches :** i) Cutting process in broaching, geometric elements of broach teeth, cutting variables in broaching classification of broach design of broaches, cutting forces in broaching.
- ii) Gear Cutting Tools:** (Different types) gear shaper cutter, gear hob and their geometry.
- iii) Thread cutting tools:** Geometry of tapes & dies.
- iv) Tools for NC/CNC machines.** (7)

UNIT-V: Tool Wear, Tool Life, Machinability and Coolants: Wear mechanism, type of tool wear and chipping of different tool material, tool failure criteria, direct and indirect. Tool life equation, effect of process parameters on tool life, tool life tests-machinability, criteria for machinability, distribution of heat generated in metal cutting, functions of cutting fluids, types and selection of cutting fluid. (8)

UNIT-VI: Tool Materials and Economics of Machines: Properties and applications of various tool materials HSS, cast cobalt alloys, Carbides, ceramics, diamonds, UCON, CBN, Recent tool materials. Classification of carbides. Component of machining costs, optimisation criteria, high efficiency zone, tool life for minimum cost of production and for maximum production rate.

Surface Finish : effect of machining parameters, surface finish expression, cost of surface finish. (8)

TEXT BOOKS :

- 1) Metal Cutting Theory and Cutting Tool Design : MIR Pub. by Arshinov.
- 2) Fundamentals of Metal Cutting and Machine Tools by WFL, Juneja.

REFERENCE BOOKS :

- 1) Production Technology, By HMT
- 2) Metal Cutting Theory and Practice : Central Book Pub. by A. Bhattacharya.
- 3) Production Technology : PHI Astme.

SPE03 MATERIAL HANDLING SYSTEMS

Lecture : 03 Hrs/ w

Tutorial : _____

Credits : 03

Internal Assessments: 20

University Exam: 80

Theory Paper (Hrs.) : 03

Course Objectives:

- This course will cover the different classifications of material handling equipment. Within each of these classifications, we will discuss the alternate types of equipment available and what situations are appropriate for applying the different variations.
- A special emphasis will be on the application of material handling equipment in a warehouse environment. Distribution activities are becoming a focus for many industrial engineers and the ability to apply and evaluate material handling equipment is an essential part of evaluating and managing a storage facility.

SECTION-A

UNIT-I : Introduction, definition of material handling, its relationship with plant layout. Types of industries, related material handling equipment. Design of plant layout. Site selection for plant. (6)

UNIT-II: Principles of mechanical handling, types of material handling equipments and their field of applications, selection and specification of equipments. Screw conveyor. Introduction, calculation of HP of motor used, characteristics and field of application of screw conveyers, determination of application of screw conveyers of salient dimensions and power requirements. (8)

UNIT- III: Belt conveyers : Introduction, types of drives used for belt conveyers, methods of maintaining belt tensions. Optimization of cross sectional area of belt conveyers supported on (a) two roller system (b) three roller system, determination of salient dimensions and power requirements. (8)

SECTION-B

UNIT-IV: Types of cranes and their application : Electric Over head Travelling (E.O.T.) cranes, types of EOT cranes and their applications, design of mechanical system used for :
a) Cross travel of the crane,

- b) Longitudinal travel of the crane and
 - c) Hoisting and lowering motion of the crane load.
- Design of breaking, system of various types of EOT cranes, functions of limit switches used EOT cranes. (8)

UNIT-V: Introduction, working principles, and field of applications of the following mechanical handling equipments (No mathematical treatment is contemplated)

- i) Pneumatic conveyers
- ii) Hydraulic conveyers
- iii) Escalators
- iv) Robots in material handling. (8)

UNIT-VI: A) Introduction, working principles and field of applications of following mechanical material handling equipments. (No mathematical treatment is contemplated)

- i) Ladle Crane
 - ii) Electric Lifts
 - iii) Skip Hoists
 - iv) Fork Lift Trucks
 - v) Winches
- B) Repairs and maintenances of material handling equipments and hazards with M.H.E. (7)

TEXT BOOKS :

- 1) Material Handling System Design : James Apple
- 2) Material Handling Equipments : Alexandrov
- 3) Introduction to Material Handling : Siddhartha Ray Publish by New Age Int. Pub. ISBN: 81-224-2099-0

REFERENCE BOOKS :

- 1) Material Handling Hand Book Published By JOHN WILLEY & Sons.
- 2) Plant Layout and Material Handling : James Apple 3RD Ed ISBN: 047107171-4 (JOHN WILLEY & Sons)
- 3) Plant Layout and Material Handling : National Productivity Council
- 4) Handbook of Material Handling, By R Robinson, Chichester, ISBN: 0-470-20098-7

SPE04 CONTROL SYSTEMS ENGINEERING

Lecture : 03 Hrs/ w

Tutorial : 01 Hrs/ w

Credits : 04

Course Objectives:

- To develop the student's skills in applying Laplace transform to obtain transfer functions.
- To develop student's skills associated with modeling dynamic

Internal Assessments: 20

University Exam: 80

Theory Paper (Hrs.) : 03

systems through block diagrams and signal flow graphs.

- To develop student with knowledge of state variable models of feedback control systems.
- To provide the student with skills in analyzing characteristics of dynamics systems and measures of performances.
- To provide the student with analysis skills associated with the assessment of system stability.
- To provide the student with the ability to perform root locus analysis.

SECTION-A

UNIT-I: Introduction, system concept, open and closed loop systems, mathematical models, transfer functions, formulation of mathematical model of mechanical, hydraulic, thermal and simple electrical systems. Concept of block diagram, block diagram algebra, signal flow graphs. (7)

UNIT-II: Basic control actions: proportional, integral and PID controllers, principle of working and characteristics performance of control system and components for the following types :- position, velocity, temperature, pressure, force, torque, flow level etc. (for mechanical, hydraulic, pneumatic and electrical systems). Study of important automatic speed systems in various prime movers. (8)

UNIT-III: Transient Response Analysis: - method of analysis transient and steady state response of first, second and higher order systems, impulse and step input responses. Transient response specification, Steady state errors and error constant. (7)

SECTION-B

UNIT-IV : Concept stability, necessary condition for stability, Rouths stability criterion, root locus concept, construction of root loci, systems with transportation lag. (8)

UNIT-V: Logarithmic and polar plots, Nyquist stability criterion; stability analysis, determination of system parameter from experimental results. (8)

UNIT-VI: Design and compensation techniques : introduction, preliminary design considerations; lead and lag compensations. (7)

TEXT BOOKS:

- 1) Modern Control Engineering : Katsuhiko, Ogata Prentice Hall.
- 2) Automatic Control Engineering : Francis H. Raven, McGraw Hill
- 3) Feedback Control Systems By U A Bakshi, Pearson

REFERENCE BOOKS:

- 1) Control System Engineering : I.J.Nagrath & M.Gopal, Wesley Eastern.

- 2) Automatic Control System : Kuo B.C.
- 3) Automatic Control Introduction : Webb C.R.
- 4) Control System Engineering : Dorf R.C.

5FEPE05 FREE ELECTIVE - I
(1) INDUSTRIAL ENGINEERING

Lecture : 03 Hrs/ w

Tutorial : _____

Credits : 03

Internal Assessments: 20

University Exam: 80

Theory Paper (Hrs.) : 03

Course Objectives:

- This course studies the definition of industrial engineering and the evolution of its approach in solving problem as well as discussing the manufacturing system which use as an object of the study. The course objective is to introduce the discipline and profession of industrial engineering.

SECTION - A

Unit I: The Purpose, Fundamentals and Evolution of Industrial Engineering. The Role and Career of the Industrial Engineer in the Modern Organization. The Industrial Engineer as Manager. Industrial Engineering in Government, Service Industry Applications. (7)

Unit II: The Concept and Importance of Productivity, Productivity Improvement through Business Process Reengineering, Total Productivity Management, Performance Management; A Key Role for Supervisors and Team Leaders, Managing Change through Teams, Involvement, Empowerment, and Motivation. (7)

Unit III: Methods Engineering and Workplace Design, Continuous Improvement, Work Design and Flow Processes for Support Staff, Setup Time Reduction, Measurement of Work, Purpose and Justification of Engineered Labor Standards, Standard Data Concepts and Development, Developing Engineered Labor Standards, Allowances, Computerized Labor Standards, Implementation and Maintenance of Engineered Labor Standards. (8)

SECTION - B

Unit IV: Ergonomics, Resources, Designing, Implementing, and

Justifying an Ergonomics Program, Ergonomic Consumer Product Design, Manufacturing Ergonomics, Ergonomics in the Office Environment, the Interface between Production System Design and Individual Mechanical Exposure. Occupational Safety Management and Engineering. (7)

Unit V: Quantitative Approach to the Site Selection Process, Facilities Layout and Design, A Participatory Approach to Computer-Aided Workplace Design, Planning a Manufacturing Cell, Scheduling and Inventory Control of Manufacturing Systems, An Introduction to Supply Chain Management, Production Scheduling. (8)

Unit VI: Industrial Engineering Support for Materials Management, Materials Handling, Warehouse Management, Distribution Systems, Inventory Management and Control. Product Design and Quality Management, Product Development, Design for Manufacture and Assembly, Value Management. World-Class Manufacturing: An Industrial Engineering View. (8)

TEXT BOOKS:

1. Dr.B.Kumar, Industrial Engineering; Khanna Publishers.
2. Martand Telsang, Industrial Engineering and Production Management; S.Chand.ISBN:81-219- 1773-5

REFERENCES BOOKS:

1. Turner, W.C., et. Al, 1993, "Introduction to Industrial and System Engineering", Prentice Hall.
2. Hicks, P.E., 1994, "Industrial Engineering and Management: a New Perspective", McGraw-Hill, Inc.
3. Eide, et. Al., 2002, "Engineering Fundamental and Problem Solving", John Wiley & Sons.

5FEPE05 FREE ELECTIVE - I
(2) INDUSTRIAL SAFETY MANAGEMENT

Lecture : 03 Hrs/ w

Tutorial : _____

Credits : 03

Internal Assessments: 20

University Exam: 80

Theory Paper (Hrs.) : 03

Course Objectives:

The course will allow you to realize the following objectives-

- Develop range of competencies necessary in the field of safety management
- Knowledge and understanding on the subject and skills needed for different situations
- Risk assessment, health and safety regulations
- Develop skills in communication, management and critical thinking

- Plan of conduct during and after investigations depending on sensitivity of subject matter
- Identify and analyze broadly defined problems, evaluate strategies

SECTION -A

UNIT - I : Concepts : History of Safety movement – general concepts of management – planning for safety for optimization of productivity -productivity, quality and safety-line and staff functions for safety-budgeting for safety-safety policy. (7)

UNIT-II: Techniques-Incident Recall Technique (IRT) – disaster control – damage control-job safety analysis – safety survey – safety inspection – safety sampling – motivating techniques – evaluation of performance of supervisors on safety-safety posters – safety displays – safety pledge – safety Lab. (8)

UNIT III: Components of safety audit – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication - liaison with departments to ensure co-ordination – check list – identification of unsafe acts of workers and unsafe conditions in the shop floor. (8)

SECTION – B

UNIT-IV: Concept of an accident – Cost of accident- reportable and non reportable accidents – reporting to statutory authorities – principles of accident prevention – accident investigation and analysis – records for accidents – departmental accident reports – documentation of accidents – unsafe act and condition – domino sequence – supervisory role – role of safety committee –cost of accident – factories act – safety health. (8)

UNIT V: Safety Performance Monitoring : Calculation of accident indices – frequency rate – severity rate – frequency severity incidence – incident rate – accident rate – safety “t” score – problems. (7)

UNIT VI: Safety Education And Training: Importance of training- identification of training needs-training methods - programmes-seminars – conferences – competitions – motivation – communication - role of government agencies and private consulting agencies in safety training – awards – celebrations. (7)

TEXT BOOKS:

1. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York.

2. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay.

REFERENCE BOOKS:

1. Dan Petersen, “Techniques of Safety Management”, McGraw-Hill Company, Tokyo.
2. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey.
3. “Safety and Good House Keeping”, N.P.C., New Delhi.
4. “Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago.
5. Lees, F.P., “Loss Prevention in Process Industries” Butterworth publications, London, 2nd edition.
6. John Ridley, “Safety at Work”, Butterworth & Co., London.

SPE06 COMMUNICATION SKILLS

Lecture : 02 Hrs/w

Internal Assessments: 10

Tutorial : _____

University Exam: 40

Credits : 02

Theory Paper (Hrs.) : 02

UNIT-I: Comprehension over an unseen passage.
Comprehension - A - word study :- Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.
Comprehension - B - Structure study :- Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc.
Active and passive forms, negative and interrogative, punctuation and capitalization. (8)

UNIT-II : Theoretical background - importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectively and subject content. Non-verbal communication, types of graphics and pictorial devices. (8)

UNIT- III: Specific formats for written communication like - business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-

to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews. Methodology of conduction of meetings, seminars, symposia, conference and workshop. (8)

BOOKS RECOMMENDED :

- 1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
- 2) Cbrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
- 3) Raman Sharma “Technical Communication”, Oxford University Press.
- 4) F. Frank Candlin ; General English for Technical Students, University of London Press Ltd.

SPE07 DESIGN OF MACHINE ELEMENTS –Lab.

Practical : 02 Hrs/ w

Tutorial : ____

Credits : 01

Practical Term Work: 25

Practical / Oral Exam: 25

Course Objectives:

- Apply the study of the different types load considerations and design aspects of various machine members.
- Apply the ability to analyze, design and/or select machine elements - with attention to safety, reliability, and societal and fiscal aspects.
- Design shafting and specify appropriate keys and couplings.
- Design springs, common welded and bolted connections.

TERM WORK

Any eight of the following design. (Standard components shall be selected from relevant I.S. codes and Design Data Handbooks for the exercises given below.)

1. Design of cotter joint.
2. Study of Engineering Materials, their applications and selection as per different standards used in practice.
3. Design of Knuckle joint.
4. Design of circumferential/longitudinal riveted joint of boiler.
5. Design of springs.
6. Design of rigid flange coupling.
7. Design of flexible coupling (Bush pin type)
8. Design of lever of a safety valve.

9. Design of eccentrically loaded bracket.
10. Design of pipe and pipe joints subjected to internal pressure.
11. Design of shaft carrying one pulley and supported in two bearing.
12. Design of Coupling and Detailed Working drawings with assembly.
13. Design of bolted, riveted and welded joints for transverse and eccentric loading.
14. Design of Gear Drive involving Gears, Shafts, and Keys with working drawings.
15. One assignment using CAD package on any one of the exercises.

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

SPE08 TOOL ENGINEERING –I –Lab.

Pra

Practical : 02 Hrs/ w

Tutorial : ____

Credits : 01

Practical Term Work: 25

Practical / Oral Exam: 25

Course Objective:

- Student should have the basic knowledge of how to design various tools used for machining (metal cutting), Student should be able to design Single point tool, Circular and flat form tools, drill, broach. Student should also have the knowledge of selecting proper tool which will give the desired quality in the most economical way.

PRACTICALS :

At least six experiments based on above syllabus as given below:

- 1) Measurement of forces on lathe tool dynamometer.
- 2) Drawing and design of single point tool.
- 3) Drawing and design of circular form tool for two jobs.
- 4) Drawing and design of flat form tools.
- 5) Design of broach.
- 6) Study of geometry of drill and reamer and measurement of axial thrust and torque by drill tool dynamometer.
- 7) Study of geometry of taps and dies.
- 8) Study of geometry of gear cutting tools.

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be vivavoce based on above practical and the syllabus of the course.

SPE09 COMMUNICATION SKILLS – Lab.**Practical :** 02 Hrs/ w**Tutorial :** _____**Credits :** 01**Practical Term Work:** 25**Practical / Oral Exam:** 25**Course Objective:**

- On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and communication for technical English language, actively participate in group discussions and interviews and bit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and action. The sample list of experiments is given below. This list can be used as guideline for problem statements but f scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.
 1. Assignments and tests for vocabulary building
 2. Technical report writing
 3. Group discussions
 4. Interview techniques
 5. Projects and tasks such as class news letter
 6. Writing daily diaries and letters
 7. Interactive language laboratory experiments.

TEXT BOOKS :

- 1) Norman Lewis : Word Power Made Easy
- 2) Ghosh: “Technical Communication”, Oxford University ress.
<http://www.teachingenglish.org.uk>

SPE10 COMPUTERAPPLICATIONS IN PRODUCTIONENGINEERING –Lab.**Practical :** 02 Hrs/ w**Lecture :** 01 Hrs/ w**Credits :** 03**Practical Term Work:** 25**Practical / Oral Exam:** 25**Course Objective:** Student will

- Understand and practical knowledge of 2D and 3D modeling of various part models.
- Have a good understanding of the various kinds of databases and the support they provide to different levels of management.
- Be able to use SQL with confidence to implement a relational database, and to maintain and access data in relational databases
- Be able to use Word, Excel and Presentation documentations.
- Have a good understanding of various Numerical, Statistical Analysis and its plots.

UNIT – I: MODELING SOFTWARE:

- 1) Sketching, selection of sketch plane, creating feature on work plane, extrude, dimensioning sketches, constraining sketches.
- 2) Create Rectangle, Circle, and Polygons. Extrude these to make box, cylinder & prism and dimension the above part, change size by editing dimensions & using constraints.
- 3) Create various drawing views of the 3-D parts.
- 4) Extrudes to face/plane, intersect, face draft, 3D rounds, 3D fillets & 3D chamfers, setting & modifying feature dimensions, history based part modification.
- 5) Use extrudes commands to make holes through the above objects. Also face drafts a part on another part.
- 6) Create 3-D rounds and fillets on box corners and Use history to modify above feature and their dimensions.

UNIT II : DBMS SOFTWARE:

- 1) Design and draw an ER diagram using standard notations for given problem definition
- 2) Convert given ER diagram into Database Tables.
- 3) Create Database Tables and Indices in back end Database like /MS ACCESS /ORACLE / SQL Server / My SQL using SQL DDL statements and applying all required constraints on Tables and/or Tuples. (*Create at least 03 tables using all types of possible constraints, and relationship (foreign key) between them.*)
- 4) Use SQL DML statements such as INSERT, UPDATE, DELETE to insert the data into tables and to update/delete the data inserted into/from tables if required.
- 5) Write and execute SQL queries to extract information from the tables.
- 6) Study on any two of the following:
 - a) Inter-organizational and global information systems
 - b) Functional and enterprise system
 - c) Intelligent systems in Business.
 - d) Electronic Commerce (E-Commerce).

UNIT III: NUMERICAL & STATISTIC ALANALYSIS SOFTWARE (MATLAB / PYTHON):

- 1) Matrices and array manipulation;
- 2) Solution of linear algebra and nonlinear systems;
- 3) Input/output and simple plotting (2D and 3D plot)

- 4) Data analysis and Statistics;
- 5) Initial value and boundary value problems;
- 6) Interpolation (global, piecewise, regression);
- 7) Numerical integration algorithms;

UNIT IV: OFFICE (Microsoft / OpenOffice):

- 1) Word processing: MS-Word, word basics, formatting text and documents, working with header and footer, footnotes, endnotes, tables and sorting, graphics, mail merge and macros.
- 2) Spreadsheets and their uses in business, Excel basics, rearranging worksheets, excel formatting techniques, using functions, chart features and working with graphics in excel.
- 3) Power Point: Basics, working with texts and graphics in Power Point.

TERM WORK:

- 1) Minimum Two practicals from each on Unit I, II and III
- 2) Prepare a mail merge application using Word and Excel.
- 3) Prepare a Presentation on any one Topic from V semester syllabus A Journal / Report on experiments conducted shall be submitted by each student. Using. and presented by using .
Practical examination shall be viva-voce based on above units, taken jointly by internal & external examiner.

TEXT BOOKS:

- 1) "MASTERING CAD CAM" By Ibrahim Zeid, 2005, TMH, ISBN 0-07-059411-2
- 2) "DATABASE MANAGEMENT AND ORACLE PROGRAMMING", By S S KHANDARE, 2004, S CHAND & Co. NEW DELHI, ISBN 81-219-2283-6
- 3) "Getting Started with MATLAB, By Rudra Pratap, 2010, Oxford University Press, NEW DELHI, ISBN 978-0-19-806919-5

REFERENCE BOOKS:

- 1) "INTRODUCTION TO DATABASE MANAGEMENT", By Dr Madhulika Jain, 2002, BPB PUBLICATION, NEW DELHI, ISBN 81-7656-638-1
- 2) "Pro/Engineering Wildfire for Engineers and Designers" By Prof. Sham Tickoo, 2003, Wiley Dreamtech India Pvt. Ltd. New Delhi, ISBN 81-7722-413-1

SIXTH SEMESTER

6PE01 TOOL ENGINEERING - II

Lecture : 04 Hrs/ w
Tutorial : 01 Hrs/ w
Credits : 05

Internal Assessments: 20
University Exam: 80
Theory Paper (Hrs.) : 03

Course Objective:

- Student should have the basic knowledge of how to design various tools used for machining (metal cutting), Student should be able to design jigs, fixtures, press tools and dies. Student should also have the knowledge of selecting proper jigs, fixtures and forming process / tools, which will give the desired quality in the most economical way

SECTION-A

UNIT-I & II : Jigs & Fixtures : Design economics, principles of locations, types of location, preparation of jamming problem of chips & dust in location, use of dowels, redundant location, principles of clamping, types of clamps, power clamping drill bushes, types of drill jigs and their design, milling fixtures, turning fixtures, grinding & broaching fixtures, indexing devices in jigs of fixtures. (14)

UNIT-III : Rolling : Principle, classification of rolling mill, construction of rolling mill, layout of rolling mills, maximum permissible reduction in one pass, no. passes, roll pass design, box pass and oval pass, defects in rolling, sectional rolling passes, rolling torque of power.

Extrusion : process fundamental; forward, backward, impact, hydrostatic extrusion, pressure required in extrusion. (10)

SECTION-B

UNIT-IV & V : Press Tools : Classification of presses, shear action in die cutting operation, clearance, cutting forces, shear on punch and die, centre of pressure, classifications of cutting operation, operating of metals, drawing fundamental, types of die construction, function of nomenclature of die components, planning for cupping operation.

Miscellaneous dies : Horn die, cam action die, rubber & bulging, sub-pressing die. (14)

UNIT-VI: Forging : process fundamental, classification & schedule of forging equipment, classification of forging process, type of forging product, perform stages & design of product for close die forging, shape of perform stages for class III forgings, strength of forged component, trim ting, mounting of dies, non classified forgings upset forging. (10)

TEXT BOOKS:

- 1) PRODUCTION ENGINEERING By P C Sharma
- 2) Tool Design - Donaldson, T.M.H.

REFERENCE BOOKS:

- 1) An Introduction Jig & Tool Design - EKBS, T.M.H.A., Kempster.

- 2) Jigs & Fixtures - P.H.Joshi, T.M.H.
- 3) Rolling Practice - Burtsev, MIR.
- 4) Techniques Press Working Sheet Metal - Eary, P.H. Inc.
- 5) Fundamentals of Tool Design - P.H.Astme.
- 6) Manufacturing Technology - P.N.Rao, T.M.H.

6PE02 METROLOGY AND QUALITY CONTROL

Lecture : 03 Hrs/ w

Tutorial : 01 Hrs/ w

Credits : 04

Internal Assessments: 20

University Exam: 80

Theory Paper (Hrs.) : 03

Course Objectives:

- Future manufacturing processes will require smaller tolerances than currently obtained to achieve the desired quality and reliability. Designers of components and machines will need a better understanding of the potential error sources and the way they will influence the final component. This course will build the foundations for dimensional metrology and error analysis to give the student the ability to predict the potential precision - that is, the accuracy and repeatability - of a new machine design. The course will:
 - Describe the foundations of mechanical metrology
 - Discuss the instruments currently used for precision measurement, their operating principles, advantages and limitations
 - To study how to set up the measurements and how to use the results to evaluate the performance of the machine
 - Develop an understanding of techniques for error analysis and performance prediction

SECTION - A

- UNIT-I: i) Standards of measurements:** principles of measurements, line and end standards, slip gauges, end bars, wave-length standards, classification of standards.
- ii) Interchangeability. Universal and local interchangeability, selective assembly, concept of limits, tolerance and allowances, types of fits and gauges. B.S. system and Indian standard specification for limits and fits, design of plain limit gauges and their manufacture.
- ii) Screw thread limit, fits, design of screw thread limit gauges. (8)

- UNIT-II: i) Measuring instruments:** 1. Linear measurements - length measuring instruments based on Vernier principle, Micrometers, Dial gauges.
- ii) Comparators:** various comparators such as mechanical, electrical, and electronic optical and pneumatic

comparators, their principle of operation and application.

- iii) Angular measurements:** Vernier and Universal Bevel protractor, Sine bar, levels, clinometers, optical dividing head. Angular slip gauges, taper gauges, autocollimator.
- iv) Optical instruments:** Projector, tool makers' microscope, interferometers. (8)

UNIT-III: Measurements :

- i) Screw thread measurement:** measurement of elements of screw threads, major & minor pitch and effective diameters, errors in screw thread elements and their effects, external and internal screw threads.
- ii) Gear measurements:** inspection of gears for tooth thickness, measurement of tooth profile, pitch measurement, alignment error, master gear, Parkinson gear tester.
- iii) Surface roughness:** surface texture measurements and gauging, surface roughness in various manufacturing process.
- iv) Geometrical features:** flatness, squareness, roundness, cylindricity.
- v) Automated inspection:** in process gauging and principle of co-ordinate measuring machine. (7)

SECTION - B

- UNIT-IV: i) Basic concepts of quality and quality control:** fitness, for use, quality characteristics, parameters of fitness for use quality function, quality control, quality assurance.
- ii) Quality policies and objectives:** the need for quality policies, formulation of quality policies, quality objectives for break through and control.
- iii) Quality costs:** phases in quality cost program, discovering the optimum quality cost.
- iv) Process acceptance is product acceptance, advisory Vs. mandatory process, quality mindedness, quality control circles, vendor inspection, vendor rating, process capability study. (8)**

- UNIT-V: Statistical quality control :** importance of statistical methods in quality control, basic philosophy and principles of sub grouping, meaning of statistical control, variables and attributes, measurements and inspection, different types of control charts (X-R, MP, P and C charts) (7)

UNIT-VI: Acceptances sampling : sampling inspection, viz hundred percent inspection, basic concepts of sampling inspection, operating characteristics curve, conflicting interests of consumer and producer's producers and consumer's risk, AQL, LTPO, AOQL, Single and double sampling plans, acceptance/rejections, acceptance rectification plans. (7)

TEXT BOOKS:

- 1) Engineering Metrology : R.K.Jain
- 2) Engineering Metrology: I.C.Gupta
- 3) Statistical Quality Control : Gupta R.C.

REFERENCE BOOKS:

- 1) Quality Control Hand Book : J.M.Juran
- 2) Statistical Quality Control : Grant
- 3) Metrology and Measuring Instruments : M.R.Taher.
- 4) Engineering Metrology : K.W.B.Sharp,
- 5) Statistical Quality Control : Grant E.L., R.S.Leavenwoth.

6PE03 MACHINE TOOL DESIGN

Lecture : 04 Hrs/ w
Tutorial : 01 Hrs/ w
Credits : 05

Internal Assessments: 20
University Exam: 80
Theory Paper (Hrs.) : 03

Course Objectives:

- The main objective of this course is to offer the student the basics of Machine Tool Design.
- To make the students understand the concepts & broad principles of contents of the course.
- Sensitizes the students of the importance of course in real life environment.
- Study of procedure to design various machine tool members under different loading.

SECTION-A

UNIT-I: Design of spur, helical, bevel and worm gear drives, design of belt and chain drives. (8)

UNIT-II: Design of clutches and brakes, journal bearing and lubrication, selection of ball and roller bearings. (8)

UNIT-III: General classification, general requirements of m/c tools, aim of speed and feed rate regulation, classification of speed and feed boxes, step less regulation of speed and feed rates. (8)

SECTION-B

UNIT-IV : **Design of speed and feed boxes :-** stepped regulation of speed, break up of speed step, selection of best possible structure diagram, speed chart, design of feed box, determining the numbers of teeth of gears. (8)

UNIT-V: Design of m/c tool structure :- Functions, and their requirements design criteria, materials used, profiles used, basic design procedure, guide ways, slide ways and antifriction ways, shapes and material used, method of adjusting clearance in slide ways, protecting devices for slide ways. Design of spindles. (10)

UNIT-VI: Regulation of speed in electrical control circuits, electrical circuits diagram for starting and stopping the motor of a m/c tool, electrical brakes, electromagnetic clutch, ferromagnetic power clutch, thermal relay in m/c tools, electrical automation in m/c tools. Acceptance test of lathe and drilling. (6)

TEXT BOOKS :

1. MACHINE TOOL DESIGN, N. K. Mehta, Tata McGraw Hill, ISBN 0-07-451775-9.
2. DESIGN OF MACHINE TOOL, D. K Pal, S. K. Basu, 4th Edition. Oxford IBH 2005, ISBN 81-204-0968

REFERENCE BOOKS:

1. PRINCIPLES OF MACHINE TOOL, Bhattacharya and S. G. Sen., New central book agency Calcutta, ISBN 81- 7381-1555.
2. MACHINE TOOL, N. S. Acherkan, Vol. I, II, III and IV, MIR publications.
3. DESIGN PRINCIPLES OF METALCUTTING MACHINE TOOLS, F. Koenigsberger, The Macmillan Company New York 1964.
4. MACHINE TOOL DESIGN HANDBOOK, C.M.T.I. Bangalore, (TMH)
5. DESIGN DATA HANDBOOK, K. Mahadevan and K. Balveera Reddy, C.B.S. Publishers & Distributors
6. Product Design and Manufacturing, (3/e), A. K. Chitale and R. C. Gupta, Prentice- Hall of India Pvt. Ltd.

6PE04 WORK STUDY

Lecture : 04 Hrs/ w
Tutorial : _____
Credits : 04

Internal Assessments: 20
University Exam: 80
Theory Paper (Hrs.) : 03

Course Objectives:

- The Work-Study Program encourages community service work and

work related to each student's course of study. It develops scientific methods for doing work.

- Establishes goals for productivity and systems of reward for meeting goals. Also trains the personnel in how to use the methods and thereby meet the goals.

SECTION-A

UNIT-I: Work Study: Definition, objectives and scope of work study, Contribution of Taylor and Gilbreth, Work study and Productivity. Problems in increasing productivity through work study. The human factor in the application of work study. Classification of work study. (8)

UNIT-II: Method study: Definition, objectives and basic procedure of method study, symbols in charting, different recording techniques, analysis and critical examinations of operation and development of improved method. Principles of motion Economy, Introduction to memomotion and micromotion study. (8)

UNIT-III: Charts and Diagrams: Study of Operation process chart, Flow process chart, Multiple activity charts, Two handed charts. SIMO chart, Flow and string diagram cycle graph, crono cycle graph, (8)

SECTION-B

UNIT-IV: Work Measurement: Definition of Time study, basic procedure and equipments of time study. Breaking of an operation into elements. Allowances and their applications, Calculation of standard time. (8)

UNIT-V: Work sampling :- Concept, steps, advantages, applications and limitations of work sampling, sampling errors and confidence level, Introduction to standard data and synthetic time study devices. Introduction to Job Evaluation system and its necessity; Job Analysis, Description and Evaluation. Evaluation Systems like Factor Comparison, Point System, Merit rating. (8)

UNIT-VI: Application of Work Study: Introduction of work study into organization, its application in manufacturing and service sector, training of personnel in work study, Wage incentives plans, Case studies and analysis. (8)

TEXT BOOKS :

1. ILO, "INTRODUCTION TO WORK-STUDY", Universal Publishing

Company. ISBN 81-8502700-4.

2. "WORK STUDY", By O. P. Khanna, Dhanpat Rai Publications, New Delhi.
3. Work Study And Ergonomics by S.K. Sharma, Savita Sharma, 1 st Ed. , S.K. Kataria & Sons , 4760-61/23, Ansari Road, Daryaganj, New Delhi-110002 (India) ISBN 9788188458349

REFERENCE BOOKS:

1. Yoga M., JOB EVALUATION, National Productivity Council; New Delhi, India; 1971; First Edition
2. Zandin Kjell.B, "MOST WORK MEASUREMENT SYSTEMS". Publisher: M. Dekker ISBN-10: 0-8247- 6899-X, ISBN-13: 9780824768997
3. Maynard H. B., "INDUSTRIAL ENGINEERING HANDBOOK", 3rd edition, McGraw Hill Book Company. ISBN 0-07-041084-4
4. Text Book of Work Study And Ergonomics, By Suresh Dalela and Saurabh Dalela

6FEPE05 FREE ELECTIVE - II (01) INDUSTRIAL AUTOMATION

Lecture : 03 Hrs/ w

Tutorial : _____

Credits : 03

Internal Assessments: 20

University Exam: 80

Theory Paper (Hrs.) : 03

Course Objectives:

- To understand & implementation of Basic & Application sensor for simple factory Automation
- The course is aimed to study the concepts and implementation techniques of Industrial Electronics and Industrial Automation.
- It provides the understanding of PLC hardware and programming techniques.
- Furthermore, it provides the basic understanding of Hydraulic and Pneumatic systems
- To understand basic skills useful in automated machines and equipment and describe the terms and phrases associated with industrial automation.

SECTION – A

UNIT- I: Automation of assembly lines : Concept of automation, mechanization and automation, Concept of automation in industry, mechanization and automation, classification, balancing of assembly line using available algorithms. Transfer line-monitoring system (TLMS) using Line Status, Line efficiency. Buffer stock Simulation in assembly line. (7)

UNIT- II: Automation using hydraulic systems: Design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators, intensifiers etc. Selection of hydraulic fluid, practical case studied on hydraulic circuit design and performance analysis. Servo valves, electro hydraulic valves, proportional valves and their applications.

(7)

UNIT- III: Automation using pneumatic systems : Pneumatic fundamentals - control elements, position and pressure sensing -logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods – step counter method - compound circuit design - combination circuit design. Pneumatic equipments - selection of components – design calculations -application - fault finding – hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

(8)

SECTION – B

UNIT- IV : Automation using electronic systems : Introduction, various sensors, transducers, signal processing, servo systems, programming of microprocessors using 8085 instruction, programmable logic controllers.

(7)

UNIT- V: Automated work piece handling: Working principles and techniques, job orienting and feeding devices. Transfer mechanisms automated feed cut of components, performance analysis. Uses of various types of handling systems including AGV and its various guiding technologies.

(8)

UNIT- VI: Introduction to robot technology: Robot physical configuration and basic robot motions, Types of manipulators- constructional features, servo and non servo manipulators. Feedback systems and sensors encoders and other feedback systems, vision, ranging systems, tactile sensors. Programming languages description of VAL and other languages. Artificial intelligence- legged locomotion and expert systems.

(8)

TEXT BOOKS:

1. Groover, M.P., CAD/CAM- Prentice Hall
2. Yoram Koren, Robotics for Engineers- McGraw Hill 1992
3. Paul, R.P., Robot Manipulators- MIT Press 1993

REFERENCE BOOKS:

1. Andrew Parr, “ Hydraulic and Pneumatic “, (HB), Jaico Publishing House,
2. Bolton. W. “ Pneumatic and Hydraulic Systems “, Butterworth - Heineman,

6FEPE05 FREE ELECTIVE - II

(02) ENTREPRENEURSHIP DEVELOPMENT AND ENGINEERING ECONOMICS

Lecture : 03 Hrs/ w

Internal Assessments: 20

Tutorial : _____

University Exam: 80

Credits : 03

Theory Paper (Hrs.) : 03

Course Objectives:

- Engineering Economics gives the students an overview of the economics methods employed in effective engineering decisions as related to the designing, planning and implementation of successful projects. It emphasizes the practical benefits of the applications of such tools as Time Value of Money calculations, Depreciation, Replacement Analysis, Benefit to Cost Ratios, Break-even Analysis, and Life Cycle Cost.
- Entrepreneurship Development and Management is one of the core competencies of technical human resource. Creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects can be helpful in motivating technical/ vocational stream students to start their own small scale business/enterprise.

SECTION – A

UNIT I : Industrial Economics : Basic Concepts, Demand Analysis, Types of Demand, Determinants of Demand, Methods of Demand Forecasting, Supply, Law of Diminishing Marginal Utility, Elasticity of Demand. (7)

UNIT II : Factors Of Production, Production Function, firm and Industry, Laws of Return, Cost Concepts, Fixed Variable, Average, Marginal And Total cost, Break Even Analysis, Depreciation Cost, Taxation System, Types of Taxes. (8)

UNIT III: Optimum size of Unit, Optimum Firm, Industrial Combinations, Causes for the Growth of combinations. Forms of combination In India, Various Competitive Situations, Perfect, Monopoly, Monopolistic, Oligopoly. Price Determination Under These Situations. Impact of Globalization on Indian Economy. (7)

SECTION – B

UNIT IV: Concept of Entrepreneurship, Definition, competencies Of Entrepreneurs, Entrepreneurial Functions, Achievement, Motivation, Types of Enterprises. Policies Governing Small Scale Industries, Procedure to Set Up Small Scale Industrial Unit, Advantages and Limitations Of SSI. (8)

UNIT V: Market Survey And Factors Governing Product Selection. Project Report Preparation, Technical, Financial and Marketing Analysis of the Project. Factors Governing the Selection of Site, Plant And Machinery. Financial and Ratio Analysis. (7)

UNIT VI: Role Of Consultancy organizations, Role of District Industries Center, State Ind. Development Corporations, Banks And Financial Institutions, Latest SSI Intensive Schemes (To be confirmed From DIC Time to Time) Determination Of Working Capital Requirement, Industrial Overheads, Determination Of product Sales Cost. (8)

TEXT BOOKS :

1. D.Salvatore , “Managerial Economics in a global economy” Tata McGraw Hill
2. Reckie and Crooke., “ Managerial Economics” Prentice Hall; 4 edition.
3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi

REFERENCES BOOKS ::

1. Khan M.Y., Jain P.K , “Management Accounting”, Tata Mc Graw Hill, 1995.
2. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
3. Entrepreneurship: New Venture Creation - David H. Holt
4. Handbook of Small Scale Industry by PM Bhandari

6PE06 TOOL ENGINEERING – II – Lab.

Practical : 02 Hrs/ w

Tutorial : _____

Credits : 01

Objectives:

- To meet the requirements of industry in the fields of jigs, fixtures and dies.

- To train students in designing different tools drill jigs, turning fixture, milling fixture and forming dies.
- Student should have the knowledge of metal forming process.

TERM WORK:

At least eight designs based on above syllabus as given below:

- 1) Design and drawing of drilling / reaming jigs. - **3 sheets**
- 2) Design and drawing of milling fixtures. - **3 sheets**
- 3) Design of drawing of press tools - **3 sheets**
(For all above 3 designs at least **one printout of each design** is showing manufacturing drawing with tolerances, material specification and heat treatment using well known commercial available drafting package.)
- 4) Design of drawing of forging dies - **1 sheet**
- 5) Problem on roll pass design - **1 sheet**
- 6) Design and drawing of one progressive die. - **1 sheet**
- 7) Design and drawing of one drawing die. - **1 sheet**
(Out of above 4 designs take printout of any one design using well known commercial available drafting package.)
- 8) 3D model of various elements of jigs and fixtures using well known commercial available drafting package.

Above mentioned design work should be done by a batch of not more than ten students for each component.

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be vivavoce based on above practical and the syllabus of the course, taken jointly by internal & external examiner.

6PE07 METROLOGY AND QUALITY CONTROL - Lab.

Practical : 02 Hrs/ w

Tutorial : _____

Credits : 01

Objectives:

- To develop hands-on-skills on tools and techniques of measurements for industrial Metrology and Quality Control.
- Making the students well acquainted with basic concept to quality and it's correlational criteria's to implement the concept of quality.
- Students should be able to apply the principles of Metrology and Quality Control system.
- To provide the students with a sound basic background in a vast field of Metrology and Quality Control and understand its practical applications.
- Develop an understanding of techniques for error analysis and performance prediction

Practical Term Work: 25

Practical / Oral Exam: 25

TERM WORK:

Term work shall consist of eight experiments based on the following:-

- 1) Design and drawing of at least two types of limit gauges.
- 2) Problem solving and sketching figures for Selection of slip gauges
- 3) Problem solving and sketching figures for angle gauges
- 4) Study of comparators
- 5) Study of angular measurement
- 6) Study of screw thread measurement
- 7) Measurement of Gear tooth thickness using Gear tooth Vernier caliper and Span Micrometer
- 8) Study of flatness and squareness measurement
- 9) Measurement of angle by Sine bar / Sine center.
- 10) Study and Experiment on Profile Projector.
- 11) Measurement of Screw thread parameters using Floating Carriage Micrometer.
- 12) Calibration of instrument using Calibration setup.

6PE08 MACHINE TOOL DESIGN–Lab.

Practical : 02 Hrs/ w

Tutorial : _____

Credits : 01

Practical Term Work: 25

Practical / Oral Exam: 25

Objectives:

- To have develop hands on skills in the subject
- Develop the practical aspects of the theory knowledge
- Application of the theory with Understanding of fundamentals of the subject and be in a position to explain the procedure of the experiments.

TERM WORK:

Practical Minimum 8 out of following:

1. Design and working drawing of Speed Gear Box
2. Design and working drawing of Feed Gear Box
3. Design of clutches or breaks drive.
4. Design of belt or chain drive.
5. Design of electrical circuits.
6. Inspection and acceptance test.
7. Study of Step-less Drives
8. Design of Base
9. Design of Bed
10. Design of Column
11. Design of Slide ways
12. Design of Spindle
13. Power Screw Design (Sliding & Rolling friction)
14. Design of Guide ways

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

6PE09 MINOR PROJECT (MACHINE SHOP PRACTICE)

Practical : 03 Hrs/ w

Tutorial : _____

Credits : 03

Practical Term Work: 25

Practical / Oral Exam: 25

Objectives:

- Applying tools and methodologies of a field of practice in a Machine Shop Project.
- Applying skills and academic knowledge in a workplace.
- Application of the theory with Understanding of fundamentals of the subject and be in a position to explain the procedure of the experiments.

TERMWORK:

Term work shall consist of minimum 02 composite jobs involving operations on the **Lathe, Shaping, Milling, Drilling and Slotting Machine.**

Each student shall submit details of operations, process analysis along with flow process charts for the jobs prepared and time estimation of each job in the form of journal.

PRACTICALEXAMINATION:

Practical examination shall consist of assessment of above term work and oral based on above term work.

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
ELECTRONICS & TELECOMMUNICATION ENGINEERING
SEMESTER PATTERN (C. G. S.)
FIFTH SEMESTER**

**5XT1/ 5XN 1 ELECTRONIC DEVICES AND CIRCUITS-II
SECTION-A**

- Unit I :** Linear wave shaping using RC and RL circuits, analysis and calculations of RC low pass and high pass filters, analysis of clipping and clamping circuits using diodes and switching transistors.
- Unit II :** Switching characteristics of semiconductor devices : Diode as switch, transistor as a switch, characteristics and analysis, FET as a switch, characteristics, JFET, CMOS, switching speed of devices : Schottky diode and transistor, Logic gates.
- Unit III :** Collector coupled bistable, monostable and astable multivibrators, Time base generators & Sweep Generators. Boolean Algebra, Number systems, Gray codes, Arithmetic operations using Two's compliments.

SECTION-B

- Unit IV :** Study and analysis of Digital Logic Families : RTL, DTL, HTL, TTL, ECL, IIL, CMOS, and their characteristics, tri-state logic, 5400/7400 TTL series.
- Unit V :** Flip-flops : R-S, J-K, Master slave J-K, D-type, T-type; registers and counters, adders and subtractors using logic gates, D/A converters and types: Weighted resistor, R-2R ladder. A/D converters and Types: Ramp, Dual slope, Successive approximation.
- Unit VI :** Types of semiconductor memories, sequential memories, 2 and 4 phase ratioless shift registers, static shift registers, implementation of ROM (ROM, PROM, EPROM, EEPROM) BJT RAM cell, MOS-RAM, CCD memories.

BOOKS RECOMMENDED :

- 1) Jacob Millman & Herbert Taub : "Pulse Digital & Switching waveforms", McGraw Hill International Book Co.
- 2) Taub H. and Schillings D.L., London, : "Digital Integrated Electronics", McGraw Hill Company.
- 3) R. P. Jain : "Modern Digital Electronics", Tata McGraw Hill, New Delhi 1998.

- 4) Malvino A.P. & Leach D.P. : "Digital Principles & Applications", TMH Publishing Co., New Delhi (3rd Edition).

**5XT2 / 5XN2 POWER ELECTRONICS
SECTION-A**

- Unit I :** SCR, Triac, LASCR, Diac-construction, characteristics, two transistor analogy for turning ON of a SCR, turn ON mechanism, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuits. Introduction to GTO, power transistor, power MOSFET, IGBT - their construction & characteristics.
- Unit II:** Series parallel operation of SCRs, static & dynamic equalizing ckts., equalisation of current in parallel connected SCRs, string efficiency, derating factor, Protection of SCRs against di/dt, dv/dt, radio freq., interference, over voltage, over current.
- Unit III:** Principle of phase control, half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of free wheeling diode, single phase dual converters. Three phase half controlled bridge and fully controlled bridge rectifier.

SECTION-B

- Unit IV:** Classification of ckt. for forced commutation, series inverter, improved series inverter, parallel inverter, output voltage and waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorised bridge inverter, current source inverter, harmonics reduction techniques.
- Unit V:** Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, step-up chopper and AC chopper. Basic principle of cycloconverter, single phase to single phase cycloconverter.
- Unit VI:** Speed control of DC series motors using chopper, speed control of DC shunt motor using phase controlled rectifiers, Static ckt. breaker, UPS, fan speed regulator, principle of soft start ckts, electronic ballast.

TEXT BOOKS:

- 1) M. Ramamoorthy, Thyristor and their application.

- 2) M. H. Rashid - Power Electronics Circuits, Devices and Application, Pearson Edu.
- 3) SCR Manual GE.

REFERENCE BOOKS :

- 1) Joseph Vithayathil, "Power Electronics: Principles and Applications", McGraw-Hill
- 2) Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics: Converters, Applications, and Design", Wiley
- 3) K. Hari Babu – Power Electronics, Scitech Pub..
- 4) Devdatta Y. Shingare, A Text book of Industrial & power electronics, Electrotech Pub. Satara.
- 5) J. S. Katre, Power Electronics, Tech-max Pub. Pune.

**5XT3 / 5XN3 CONTROL SYSTEM ENGINEERING
SECTION-A**

Unit I : Basic definition; closed and open loop systems; transfer function, block diagrams, derivation of transfer functions of physical systems, signal flow graphs, basic control action.

Unit II : Time Response Analysis: Typical test inputs, , Impulse response function, Transient Domain specifications, Analysis of first, second & higher order systems, Steady state analysis: steady state error and error constants, Dynamic error coefficients.

- Unit III:**
1. Stability Analysis: stability of control system, Routh Hurwitz's stability criterion,
 2. Roots Locus: Introduction to Root Locus method; Root Locus plots, Rules for constructing root loci, stability analysis of systems using Root locus, concept of dominant closed loop pole pair, Root contour plots, effect of addition of zeros & poles.

SECTION-B

Unit IV : Introduction of frequency response, Bode plots, stability margins on the Bode plot, stability analysis of systems using Bode plots, polar plots, Nyquist stability criterion, relative stability.

Unit V : State Space representation of systems, conversion of state variable models to transfer functions, conversion of transfer functions to state variable models, solution of state equations, concepts of controllability and observability.

Unit VI : Sample Data Control Systems : Representation of sampled data (Discrete) systems, review of Z-transforms, Sampler and hold ckt., Zero order hold, sampling theorem, Z-transform analysis of sampled data control systems (open & closed loop systems), Z transform of systems. Solution of difference equation by Z-transform methods. Response of discrete systems. Pulse Transform functions of open loop, closed loop systems with different sampler locations. Digital controller & its transfer functions, Stability analysis of discrete time system using bilinear transformation.

TEXT BOOK :

1. Nagrath I. J. and M. Gopal, "Control Systems Engineering", 5th Ed. New Age International.
2. K. Ogata : Modern Control Engineering, Fourth Edition(PHI)

REFERENCE BOOKS:

- 1) Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11th Ed., Pearson Education.
- 2) M. Gopal : Digital Control Systems Principles & Design (TMH)
- 3) Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.
- 4) Bhattacharya: Control System Engineering, 2nd Edition (Pearson Education).

**5XT4 / 5XN4 COMMUNICATION ENGINEERING-II
SECTION-A**

Unit I : AM Transmitters : Modulation, need of modulation, AM Modulation, Frequency spectrum, Principles of DSB-FC, DSBSC, SSB-SC modulation and their comparison, Details of DSBFC Transmitter, Generation of DSB-SC by using balanced modulators (FET & Diodes), DSB-SC Transmitter, Generation of SSB-SC by filter method, phase-shift method & third method (weavers).

Unit II : AM Receivers : TRF receiver, Super heterodyne receiver, Details of each block such as RF amplifier, mixer oscillator, IF amplifier, Diode detector, Audio Amplifier. Need and type of AGC, selectivity sensitivity, fidelity Image rejection ration, communication receiver, SNR of DSB-FC, DSB-SC & SSB-SC

Unit III: FM Transmitters : FM Modulation, Frequency Spectrum, Circuits & Analysis for direct FM generation using FET and varactor diode. Circuit & analysis of Indirect FM generation, Narrow Band and Wide Band FM, their comparison, pre-emphasis and De-emphasis. Stereo FM Transmitter.

SECTION-B

Unit IV : FM Receivers : Details of FM receiver blocks such as R.F. amplifier, local oscillator, IF amplifier, Mixer, Audio Amplifier, AGC, Limiter, FM Discriminator, Single Slope and Balanced slope detector, Analysis of Foster Seeley and ratio detectors, Stereo FM receiver, Noise in FM Reception, FM threshold effect.

Unit V: Pulse Modulation Techniques: The sampling theorem, Sampling of Band-Pass Signal, Linear and Non linear quantization, Aliasing effect, Aperture effect, Reconstruction filter, Time Division Multiplexing, Pulse Amplitude Modulation, Pulse Time Modulation, PCM, DM, ADM

Unit VI : Telephone Switching Techniques : Introduction to Switching System, Pulse dialing, Touch tone dial telephone, Space Division Switching SPC, Centralized and Distributed SPC, Time Division Switching : Basic Time Division space switching, Time Division time switching, Time multiplexed space switching, Time Multiplexed time switching, EPABX.

Text Books:-

- (1) Taub and Schilling D.L. : Principles of Communication Systems, McGraw Hill Co, Tokyo, 1994 (II Ed.)
- (2) Kennedy G. : "Electronic Communication System" Tata Mc-Graw Hill Co., New Delhi (Third Edition)
- (3) T. Vishwanathan : " Telecommunication Switching systems and Networks", PHI learning Private Ltd., 2009

Reference Books :

- (1) Wayne Tomasi, "Electronic Communication Systems", Pearson Education, third edition
- (2) Simon Haykin : "Communication System, John Wiley and Sons Ltd., New York, (Third Edition), 1994
- (3) B. P. Lathi : " Modern Digital and Analog Communication systems" 4th Edition Oxford University Press.
- (4) Hari Bhat: "Analog communication", 2nd Edition Pearson India, 2010
- (5) S. Kundu: "Analog and Digital communication", Pearson India 2010

FREE ELECTIVE-I**5FEXT5 / 5FEXN5 (1) CONSUMER ELECTRONICS****SECTION-A**

Unit I : Audio Systems: Microphones, Loudspeakers, Speaker baffle and enclosure, Acoustics, Mono, Stereo, Quad, Amplifying Systems, Equalizers and Mixers, Electronic Music Synthesizers, Commercial Sound, Theater Sound System
(8 Lectures)

Unit II : Video Systems and Displays: Colour TV standards and systems, TFT, Plasma, HDTV, Digital TV, Remote Controls, Video Telephone and Video Conferencing
(8 Lectures)

Unit III : Domestic Appliances: Washing machines, Microwave ovens, Air- conditioners and Refrigerators, Computers Office Systems: FAX, Xerox, Telephone Switching System, Mobile Radio System.
(8 Lectures)

SECTION-B

Unit IV : Recording and Reproduction Systems: Disc recording and reproduction, Magnetic recording and reproduction, Video disc recording and play back, Distortion and Noise reduction in Audio and Video System
(8 Lectures)

Unit V : Power Supplies and other systems: SMPS, UPS and Preventive Maintenance, Set Top Boxes, Remote controls, Bar codes, ATM, Dish washers
(8 Lectures)

Unit VI : Calculators: Structure, internal organization, servicing; In-Car Computers: electronic ignition, electronic ignition lock system, Antilock Braking System (ABS), Electronically controlled Suspension (ECS), Instrument panel displays, ultrasonic car safety belt system, Air Bag System, Vehicle proximity detection system, car navigation system
(8 Lectures)

Text Book:1. Consumer Electronics S P Bali Pearson Ed 2005

FREE ELECTIVE-I**5FEXT5 /5FEXN5 (2) FIBER OPTICS****SECTION-A****Unit -I : Light Ray Theory**

Propagation of light in different media : propagation of light in an optical fiber, Basic structure and optical path of an optical fiber, Acceptance angle and acceptance cone, Numerical aperture(NA) (General), Modes of propagation, Meridional and skew rays, Number of modes and cut-off parameters of fibers.
8 Lectures

Unit - II: Losses and Dispersion in Optical Fiber

Fiber Losses : Attenuation in optic fibers, Materials losses, Rayleigh scattering losses, Absorption loss, Leaky modes, Bending losses, Radiation losses.

Dispersion in optical fiber: Electrical Vs. optical bandwidth. Bandwidth-length product, Intermodal dispersion, Mixing modes, Material chromatic dispersion. **(8 Lectures)**

Unit-III: Light Sources and Detectors for Optical Fiber (8 Lectures)

Light Sources : Introduction, LED (Light Emitting Diode), Processes involved, structure material and output characteristics of LED, Fiber LED coupling, Bandwidth, Spectral emission of LEDs, LASERS : Operation types, Spatial emission pattern, Current Vs. output characteristics.

Detectors : Introduction, Characteristics of photo detectors (General), Photoemissive type, Photoconductive and photo voltaic devices, PN junction type, PIN photo diode, Avalanche photo diode (APD).

SECTION-B**Unit -IV: Fiber optic Communication systems and Modulation**

Fiber Communication systems : Transmitter for fiber optic communication, High performance transmitter circuit LED – Analog transmitter, LASER transmitter, Digital laser transmitter, Analog laser transmitter with A/D conversion and digital multiplexing, Fiber optic receiver, Fiber based modems : Transceiver.

Modulation : LED analog modulation, Digital modulation, Laser modulation, Pulse code modulation (PCM), Intensity modulation (IM). **(8 Lectures)**

Unit -V: Optical Fiber Communication application

Optical fiber communication systems : Introduction, Important applications of integrated optic fiber communication technology, Long haul communication, Coherent optical fiber Communication, Principle of coherent detection.

(8 Lectures)

Unit -VI : Measurements on Optical Fibers

Introduction, Measurements of numerical aperture (NA), Measurements of Fiber- attenuation, Optical time Domain Reflectometry (OTDR), Measurements of dispersion losses, Measurements of refractive index, Cut-off wavelength measurement, Measurements of Mode Field Diameter (MFD),

(8 Lectures)

Text Books:

1. Optical Fiber Communications : Principles and Practices- John M. Senior (PHI)
2. Optical Fiber and Optical Fiber Communication Systems S. K. Sarkar (S. Chand and Comp.

SXT6 / 5XN 6 COMMUNICATION SKILLS

Unit I : Comprehension over an unseen passage. Comprehension – A - word study :- Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage. Comprehension - B - Structure study :- Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc. Active and passive forms, negative and interrogative, punctuation and capitalization.

Unit II : **Theoretical background** - importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content. Non-verbal communication, types of graphics and pictorial devices.

Unit III : Specific formats for written communication like – business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews. methodology of conduction of meetings, seminars, symposia, conference and workshop.

BOOKS RECOMMENDED:

- 1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.

- 2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
- 3) Raman Sharma “Technical Communication”, Oxford University Press..
- 4) F. Frank Candlin : General English for Technical Students, University of London Press Ltd.

5XT7: Electronic Devices & Circuits-II Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XT1(Electronic Devices & Circuits-II)

5XT8: Power Electronics Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XT2(Power Electronics)

5XT9: Communication Engineering-II Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XT4 (Communication Engineering-II)

5XT10: Communication Skills Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XT6 (Communication Skills)

6XT1/ 6XN1 DIGITAL INTEGRATED CIRCUITS SECTION-A

Unit I : Combinational Logic Design: Function of binary variables, Boolean Algebraic Theorems, Standard form of logic functions, K-Map up to 5 variables, Quine McCluskey Method, Don't Care Conditions and its effects, Synthesis using AND-OR Gates

(8 periods)

Unit II: Combinational Logic Design using 74/54 MSI chip series concerning to MUX, DEMUX, Decoders, Encoders, Comparators, Code converters, Priority Encoders, Parity Generator/Checker and BCD to Seven Segment Decoders

(8 periods)

Unit III: Combinational Logic Design using ROM array, PLA, PAL, preliminary design concepts using FPGAs, N-bit binary adder using 7480, Look-ahead carry adder construction

(8 periods)

SECTION-B

Unit IV: Design of counters and sequential networks. Analysis of clocked sequential networks, general models of sequential machines, equivalence and minimization networks, deviation of state graphs and tables, reduction of state assignments, SM charts **(8 periods)**

Unit V: Analysis of asynchronous sequential networks, derivation and reduction of primitive flow tables, state assignments and realization of flow tables, hazards, asynchronous sequential network design **(8 periods)**

Unit VI: Fault detection and location in combinational circuits. Paths sensitizing method, equivalent – normal – Form method (ENF), two level fault detection, fault detection and location in sequential circuit using circuit test approach **(8 periods)**

Text Books:

1. Charles H. Roth, “Fundamentals of Logic Design”, 4th Edition, Jaico Publication
2. Lee S. C., “Digital Circuit and Logic Design”, PHI
3. Jain R. P. “Modern Digital Electronic Circuits and Systems”, TMH

Reference Books:

1. Digital IC Reference data manuals
2. Texas Instruments Inc. Design with TTL ICs
3. Morris Mano, “Digital Electronics: Circuits and Systems”, PHI
4. Parag K. Lala, “Fault tolerance and fault testable hardware design, B. S. Publications, Hyderabad

6XT2 /6XN2 LINEAR INTEGRATED CIRCUITS SECTION-A

Unit I: Operational Amplifier, block diagram of op-amp, Differential amplifier: gain expressions using h - parameters, constant current source, level shifting, transfer- characteristics, frequency response, frequency compensation methods, study of ICuA741, measurement of parameters of op-amp and offset nulling and their importance.

Unit II: Linear Applications of Op-Amp: Inverting and non inverting amplifiers, voltage followers (AC & DC), integrator, differentiator, differential amplifier, instrumentation amplifiers, precision rectifiers, RMS to DC converter, voltage to current converter, sinusoidal RC oscillators, constant voltage sources, frequency to voltage and voltage to frequency converter.

Unit III: Non Linear Applications of Op-Amp and Filter Circuits: Clipping and clamping circuits, comparator, zero crossing detector, Schmitt trigger, peak detector, astable, monostable and bistable multivibrator, voltage sweep generator. Active filters : Butterworth filters using op-amp. Log and Antilog amplifiers.

SECTION-B

Unit IV: Voltage Regulator: Block schematic of regulator IC 723, regulated power supply using IC 723, short circuit protection, switch mode power supply, dual tracking regulators, regulator using 78**, 79**, and LM 317.

Unit V:1. Timers : Block schematic of IC 555, application of timer 555 as astable, monostable and bistable multivibrators, frequency divider, pulse stretcher, sawtooth generator, free running ramp generator, FSK generator.

Unit V: 2. Sample & hold circuit.

Unit VI:1. PLL: Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC-LM 565 and its applications as AM detector, FM detector and frequency translator.

Unit VI: 2. Introduction to Audio Function Generator IC 8038.

Text Books :

- 1) Gayakwad R.A. : OP-Amps and Linear Integrated Circuits, Prentice Hall of India Pvt. Ltd., New Delhi (Second Edition), 1980.
- 2) Robert F. Coughlin, Frederick F. Driscoll: Operational Amplifier and Linear Integrated Circuits, Sixth Edition, PHI Pub.

Reference Books :

- 1) Tobey J.E. and Grame J.E. : Operational Amplifier Design and Applications, International Student Edition, 1983.
- 2) T.R. Ganesh Babu, B. Suseela: Linear Integrated Circuits, Third Edition, Scitech Pub.

6XT3/6XN3 INTRODUCTION TO MICROPROCESSORS

SECTION-A

Unit I: 8085 : Architecture, Register Structure, Addressing modes, Instruction set of 8085, Timing diagrams.

Unit II : Assembly Language Programming of 8085, Introduction to assemblers, Simulators, Stack, Subroutine. Address space partitioning schemes : Memory mapped I/O and I/O mapped I/O, Address decoding techniques.

Unit III: Interrupt system of 8085, software and hardware interrupts, Data transfer schemes: Serial data transfer through SOD and SID, USART 8251 and its interfacing.

SECTION-B

Unit IV : Internal architecture, programming and interfacing of PPI 8255, Programmable interval Timer/ Counter 8254, Introduction to DMA data transfer , DMA Controller 8237 and its interfacing.

Unit V : 8086 : CPU architecture, internal operations, addressing modes, instruction formats, execution timing.

Unit VI : Instruction set of 8086, Assembly language programming (ELEMENTARY PROGRAMMING) Assembly Directives, Operators.

Text Books:

- 1) A. K. Ray and K. M. Bhurchandi: Advanced Microprocessors and Peripherals, Architecture Programming and Interfacing, TMH.
- 2) Gaonkar R.S. : Microprocessor Architecture Programming and Applications with the 8085, Penram International Pub. (Third Edition), 1997.
- 2) Gibson G.A., Liu Y.C. : Microcomputer system the 8086/8088 family, Prentice Hall India Pvt. Ltd.

Reference Books:

- 1) Hall D.V. : Microprocessor and Interfacing Programming and Hardware, McGraw Hill Co., New York, 1986.
- 2) Data sheet manuals by INTEL.

6XT4 DIGITAL COMMUNICATION

SECTION-A

Unit 1:- Introduction to Digital Communication System

Functional Blocks of Digital Communication System; Source Encoder and Decoder; Channel Encoder and Decoder; Modulator and Demodulator

Line Coding:- Need for Line coding; Properties of Line Coding; Unipolar RZ and NRZ; Polar RZ and NRZ; Bipolar NRZ (AMI); Split Phase Manchester Coding; Polar Quaternary NRZ Coding; HDB3 Coding Scrambler and Unscrambler (6)

Unit 2:- Information Theory

Measure of Information; Entropy and Information Rate of Long Independent and Dependent Sequences; Markoff Statistical Model for Information Sources; Entropy and Information rate of Markoff Sources

Source Encoding: - Huffman Encoding; Shannon's Encoding Algorithm; Shannon-Fano Algorithm;
 Discrete Communication Channel: - Noiseless Channel; Deterministic Channel; Binary Symmetric Channel; Rate of Information Transfer over Discrete Channel; Capacity of Discrete Memoryless Channel
 Continuous Channel: Shannon Hartley Theorem for channel capacity; Signal to Noise Ratio –Bandwidth Tradeoff
 (12)

Unit 3:- Bandpass Modulation and Demodulation techniques

BPSK, BFSK, ASK and DPSK generation and reception; Signal space diagram, PSD and Bandwidth of BPSK and BFSK systems; QPSK and MSK Transmitter and Receiver; Signal space diagram, PSD and Bandwidth of QPSK and MSK; Probability of Error of ASK, BPSK and BFSK systems; Comparison of Digital modulation systems
 Coherent Detection: - Integrate and Dump Filter (SNR and Probability of Error); Optimum Filter (Transfer function and Probability of Error); Matched Filter (Impulse response and Probability of Error)
 (10)

SECTION-B

Unit 4:- Base Band Transmission

Base Band Binary PAM systems, Inter Symbol Interference, Base Band Pulse Shaping and Nyquist Criterion; Eye Diagram Correlative Coding: Duobinary Encoder with Pre-coder; Modified Duobinary Encoder; Modified Duobinary Encoder with Pre-coder
 Equalization: Need for equalization; Transversal Equalizer (Problems Expected); Preset Equalizer; Adaptive Equalizer, Clock and Carrier Synchronization.
 (8)

Unit 5:- Error Control Coding

Introduction to Error Control Coding; Types of Errors; Methods of Controlling Errors;
Linear Block Codes: Matrix Description of Linear Block codes, Hamming Distance; Hamming Weight; Minimum Hamming Distance; Hamming Codes; Encoder for Linear Block code; Syndrome Decoding; Syndrome Decoder for (n,k) Linear Block Code; Error Detection and Correction capability of Linear Block Codes (Derivation expected)
 Cyclic Codes: Properties of Cyclic Codes; Systematic and Non-Systematic generator Matrix, Parity Check Matrices for Cyclic Codes; Encoders for Cyclic Codes; Syndrome Decoding for Cyclic Codes

Convolution Codes: Time Domain Approach and Transform domain approach for convolution code generation; Code Tree and Code Trellis for Convolution code
 (8)

Unit 6:- Multiple Access Schemes and Spread Spectrum Communication

Multiple Access schemes: Time Division Multiple Access, Frequency Division Multiple Access; Code Division Multiple Access; Space Division Multiple Access
Spread Spectrum Systems: Notion of Spread Spectrum; PN Sequence Generation (Problems Expected); Direct Sequence Spread Spectrum (DSSS); Jamming Margin; Processing Gain; E_b/N_0 Ratio; Frequency Hopped Spread Spectrum; Slow and Fast frequency Hopping.
 (6)

TEXT BOOKS:

1. Shanmugam K.S. : "Digital & Analog Communication Systems", John Wiley & Sons, New York, 1996.
2. Lathi B. P. : "Modern Digital and Communication Systems", Holt Rinchart and Winston Inc., New York, 1993.
3. Simon Haykin : "Digital Communication", John Wiley and Sons, Pvt. Ltd., Singapore.

REFERENCE BOOKS :

1. Proakis J. K. : "Digital Communication", Mc-Graw Hill Book Co., London (Second Edition)
2. Taub, Herbert, Schilling D.L : "Principles of Communication Systems", Mc-Graw Hill International Book Co., Tokyo.
3. W.C.Y. Lee : "Mobile Cellular Telecommunications Systems", Mc-Graw Hill International Editions, 1990
4. Glover and Grant : "Digital Communication", Prentice Hall Publication.

FREE ELECTIVE II
6FEXT5/ 6FEXN5 (1) INTRODUCTION TO WIRELESS TECHNOLOGY
SECTION-A

Unit I : (8 Lectures)

Introduction to networking: the Internet reference model, layering and protocols, OSI and other models, Network types, network media, network topologies, connectivity devices, evolution of networking, types and range of wireless communication, wireless technologies

Unit II : (8 Lectures)
Wireless LAN, satellite communication, wireless application protocol (WAP), antennas, narrow-band and spread-spectrum technologies, cellular telephony, propagation, frequencies and spectrum and personal communication system

Unit III: (8 Lectures)
Wireless Application Protocol model, WAP architecture component, Trends: technology and culture, 3G, wireless in local proximity, Bluetooth: design and principle of operation, transmitter characteristics, spurious emissions, baseband characteristics, physical channel, channel control, Bluetooth security, inter-operability requirements for blue-tooth as a WAP bearer

SECTION-B

Unit IV : (8 Lectures)
Cellular telephony, history of cellular telephony, design and principle of cellular operation, cellular telephony operation, analog cellular telephones, digital cellular telephones, digital networks, personal communication systems, the third generation, recent events in cellular telephony

Unit V : (8 Lectures)
Wireless LAN: introduction, benefits of WLANs, design and principle of operation, WLAN configuration, micro-cells and roaming, types of WLANs, WLAN customer consideration, wireless LAN standards, IEEE 802.11, 802.11b and 802.11a, selecting the WLAN, microwave LANs

Unit VI: (8 Lectures)
Communicating with a satellite, LEOs, MEOs, GEOs and HEOs systems, design and principle of operation of Global Positioning System (GPS); satellite, control and user segments, Differential GPS, geometric earth models and future of GPS

Text Book:
An Introduction to Wireless Technology by Garry S. Rogers and John Edwards, Pearson Education.

FREE ELECTIVE II 6FEXT5/ 6FEXN5 (2) ELECTRONIC TEST INSTRUMENTS: ANALOG AND DIGITAL SECTION-A

Unit I : (8 Lectures)
Analog meters, digital meters, dc voltmeter, ac voltmeters, RF probes, ammeters, ac ammeters, ohm-meters, 4-wire ohm measurements, multi-meters, meter range, other multi-meter functions: continuity indicators, diode tests, frequency counters, minimum, maximum, average read-outs, capacitance and temperature measurements, specifications

Unit II: (8 Lectures)
Floating and grounded outputs, sine wave sources, imperfections in sine wave sources,: frequency accuracy, frequency stability, amplitude accuracy, distortion, spurious responses, close-in-sidebands , Function Generators: Arbitrary waveform generators, arbitrary waveforms, AM and FM modulation, bursts, Frequency Shift Keying, Frequency sweep, sync output, phase locking, pulse generators, RF signal generators

Unit III: (8 Lectures)
Oscilloscopes: the concept of oscilloscope, digital scope block diagram, sample rate, real time and repetitive sampling, triggering, acquisition/sweep control, vertical amplifier, vertical resolution, ac and dc coupling, bandwidth limit, X-Y display mode, High impedance inputs, 50 ohm inputs, digital acquisition and display techniques, specifications of oscilloscopes, mixed signal oscilloscope, oscilloscope probes, probe compensation, active probes, differential measurements, high voltage probes, current probes

SECTION-B

Unit IV : (8 Lectures)
Oscilloscope measurements, basic waveform measurements, voltage gain measurements, phase measurements, frequency measurements, digital signal measurements, frequency response measurements, square wave tests, linearity measurements, curve tracer measurement techniques, diode I-V and resistor I-V characteristics, amplitude modulation measurements, power measurements, FFT measurements, basic time domain reflectometry

Unit V : (8 Lectures)
Spectrum and network analyzers: spectrum analyzer, bank-of-filters spectrum analyzers, FFT spectrum analyzers, wave-meters, resolution bandwidth, narrow-band and broadband measurements, swept spectrum analyzers, spectrum analyzer measurements, Network Analyzers, distortion analyzers, RF power measurements, RF power meter,

Unit VI : (8 Lectures)
Logic Analyzers: logic probes, oscilloscope logic measurements, logic analyzers, timing analyzers, glitch detect, state analyzers, data formats, state displays, timing displays, microprocessor measurements, trigger events and sequencing, microprocessor program flow, logic analyzer probing, combined scope and logic analyzer, PC-hosted logic analyzers

Text Book:
Electronic Test Instruments: Analog and Digital by Robert A. Witte, Second Edition, Pearson Education

6XT6: Integrated Circuits Lab

Minimum 4 experiments uniformly distributed based on the syllabus of 6XT1(Digital Integrated Circuits) and 4 experiments uniformly distributed on the syllabus of 6XT2 (Linear Integrated Circuits)

6XT7: Introduction to Microprocessors Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XT3 (Introduction to Microprocessors)

6XT8: Digital Communication Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XT4 (Digital Communication)

SYLLABUS PRESCRIBED FOR BACHELOR OF ENGINEERING ELECTRONICS ENGINEERING SEMESTER PATTERN (C. G. S.) FIFTH SEMESTER

5XN1 ELECTRONIC DEVICES AND CIRCUITS-II SECTION-A

Unit I: Linear wave shaping using RC and RL circuits, analysis and calculations of RC low pass and high pass filters, analysis of clipping and clamping circuits using diodes and switching transistors.

Unit II : Switching characteristics of semiconductor devices : Diode as switch, transistor as a switch, characteristics and analysis, FET as a switch, characteristics, JFET, CMOS, switching speed of devices : Schottky diode and transistor, Logic gates.

Unit III : Collector coupled bistable, monostable and astable multivibrators, Time base generators & Sweep Generators. Boolean Algebra, Number systems, Gray codes, Arithmetic operations using Two's compliments.

SECTION-B

Unit IV : Study and analysis of Digital Logic Families : RTL, DTL, HTL, TTL, ECL, IIL, CMOS, and their characteristics, tri-state logic, 5400/7400 TTL series.

Unit V : Flip-flops : R-S, J-K, Master slave J-K, D-type, T-type; registers and counters, adders and subtractors using logic gates, D/A converters and types: Weighted resistor, R-2R ladder. A/D converters and Types: Ramp, Dual slope, Successive approximation.

Unit VI : Types of semiconductor memories, sequential memories, 2 and 4 phase ratioless shift registers, static shift registers, implementation of ROM (ROM, PROM, EPROM, EEPROM) BJT RAM cell, MOS-RAM, CCD memories.

BOOKS RECOMMENDED:

- 1) Jacob Millman & Herbert Taub : "Pulse Digital & Switching waveforms", McGraw Hill International Book Co.
- 2) Taub H. and Schillings D.L., London, : "Digital Integrated Electronics", McGraw Hill Company.
- 3) R. P. Jain : "Modern Digital Electronics", Tata McGraw Hill, New Delhi 1998.
- 4) Malvino A.P. & Leach D.P. : "Digital Principles & Applications", TMH Publishing Co., New Delhi (3rd Edition).

**5XN2 POWER ELECTRONICS
SECTION-A**

Unit I : SCR, Triac, LASCR, Diac-construction, characteristics, two transistor analogy for turning ON of a SCR, turn ON mechanism, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuits. Introduction to GTO, power transistor, power MOSFET, IGBT - their construction & characteristics.

Unit II : Series parallel operation of SCRs, static & dynamic equalizing ckts., equalisation of current in parallel connected SCRs, string efficiency, derating factor, Protection of SCRs against di/dt, dv/dt, radio freq., interference, over voltage, over current.

Unit III : Principle of phase control, half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of free wheeling diode, single phase dual converters. Three phase half controlled bridge and fully controlled bridge rectifier.

SECTION-B

Unit IV : Classification of ckt. for forced commutation, series inverter, improved series inverter, parallel inverter, output voltage and waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorised bridge inverter, current source inverter, harmonics reduction techniques.

Unit V : Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, step-up chopper and AC chopper. Basic principle of cycloconverter, single phase to single phase cycloconverter.

Unit VI : Speed control of DC series motors using chopper, speed control of DC shunt motor using phase controlled rectifiers, Static ckt. breaker, UPS, fan speed regulator, principle of soft start ckts, electronic ballast.

TEXT BOOKS:

- 1) M. Ramamoorthy, Thyristor and their application.
- 2) M. H. Rashid - Power Electronics Circuits, Devices and Application, Pearson Edu.
- 3) SCR Manual GE.

REFERENCES :

- 1) Joseph Vithayathil, "Power Electronics: Principles and Applications", McGraw-Hill

- 2) Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics: Converters, Applications, and Design", Wiley
- 3) K. Hari Babu – Power Electronics, Scitech Pub..
- 4) Devdatta Y. Shingare, A Text book of Industrial & power electronics, ElectrotechPub. Satara.
- 5) J. S. Katre, Power Electronics, Tech-max Pub. Pune.

**5XN3 CONTROL SYSTEM ENGINEERING
SECTION-A**

Unit I : Basic definition; closed and open loop systems; transfer function, block diagrams, derivation of transfer functions of physical systems, signal flow graphs, basic control action.

Unit II : Time Response Analysis: Typical test inputs, Impulse response function, Transient Domain specifications, Analysis of first, second & higher order systems, Steady state analysis: steady state error and error constants, Dynamic error coefficients.

Unit III : 1. Stability Analysis: stability of control system, Routh Hurwitz's stability criterion,

Unit III : 2. Roots Locus: Introduction to Root Locus method; Root Locus plots, Rules for constructing root loci, stability analysis of systems using Root locus, concept of dominant closed loop pole pair, Root contour plots, effect of addition of zeros & poles.

SECTION-B

Unit IV : Introduction of frequency response, Bode plots, stability margins on the Bode plot, stability analysis of systems using Bode plots, polar plots, Nyquist stability criterion, relative stability.

Unit V : State Space representation of systems, conversion of state variable models to transfer functions, conversion of transfer functions to state variable models, solution of state equations, concepts of controllability and observability.

Unit VI : Sample Data Control Systems :

Representation of sampled data (Discrete) systems, review of Z-transforms, Sampler and hold ckt., Zero order hold, sampling theorem, Z-transform analysis of sampled data control systems (open & closed loop systems), Z transform of systems. Solution of difference equation by Z-transform methods. Response of discrete systems. Pulse Transform functions of open loop, closed loop systems with different sampler locations. Digital controller

& its transfer functions, Stability analysis of discrete time system using bilinear transformation.

TEXT BOOKS :

1. Nagrath I. J. and M. Gopal, "Control Systems Engineering", 5th Ed. New Age International.
2. K. Ogata : Modern Control Engineering, Fourth Edition(PHI)

REFERENCE BOOKS:

- 1) Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11th Ed., Pearson Education.
- 2) M. Gopal : Digital Control Systems Principles & Design (TMH)
- 3) Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.
- 4) Bhattacharya : Control System Engineering, 2nd Edition (Pearson Education).

5XN4 COMMUNICATION ENGINEERING-II

SECTION-A

Unit I : AM Transmitters : Modulation, need of modulation, AM Modulation, Frequency spectrum, Principles of DSB-FC, DSBSC, SSB-SC modulation and their comparison, Details of DSBFC Transmitter, Generation of DSB-SC by using balanced modulators (FET & Diodes), DSB-SC Transmitter, Generation of SSB-SC by filter method, phase-shift method & third method (weavers).

Unit II : AM Receivers : TRF receiver, Superheterodyne receiver, Details of each block such as RF amplifier, mixer oscillator, IF amplifier, Diode detector, Audio Amplifier. Need and type of AGC, selectivity sensitivity, fidelity Image rejection ration, communication receiver, SNR of DSB-FC, DSB-SC & SSB-SC

Unit III : FM Transmitters : FM Modulation, Frequency Spectrum, Circuits & Analysis for direct FM generation using FET and varactor diode. Circuit & analysis of Indirect FM generation, Narrow Band and Wide Band FM, their comparison, pre-emphasis and De-emphasis. Stereo FM Transmitter.

SECTION-B

Unit IV : FM Receivers : Details of FM receiver blocks such as R.F. amplifier, local oscillator, IF amplifier, Mixer, Audio Amplifier, AGC, Limiter, FM Discriminator, Single Slope and Balanced slope detector, Analysis of Foster Seeley and ratio detectors, Stereo FM receiver, Noise in FM Reception, FM threshold effect.

Unit V : PULSE MODULATION TECHNIQUES: The sampling theorem, Sampling of Band-Pass Signal, Linear and Non linear quantization, Aliasing effect, Aperture effect, Reconstruction filter, Time Division Multiplexing, Pulse Amplitude Modulation, Pulse Time Modulation, PCM, DM, ADM

Unit VI : TELEPHONE SWITCHING TECHNIQUES: Introduction to Switching System, Pulse dialing, Touch tone dial telephone, Space Division Switching SPC, Centralized and Distributed SPC, Time Division Switching : Basic Time Division space switching, Time Division time switching, Time multiplexed space switching, Time Multiplexed time switching, EPABX.

Text Books:-

- (1) Taub and Schilling D.L. : Principles of Communication Systems, McGraw- Hill Co, Tokyo, 1994 (II Ed.)
- (2) Kennedy G : "Electronic Communication System" Tata Mc-Graw Hill Co.,New Delhi (Third Edition)
- (3) T. Vishwanathan : " Telecommunication Switching systems and Networks", PHI learning Private Ltd., 2009

Reference Books

- (1) Wayne Tomasi, "Electronic Communication Systems", Pearson Education, third edition
- (2) Simon Haykin : "Communication System, John Wiley and Sons Ltd., New York, (Third Edition), 1994
- (3) B. P. Lathi : "Modern Digital and Analog Communication systems" 4th Edition Oxford university Press.
- (4) Hari Bhat: "Analog communication", 2nd Edition Pearson India, 2010
- (5) S. Kundu: "Analog and Digital communication" Pearson India 2010

FREE ELECTIVE- I

5FEXN5 (1) CONSUMER ELECTRONICS

SECTION-A

Unit I: (8 Lectures)

Audio Systems: Microphones, Loudspeakers, Speaker baffle and enclosure, Acoustics, Mono, Stereo, Quad, Amplifying Systems, Equalizers and Mixers, Electronic Music Synthesizers, Commercial Sound, Theater Sound System

Unit II: (8 Lectures)

Video Systems and Displays: Colour TV standards and systems, TFT, Plasma, HDTV, Digital TV, Remote Controls, Video Telephone and Video Conferencing

Unit III : (8 Lectures)
Domestic Appliances: Washing machines, Microwave ovens, Air- conditioners and Refrigerators, Computers Office Systems: FAX, Xerox, Telephone Switching System, Mobile Radio System,

SECTION-B

Unit IV : (8 Lectures)
Recording and Reproduction Systems: Disc recording and reproduction, Magnetic recording and reproduction, Video disc recording and play back, Distortion and Noise reduction in Audio and Video System

Unit V : (8 Lectures)
Power Supplies and other systems: SMPS, UPS and Preventive Maintenance, Set Top Boxes, Remote controls, Bar codes, ATM, Dish washers

Unit VI : (8 Lectures)
Calculators: Structure, internal organization, servicing; In-Car Computers: electronic ignition, electronic ignition lock system, Antilock Braking System (ABS), Electronically controlled Suspension (ECS), Instrument panel displays, ultrasonic car safety belt system, Air Bag System, Vehicle proximity detection system, car navigation system

Text Book:1. Consumer Electronics S P Bali Pearson Ed 2005

FREEELECTIVE-I 5FEXN5 (2) FIBER OPTICS SECTION-A

Unit I : **Light Ray Theory** (8 Lectures)
Propagation of light in different media : propagation of light in an optical fiber, Basic structure and optical path of an optical fiber, Acceptance angle and acceptance cone, Numerical aperture (NA) (General), Modes of propagation, Meridional and skew rays, Number of modes and cut-off parameters of fibers.

Unit II : **Losses and Dispersion in Optical Fiber** (8 Lectures)
Fiber Losses : Attenuation in optic fibers, Materials losses, Rayleigh scattering losses, Absorption loss, Leaky modes, Bending losses, Radiation losses.
Dispersion in optical fiber : Electrical Vs. optical bandwidth. Bandwidth-length product, Intermodal dispersion, Mixing modes, Material chromatic dispersion.

Unit III : **Light Sources and Detectors for Optical Fiber** (8 Lectures)
Light Sources : Introduction, LED (Light Emitting Diode), Processes involved, structure material and output characteristics of LED, Fiber LED coupling, Bandwidth, Spectral emission of LEDs, LASERS : Operation types, Spatial emission pattern, Current Vs. output characteristics.
Detectors : Introduction, Characteristics of photo detectors (General), Photoemissive type, Photoconductive and photo voltaic devices, PN junction type, PIN photo diode, Avalanche photo diode (APD).

SECTION-B

Unit IV : **Fiber optic Communication systems and Modulation** (8 Lectures)

Fiber Communication systems : Transmitter for fiber optic communication, High performance transmitter circuit LED – Analog transmitter, LASER transmitter, Digital laser transmitter, Analog laser transmitter with A/D conversion and digital multiplexing, Fiber optic receiver, Fiber based modems : Transceiver.

Modulation : LED analog modulation, Digital modulation, Laser modulation, Pulse code modulation (PCM), Intensity modulation (IM).

Unit V : **Optical Fiber Communication application** (8 Lectures)
Optical fiber communication systems : Introduction, Important applications of integrated optic fiber communication technology, Long haul communication, Coherent optical fiber communication, Principle of coherent detection.

Unit VI : **Measurements on Optical Fibers** (8 Lectures)
Introduction, Measurements of numerical aperture (NA), Measurements of Fiber- attenuation, Optical time Domain Reflectometry (OTDR), Measurements of dispersion losses, Measurements of refractive index, Cut-off wavelength measurement, Measurements of Mode Field Diameter (MFD),

Text Books:

1. Optical Fiber Communications : Principles and Practices- John M. Senior (PHI)
2. Optical Fiber and Optical Fiber Communication Systems S. K. Sarkar (S. Chand and Co.)

5XN6 COMMUNICATION SKILLS

Unit I: Comprehension over an unseen passage. Comprehension –A - word study :- Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage. Comprehension - B - Structure study :- Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc. Active and passive forms, negative and interrogative, punctuation and capitalization.

Unit II: **Theoretical background** - Importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content. Non-verbal communication, types of graphics and pictorial devices.

Unit III: Specific formats for written communication like – business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews. Methodology of conduction of meetings, seminars, symposia, conference and workshop.

BOOKS RECOMMENDED:

- 1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
- 2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
- 3) Raman Sharma “Technical Communication”, Oxford University Press..
- 4) F. Frank Candlin : General English for Technical Students, University of London Press Ltd.

5XN7: Electronic Devices & Circuits-II Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XN1(Electronic Devices & Circuits-II)

5XN8: Power Electronics Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XN2(Power Electronics)

5XN9: Communication Engineering-II Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XN4 (Communication Engineering-II)

5XN10: Communication Skills Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XN6 (Communication Skills)

**6XN1 DIGITAL INTEGRATED CIRCUITS
SECTION-A**

Unit I: Combinational Logic Design: Function of binary variables, Boolean Algebraic Theorems, Standard form of logic functions, K-Map up to 5 variables, Quine McCluskey Method, Don't Care Conditions and its effects, Synthesis using AND-OR Gates **(8 periods)**

Unit II: Combinational Logic Design using 74/54 MSI chip series concerning to MUX, DEMUX, Decoders, Encoders, Comparators, Code converters, Priority Encoders, Parity Generator/Checker and BCD to Seven Segment Decoders **(8 periods)**

Unit III: Combinational Logic Design using ROM array, PLA, PAL, preliminary design concepts using FPGAs, N-bit binary adder using 7480, Look-ahead carry adder construction **(8 periods)**

SECTION-B

Unit IV: Design of counters and sequential networks. Analysis of clocked sequential networks, general models of sequential machines, equivalence and minimization networks, deviation of state graphs and tables, reduction of state assignments, SM charts **(8 periods)**

Unit V: Analysis of asynchronous sequential networks, derivation and reduction of primitive flow tables, state assignments and realization of flow tables, hazards, , asynchronous sequential network design **(8 periods)**

Unit VI: Fault detection and location in combinational circuits. Paths sensitizing method, equivalent – normal – Form method (ENF), two level fault detection, fault detection and location in sequential circuit using circuit test approach **(8 periods)**

Textbooks:

1. Charles H. Roth, "Fundamentals of Logic Design", 4th Edition, Jaico Publication
2. Lee S. C., "Digital Circuit and Logic Design", PHI
3. Jain R. P. "Modern Digital Electronic Circuits and Systems", TMH

Reference Books:

1. Digital IC Reference data manuals
2. Texas Instruments Inc. Design with TTL ICs
3. Morris Mano, "Digital Electronics: Circuits and Systems", PHI
4. Parag K. Lala, "Fault tolerance and fault testable hardware design, B. S. Publications, Hyderabad

6XN2 LINEAR INTEGRATED CIRCUITS SECTION-A

Unit I: Operational Amplifier, block diagram of op-amp, Differential amplifier: gain expressions using h - parameters, constant current source, level shifting, transfer- characteristics, frequency response, frequency compensation methods, study of ICuA741, measurement of parameters of op-amp and offset nulling and their importance.

Unit II: Linear Applications of Op-Amp: Inverting and non inverting amplifiers, voltage followers (AC & DC), integrator, differentiator, differential amplifier, instrumentation amplifiers, precision rectifiers, RMS to DC converter, voltage to current converter, sinusoidal RC oscillators, constant voltage sources, frequency to voltage and voltage to frequency converter.

Unit III: Non Linear Applications of Op-Amp and Filter Circuits: Clipping and clamping circuits, comparator, zero crossing detector, Schmitt trigger, peak detector, astable, monostable and bistable multivibrator, voltage sweep generator.
Active filters : Butterworth filters using op-amp. Log and Antilog amplifiers.

SECTION-B

Unit IV: Voltage Regulator: Block schematic of regulator IC 723, regulated power supply using IC 723, short circuit protection, switch mode power supply, dual tracking regulators, regulator using 78**, 79**, and LM 317.

Unit V: 1. Timers : Block schematic of IC 555, application of timer 555 as astable, monostable and bistable multivibrators,

frequency divider, pulse stretcher, sawtooth generator, free running ramp generator, FSK generator.

2. Sample & hold circuit.

- Unit VI:** 1. PLL: Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC-LM 565 and its applications as AM detector, FM detector and frequency translator.
2. Introduction to Audio Function Generator IC 8038.

Text Books :-

- 1) Gayakwad R.A. : OP-Amps and Linear Integrated Circuits, Prentice Hall of India Pvt. Ltd., New Delhi (Second Edition), 1980.
- 2) Robert F. Coughlin, Frederick F. Driscoll: Operational Amplifier and Linear Integrated Circuits, Sixth Edition, PHI Pub.

Reference Books :

- 1) Tobey J.E. and Grame J.E. : Operational Amplifier Design and Applications, International Student Edition, 1983.
- 2) T.R. Ganesh Babu, B. Suseela: Linear Integrated Circuits, Third Edition, Scitech Pub.

6XN3 INTRODUCTION TO MICROPROCESSORS SECTION-A

Unit I : 8085 : Architecture, Register Structure, Addressing modes, Instruction set of 8085, Timing diagrams.

Unit II : Assembly Language Programming of 8085, Introduction to assemblers, Simulators, Stack, Subroutine. Address space partitioning schemes: Memory mapped I/O and I/O mapped I/O, Address decoding techniques.

Unit III: Interrupt system of 8085, software and hardware interrupts, Data transfer schemes: Serial data transfer through SOD and SID, USART 8251 and its interfacing.

SECTION-B

Unit IV : Internal architecture, programming and interfacing of PPI 8255, programmable interval Timer/ Counter 8254, Introduction to DMA data transfer , DMA Controller 8237 and its interfacing.

Unit V : 8086 : CPU architecture, internal operations, addressing modes, instruction formats, execution timing.

Unit VI: Instruction set of 8086, Assembly language programming (ELEMENTARY PROGRAMMING) Assembly Directives, Operators.

Text Books :

- 1) Gaonkar R.S. : Microprocessor Architecture Programming and Applications with the 8085, Penram International Pub. (Third Edition), 1997.
- 2) A. K. Ray and K. M. Bhurchandi: Advanced Microprocessors and Peripherals, Architecture Programming and Interfacing, TMH.
- 3) Gibson G.A., Liu Y.C. : Microcomputer system the 8086/8088 family, Prentice Hall India Pvt. Ltd.

Reference Books:

- 1) Hall D.V. : Microprocessor and Interfacing Programming and Hardware, McGraw Hill Co., New York, 1986.
- 2) Data sheet manuals by INTEL.

**6XN4 RADAR & TELEVISION ENGINEERING
SECTION - A**

Unit I : Radar : The Radar equation-Pulse Radar-CW Radar- CW Radar with non zero IF, equation for Doppler frequency- FM-CW Radar using sideband superhetrodyne receiver, MTI Radar-Delay line canceller, MTI Radar with power amplifier & power oscillator, Non coherent MTI Radar, Pulse Doppler Radar

Unit II : Radar Transmitters. Radar Modulator-Block diagram. Radar receivers- noise figure, low noise front ends, Mixers – Different types of Displays – Duplexers- Branch type and balanced type. Navigation- Loop Antenna, Radio compass. Hyperbolic Systems of Navigation, LORAN – A. Distance Measuring Equipment . Instrument Landing System – Localizer, Glide Slope, Marker beacons.

Unit III : Television: Scanning, Blanking and synchronisation, Picture signal - composite video signal- Vestigial sideband transmission-Principle of CCD Camera - Monochrome picture tube- Monochrome TV receivers- RF tuner ,VHF tuner- Video amplifier, IF section, Vestigial sideband correction- Video detectors

SECTION - B

Unit IV : Sound signal separation, AGC, sync separation, horizontal and vertical deflection circuits, EHT generation. Colour TV system: Principle of colour signal transmission and reception, PAL, NTSC, SECAM (block schematic description), Picture tube – delta gun.

Unit V: Digital TV: Digitized Video, Source coding of Digitized Video compression of Frames – DCT based – (JPED), Compression of Moving Pictures (MPEG). Basic blocks of MPEG2 and MPEG4. Digital Video Broadcasting (DVB) – Modulation: QAM – (DVB-S, DVB-C)

Unit VI: OFDM for Terrestrial Digital TV (DVB –T). Reception of Digital TV Signals (Cable, Satellite and terrestrial). Digital TV over IP, Digital terrestrial TV for mobile. Display Technologies – basic working of Plasma, LCD and LED Displays.

Text Books:

1. Merrill I. Skolnik: Introduction to Radar Systems,3/e, Tata McGraw Hill,
2. N.S.Nagaraja: Elements of Electronic Navigation, 2/e, Tata McGraw Hill
3. R.R. Gulati: Monochrome and Colour Television. New Age international, 2008.
4. Herve Benoit, Digital Television Satellite, Cable, Terrestrial, IPTV, Mobile TV in the DVB Framework, 3/e, Focal Press, Elsevier, 2008

Reference Books:

1. Shlomo Ovadia: Broadband Cable TV Access Networks, PH-PTR, 2001
2. Byron Edde: Radar Principles, Technology & Applications, Pearson Education.
3. Mark E Long: - The Digital Satellite TV Hand Book, Butterworth-Heinemann.
4. K.R.Rao, J.O.Hwang, Techniques and standards for Image, Video and Audio coding, Prentice Hall,1996
5. John Arnold, Michael Frater, Mark Pickering, Digital Television Technology and Standards, John Wiley & Sons, Inc, 2007
6. Robert L. Hartwig, Basic TV Technology: Digital and Analog, 4/e, Focal Press, Elsevier, 2005

FREE ELECTIVE-II**6FEXN5 (1) INTRODUCTION TO WIRELESS TECHNOLOGY
SECTION-A**

- Unit I:** (8 Lectures)
Introduction to networking: the Internet reference model, layering and protocols, OSI and other models, Network types, network media, network topologies, connectivity devices, evolution of networking, types and range of wireless communication, wireless technologies
- Unit II :** (8 Lectures)
Wireless LAN, satellite communication, wireless application protocol (WAP), antennas, narrow-band and spread-spectrum technologies, cellular telephony, propagation, frequencies and spectrum and personal communication system
- Unit III :** (8 Lectures)
Wireless Application Protocol model, WAP architecture component, Trends: technology and culture, 3G, wireless in local proximity, Bluetooth: design and principle of operation, transmitter characteristics, spurious emissions, baseband characteristics, physical channel, channel control, Bluetooth security, inter-operability requirements for blue-tooth as a WAP bearer

SECTION-B

- Unit IV :** (8 Lectures)
Cellular telephony, history of cellular telephony, design and principle of cellular operation, cellular telephony operation, analog cellular telephones, digital cellular telephones, digital networks, personal communication systems, the third generation, recent events in cellular telephony
- Unit V :** (8 Lectures)
Wireless LAN: introduction, benefits of WLANs, design and principle of operation, WLAN configuration, micro-cells and roaming, types of WLANs, WLAN customer consideration, wireless LAN standards, IEEE 802.11, 802.11b and 802.11a, selecting the WLAN, microwave LANs
- Unit VI:** (8 Lectures)
Communicating with a satellite, LEOs, MEOs, GEOs and HEOs systems, design and principle of operation of Global Positioning System (GPS); satellite, control and user segments, Differential GPS, geometric earth models and future of GPS

Textbook: An Introduction to Wireless Technology by Garry S. Rogers and John Edwards, Pearson Education

FREE ELECTIVE II**6FEXN5 (2) ELECTRONIC TEST INSTRUMENTS:
ANALOG AND DIGITAL
SECTION-A**

- Unit I:** (8 Lectures)
Analog meters, digital meters, dc voltmeter, ac voltmeters, RF probes, ammeters, ac ammeters, ohm-meters, 4-wire ohm measurements, multi-meters, meter range, other multi-meter functions: continuity indicators, diode tests, frequency counters, minimum, maximum, average read-outs, capacitance and temperature measurements, specifications
- Unit II :** (8 Lectures)
Floating and grounded outputs, sine wave sources, imperfections in sine wave sources: frequency accuracy, frequency stability, amplitude accuracy, distortion, spurious responses, close-in-sidebands, Function Generators: Arbitrary waveform generators, arbitrary waveforms, AM and FM modulation, bursts, Frequency Shift Keying, Frequency sweep, sync output, phase locking, pulse generators, RF signal generators
- Unit III :** (8 Lectures)
Oscilloscopes: the concept of oscilloscope, digital scope block diagram, sample rate, real time and repetitive sampling, triggering, acquisition/sweep control, vertical amplifier, vertical resolution, ac and dc coupling, bandwidth limit, X-Y display mode, High impedance inputs, 50 ohm inputs, digital acquisition and display techniques, specifications of oscilloscopes, mixed signal oscilloscope, oscilloscope probes, probe compensation, active probes, differential measurements, high voltage probes, current probes

SECTION-B

- Unit IV :** (8 Lectures)
Oscilloscope measurements, basic waveform measurements, voltage gain measurements, phase measurements, frequency measurements, digital signal measurements, frequency response measurements, square wave tests, linearity measurements, curve tracer measurement techniques, diode I-V and resistor I-V characteristics, amplitude modulation measurements, power measurements, FFT measurements, basic time domain reflectometry
- Unit V :** (8 Lectures)
Spectrum and network analyzers: spectrum analyzer, bank-of-filters spectrum analyzers, FFT spectrum analyzers, wave-meters, resolution bandwidth, narrow-band and broadband

measurements, swept spectrum analyzers, spectrum analyzer measurements, Network Analyzers, distortion analyzers, RF power measurements, RF power meter,

Unit VI: (8 Lectures)

Logic Analyzers: logic probes, oscilloscope logic measurements, logic analyzers, timing analyzers, glitch detect, state analyzers, data formats, state displays, timing displays, microprocessor measurements, trigger events and sequencing, microprocessor program flow, logic analyzer probing, combined scope and logic analyzer, PC-hosted logic analyzers

Text Book: Electronic Test Instruments: Analog and Digital by Robert A. Witte, Second Edition, Pearson Education

6XN6: Digital Integrated Circuits Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XN1(Digital Integrated Circuits)

6XN7: Linear Integrated Circuits Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XN2 (Linear Integrated Circuits)

6XN8: Introduction to Microprocessors Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XN3 (Introduction to Microprocessors)

**FOUR YEAR DEGREE COURSE IN
B TECH CHEMICAL ENGINEERING
SEMESTER - V
CREDIT & GRADE SYSTEM
5CH01 HEAT TRANSFER**

Objective:

To introduce the concepts of heat transfer to enable the students to design components subjected to thermal loading.

SECTION-A

UNIT I: Importance of heat transfer in chemical process industries. Modes of heat transfer, steady state conduction in one dimension. Fourier's law. Heat transfer through plane, cylindrical and spherical walls, compound resistance in series, thermal insulation, critical and economic thickness. Extended surface equipments, types, their design and operation, introduction to unsteady state heat transfer. (7)

UNIT II: Heat transfer by convection, film concept, individual and overall coefficients and factors affecting them. Natural and forced convection. Dimensional analysis applied to heat transfer. Dittus-Boelter equation, Limitations and application. (7)

UNIT III: Heat transfer by parallel and counter current flow, concept of log mean temperature difference, rate of heat transfer. Heat transfer by film wise and drop wise condensation in horizontal & vertical tube. (7)

SECTION-B

UNIT IV: Heat exchange equipments and their design, double pipe, parallel, counter current, shell and tube heat exchangers, condensers, fouling factors, concepts of transfer units in heat exchangers, NTU concept for heat exchangers. (8)

UNIT V: Boiling and Evaporators: Theory of boiling. Classification, types and field applications of evaporators. Single and multiple effect evaporators. Heat transfer through submerged coils, jacketed vessels. (8)

UNIT VI: Heat transfer by radiation, concept of black body, Kirchoff's law, Stefan's law, Black and gray body radiation, view factors luminous and non-luminous gases. Heat transfer in packed and fluidized beds. Recent developments and technological forecasting in heat transfer. (8)

Text Books:

- 1) Heat Transfer by Sukhatme
- 2) Heat Transfer by Mc Adams

Reference Books:

- 1) Unit Operations of Chemical Engineering by McCab and Smith
- 2) Chemical Engineering by Coulson & Richardson, Vol. I
- 3) Heat Transfer by R.C.Sachdeva

5CH02 CHEMICAL ENGINEERING PROCESS-I (Inorganic Chemical Technology)

Chemical Engineers are trained primarily to work in chemical industries. Its basic purpose is to start from one ore or other chemical raw material and end up with a consumer product through series of chemical and physical changes, and here it differs from other manufacturing industries which are assembly industries not creative industries. It will be shown in the study of a number of types of chemical industrial process that the fundamentals chemistry, thermodynamics, kinetics, engineering and economics are always valid.

Objective:

After studying this subject the chemical engineering student will have a comprehensive picture of the chemical industry, particularly as to the reasons and the basis for many and diverse operations which are carried out in process.

SECTION A

- UNIT-I:** 1. Sugar and Starch Industries: Sugar, Starches and related products.
2. Soap and Detergents: Detergents, Soap and Glycerin. (7)

- UNIT-II:** 1. Pulp and Paper Industries: Types, raw materials, manufacture of pulp and paper.
2. Cement and Lime Industries: Portland Cement, types, raw materials, setting and hardening of cement, manufacturing processes of Portland cement; Manufacture, use of lime and gypsum. (8)

- UNIT-III:** 1. Industrial Gases: Manufacture and application of carbon dioxide, hydrogen, oxygen, nitrogen.
2. Fuel Gases: Manufacture and uses of producer gas, water gas, natural gas, synthesis gas. (8)

SECTION B

- UNIT-IV:** 1. Acids: Sulfuric acid, nitric acid, hydrochloric acid.
2. Fertilizer Industry: Manufacture of ammonia, urea, diammonium phosphate, super phosphates (SSP and TSP) (8)

- UNIT-V:** Principles of electro-chemical technological process; Electrolytic process in igneous and molten system; caustic soda, chlorine. (7)

- UNIT-VI:** Electro-thermal Industries: aluminum, lithium, titanium. Electro-chemical sources of energy and storage. (7)

Note: The students are expected to visit the various industries to have a thorough understanding of the subject.

Text Books:

1. Austin, G.T., "Shreve's Chemical Process Industries", Fifth Edition, McGraw-Hill International Book Co, Singapore, 1984.
2. Dryden, C.E., "Outlines of Chemical Technology", Edited and Revised by Gopala Rao M. and M. Sittig, Third edition, Affiliated East-West press, 1997

Reference Books:

1. Kent, J.A., "Riggel's Hand Book of Industrial Chemistry", 7th Edition, Van Nostrand Reinhold, 1974.
2. CHEMTECH 1-4, "Chemical Engineering Education Development Centre", I.I.T., Madras 1975-78.

5CH03 ECONOMICS & MANAGEMENT

Engineers are trained primarily to work in industries, market as managers. They should have knowledge about the basic concepts of economics, latest developments in the field, foreign trades, banking, etc. As a manager they should have basic knowledge about management from production to marketing.

Objective:

After studying this subject the engineering student will have understanding of the happenings in the field of economics and preliminary idea about management.

SECTION A

- UNIT-I:** Nature and scope of economics, Demand and Supply, Demand: concepts, specification, types of demand. Demand Analysis: significance of demand analysis, law of diminishing utility, consumer surplus. Demand Forecasting: concept of forecasting, types of forecast, steps in demand forecasting, techniques of demand forecasting. (8)

- UNIT-II:** Market: Meaning, types of market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition. Inflation: Causes, measurement, effects, controlling of inflation. (7)

UNIT-III: Nature and characteristics of Indian economy, Privatization – meaning, merits and demerits.
Globalisation of Indian economy – merits and demerits.
Concepts of VAT, WTO, GATT & TRIPS agreement, Banking, Foreign exchange.
(8)

SECTION B

UNIT-IV: Basic concepts and functions of Management, Personal Management. Production Management: Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Concepts of material management, inventory control; its importance and various methods. (8)

UNIT-V: Marketing Management: Definition of marketing, marketing concept, objectives and functions of marketing. Marketing Research – Meaning; Definition; objectives; Importance; Limitations; Process. Advertising – meaning of advertising, objectives, functions, criticism. (7)

UNIT-VI: Financial Management: Introduction, Objectives of Financial Management, Functions and Importance of Financial Management. Concept of capital structure and various sources of finance. (7)

Text Books:

1. Modern Economic Theory – K.K. Dewett, S.Chand
2. Principles and Practice of Management: R.S. Gupta, B.D.Sharma, N.S. Bhalla Kalyani Publishers

Reference Books:

1. Principles of Economics: P.N. Chopra (Kalyani Publishers).
2. Micro Economic Theory – H.L. Ahuja (S.Chand)
3. Indian Economy: Rudar Dutt & K.P.M. Sundhram
4. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)
5. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay).
6. Financial Management – I.M. Pandey (Vikas Publishing House, New Delhi)

5CH04 MATERIAL SCIENCE & ENGINEERING

Materials Science & Engineering is the study of mechanical, physical, and chemical properties of engineering materials, such as metals, ceramics, polymers, and composites.

Objectives: The objective of a Materials Engineer is to predict and control material properties through an understanding of atomic, molecular, crystalline, and microscopic structures of engineering materials.

SECTION A

UNIT I: Introduction to materials and their principle properties, Simple stresses and strains, Concept of stress, strain, shear stress, shear strain, Hooks law, Elastic limit, stress-strain curve for mild steel and elastomeric materials, factor of safety, Poisson's ratio, Strain energy due to axial load and impact. Introduction to determination of mechanical properties of materials ASTM methods. (7)

UNIT II: Basic principles in their selection for fabrication and erection of chemical plant. Testing of materials, destructive and nondestructive tests, structure of atom and chemical bonds, crystal structures and their influence on material properties, Deformation and slip processes. (7)

UNIT III: Metals and their alloys: Iron – carbon diagram, Ferrous and nonferrous alloys, mild steel, special steels, stainless steels, brasses, brasses, aluminum alloys and titanium alloys, high and low temperature material, insulation, refractories. Methods for fabrication, rolling, bending, central punching, revetting, welding. Nickel and its alloys: aluminum and its alloys. (8)

SECTION B

UNIT IV: Corrosion and its control: Corrosion attack methods, Different types of corrosion: chemical, biochemical, and electrochemical; Internal and external factors affecting corrosion of chemical equipments, Methods to minimize corrosion, corrosion charts for process equipments. Polyaniline and anticorrosive surface coatings electrochemical corrosion prevention corrosion case studies from the chemical industry. (8)

UNIT V: Polymers, natural and synthetic: Selection of polymetric materials for equipment linings, fiber reinforced plastic, application of special polymers like Nylon 66, Teflon in engineering. Polymer Composites. (7)

UNIT VI: Ceramic and glasses: Definition of ceramics and glasses; interaction between structure, processing, and properties; Applications of ceramic and glass materials; Crystalline and noncrystalline ceramics, silicates, refractories, clays, cements, glass vitreous silica, and borosilicate. (7)

Text Books:

1. James F. Shackelford, Introduction to Material Science, McMillan publishing company, New York ISBN 1990
2. D.Z. Jestrzebaski, Properties of Engineering Materials, 3rd Ed. Toppers. Co. Ltd.

Reference Books:

1. J.L. Lee and Evans, Selecting Engineering materials for chemical and process plants, Business Works 1978
2. Design of machine elements, Spott M.M. Prentice Hall
3. A text book of machine design, Khurmi R.S. and Gupta J.K.
4. Material Science & Metallurgy for Engineers, Dr.V.D.Kodgire, Everest Publishing House.

5FECH05 FREE ELECTIVE -I
5FECH05 (1) AIR POLLUTION CONTROL

Objective:

This subject covers the sources, characteristics and effects of air pollution and the methods of controlling the same. The student is expected to know about source inventory and control mechanism.

SECTION A

UNIT I: Sources of air pollution: Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution –Source inventory. (7)

UNIT II: Effects of air pollution: Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozon layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles. (8)

UNIT III:Dispersion of pollutants: Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models–Applications. (7)

SECTION B

UNIT IV: Air Pollution Control: Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion –Pollution control for specific major industries. (8)

UNIT V: Air Quality Management: Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts–

Zoning – Town planning regulation of new industries – Legislation and enforcement –Environmental Impact Assessment and Air quality. (8)

UNIT VI: Sampling and Analysis: Basic principle of sampling – Statistical Techniques - Source and ambient sampling – Analysis of Gaseous and Particulate pollutants - Standards. (7)

Text Books:

1. Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2002
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996

Reference Books:

1. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996
2. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New York, 1997
3. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 1991
4. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 1985
5. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi
6. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw-Hill, New Delhi, 1991

5FECH05 (2) RISK AND SAFETY MANAGEMENT IN INDUSTRIES

Public awareness of hazards and risks has enhanced the importance of safety assessment and management in today’s increasingly litigious society. Worldwide the burden of responsibility for safety is shifting towards those who own, manage and work in industrial and commercial organizations. The management of safety and risk needs to be integrated into the overall

management of the organization. It should be appropriate and cost-effective without dampening the innovative entrepreneurial spirit of employees with inflexible bureaucratic rules and procedures. An organization’s exposure to potential hazards needs to be managed so as to reduce the chance of loss and mitigate any effects. Risk and safety issues need to be evaluated in a structured and calculated manner but in the light of an overall organizational strategy.

SECTION A

UNIT-I: Hazard identification methodologies, risk assessment methods - PHA, HAZOP, MCA, ETA, FTA, consequence analysis, probit analysis. (8)

UNIT II: Hazards in work places - nature and type of work places, types of hazards, hazards due to improper house-keeping, hazards due to fire in multi-floor industries and buildings, guidelines and safe methods in the above situations. (7)

UNIT- III: Workers' exposures to hazardous chemicals, TLVs of chemicals, physical and chemical properties of chemicals leading to accidents like fire explosions, ingestion and inhalation, pollution in work places due to dangerous dusts, fumes and vapours, guidelines and safe methods in chemicals handling, storage and entry into confined spaces. (8)

SECTION B

UNIT-IV: Hazards peculiar to industries like fertilizer, heavy chemicals, petroleum, pulp and paper, tanneries, dyes, paints, pesticides, glass and ceramics, dairy and sugar industries, guidelines for safeguarding personnel and safeguarding against water, land and air pollution in the above industries. (8)

UNIT- V: Safety education and training - safety management, fundamentals of safety tenets, measuring safety performance, motivating safety performance. (7)

UNIT VI: Legal aspects of industrial safety, safety audit. (7)

Text Books:

1. F. P. Lees, "Loss prevention in process industries", 2nd, Butterworth-Heinemann, 1996.
2. W. Handley, "Industrial safety handbook", 2nd ed., McGraw-Hill, 1977.

Reference Books:

1. S. P. Levine, "Protecting personnel at hazardous waste sites", Martin-Butterworth, 1971.
2. R. P. Blake, "Industrial safety", Prentice Hall, 1953.
3. D. Patterson, "Techniques of safety management", McGraw-Hill, 1978.

5CH07 HEAT TRANSFER - LAB**List of Experiments:**

1. Heat conduction
2. Natural convection
3. Thermal radiation-determination of emissivity
4. Double pipe heat exchanger
5. Shell and tube heat exchanger
6. Plate Heat exchanger
8. Heat transfer in agitated vessels
9. Double effect evaporator
10. Open pan evaporator
11. Heat pipe demonstrator
12. Fluidized bed heat transfer

Note: The students should perform minimum EIGHT experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

5CH08 MATERIAL SCIENCE & ENGINEERING -LAB**List of Experiments:**

1. Microstructure observation and study of metals and alloys. (Minimum five) low carbon steel, medium carbon steel, high carbon Steel, tin, bronze, brass, phosphor bronze.
2. Study of properties of polymeric materials; impact test and polymeric Tests.
3. Corrosion testing (salt spray test for different samples such as plain carbon steel, chrome plate steel, galvanized steel.)
4. Different types of hardness test on metals, i.e. Rockwell hardness test, Brinell hardness test, Shore scleroscope tests.
5. Izod and Charpy impact test on mild steel, copper, brass and aluminium.
6. Chemical analysis of metals and alloys (Any one element to be analysed e.g. molybdenum from stainless steel, carbon from steel, copper from brass etc.)
7. Macrostructure observation: (flow lines observation in forging by macro etching sulphur printing of steel.)
8. Study experiments based in, i) Dye penetration ii) Rubber lining, iii) Ultrasonic test, iv) Heat treatments.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

**6CH01 CHEMICAL ENGINEERING OPERATION-II
(MASS TRANSFER-I)**

SECTION-A

UNIT I: Importance of Mass Transfer Operation. Classification of mass transfer, operations based on gas-liquid-solid contacts. Concepts of flux, resistance, driving force, equilibrium, direction of mass transfer, Dimensionless numbers in mass transfer. Diffusion, Fick's law I and II, Dependence of diffusivity on physical properties, Schmidt's no. calculation, Determination of diffusivity in liquid-liquid, gas-gas, gas-liquid diffusion. (7)

UNIT II: Interphase mass transfer, various coefficient of mass transfer and their determination, resistance concept, controlling phase concept, Mass transfer in turbulent flow, Analogies of mass transfer, Empirical equations. Theories of mass transfer, two film theory, Higbie's penetration theory, Derivation of flux equation, surface renewal theory, Applications and problems. (7)

UNIT III: Absorptions, stagewise absorption, material balance overall, stepwise minimum irrigation rate, Absorption and stripping factor calculation of number of stages, McCabe-Thiele graphical method, Kremser-Brown-Souder's equation. Equipments of absorption, tray towers, packed towers. Continuous absorption, concept of HTU, NTU, HETP, comparison with stepwise columns, design concepts, determination of height and diameter of packed absorption column. (8)

SECTION-B

UNIT IV: Adsorption: Adsorption equilibria, types of adsorption, properties of adsorbents, single and multi-stage adsorption, adsorption isotherms, principles of adsorption, Break through curves, adsorption of liquids, basic equations, adsorber design, adsorption equipments. Ion Exchange: Principles of ion exchange, techniques and applications, Ion exchange equilibria, rate of ion exchange. (7)

UNIT V: Drying and humidification: Principles of drying, phase equilibrium, cross circulation drying, through circulation drying, drying of suspended particles, rate of drying curve, dryers for solids and pastes, dryers for solutions and slurries, i.e. various types of dryers, Humidification: Terms, definitions, wet bulb temp., dry bulb temperature and measurement of humidity, adiabatic saturation temperature, study of

temperature humidity chart, Enthalpy-humidity charts, determination of humidity, and concept of dehumidification, equipments for humidification operations. (8)

UNIT VI: Crystallisation: Principles of crystallisation, equilibria, calculation of yield, heat effects, crystal growth, properties of crystals nucleation, fractional crystallisation, caking of crystals, Various types of crystallise's and their applications. Membrane separation process, Types of membrane, separation of gases, separation of liquids, Dialysis, Reverse Osmosis, pervaporisation, desalination. Recent developments in mass transfer operation. (8)

Text Books:

- 1) Unit Operation in Chemical Engineering: W.L. McCabe & J.C. Smith, McGraw Hill
- 2) Mass Transfer Operation: R.E. Treybal

Reference Books:

- 1) Mass Transfer: T.K. Sherwood, R.I. Pigford, McGraw Hill
- 2) Chemical Engineering: Coulson & Richardson

**6CH02 CHEMICAL ENGINEERING PROCESS-II
(Organic Chemical Technology)**

Chemical Engineers are trained primarily to work in chemical industries. Its basic purpose is to start from one ore or other chemical raw material and end up with a consumer product through series of chemical and physical changes, and here it differs from other manufacturing industries which are assembly industries not creative industries. It will be shown in the study of a number of types of chemical industrial process that the fundamentals chemistry, thermodynamics, kinetics, engineering and economics are always valid.

Objective:

After studying this subject the chemical engineering student will have a comprehensive picture of the chemical industry, particularly as to the reasons and the basis for many and diverse operations which are carried out in process.

SECTION A

UNIT I: 1. Fermentation Industries: Industrial alcohol, absolute alcohol, wine.
2. Organic acid production: Acetic acid, lactic acid, citric acid. (7)

UNIT II: 1. Polymerization Industries: Polyethylene, polypropylene, PVC, polyester synthetic fibers.
2. Rubber Industries: Natural rubber, synthetic rubber, SBR. (8)

- UNIT III:** 1. Petroleum Refinery: Refining of crude oil, products of refining.
2. Petrochemicals: Significant petrochemicals and their derivatives. (8)

SECTION B

- UNIT IV:** 1. Nitration: Nitration agents, kinetics, mechanism, industrial preparation of nitrobenzene, nitronaphthalene, chloronitronaphthalene, nitroacetanilide.
2. Sulphonation and Sulfation: agents, kinetics, mechanism, technical preparation of aliphatic sulphonates, sulphonation of lauryl alcohol, dimethyl ether. (8)
- UNIT V:** 1. Hydrogenation: Catalytic hydrogenation, kinetics, mechanism, hydrogenation of fatty oils, synthesis of methanol.
2. Hydrolysis: Hydrolysis of fat, carbohydrate, starch: Manufacture of ethanol from ethylene, manufacture of phenol. (7)
- UNIT VI:** 1. Halogenation: Technical preparation of halogen compounds- allyl chloride, DDT, BHC, chlorobenzene, vinyl chloride.
2. Oxidation: Liquid and vapour phase oxidation, technical oxidation of isopropyl benzene, naphthalene, benzene, ethyl benzene, naphthalene sulfonic acid. (7)

Note: The students are expected to visit the various industries to have a thorough understanding of the subject.

Text Books:

1. P.H. Groggins, "Unit Processes in Organic Synthesis", McGraw Hill Book Co., Kogakusha (1984)
2. J.A. Kent, "Riegel's Hand book of Industrial Chemistry", 7th Edition, Van Nostrand Reinhold Co., New York (1974)

Reference Books:

1. Peter Wiseman, "An Introduction to Industrial Organic Chemistry", 2nd Edition, Applied Science Publishers Ltd., London (1979)
2. CHEMTECH 1-4, "Chemical Engineering Education Development Centre", I.I.T., Madras 1975-78

6CH03 COMPUTER PROGRAMMING & APPLICATIONS

Application of the following techniques is for problems of interest in chemical engineering, writing and testing of programs in C Language.

SECTION-A

- UNIT I:** Numerical solution of first order differential equations with initial condition, Euler's method, Runge-Kutta method. (7)
- UNIT II:** Systems of linear equations, solution by the method of determinants, matrix inversion for the solution of linear equations, Gauss elimination method. (7)
- UNIT III:** Roots of algebraic and transcendental equation, iteration methods, Regula-Falsi method, Newton-Raphson method, roots of simultaneous and solution set of transcendental and algebraic equations. Development of equations for heat transfer, fluid mechanics and reaction engineering problems. (8)

SECTION-B

- UNIT IV:** Regression analysis - Least Square, error approach, approximation by Chebychev orthogonal polynomial. (7)
- UNIT V:** Elements of optimization techniques, single variable function, optimization-direct search, with and without acceleration, method of regular intervals and fibonacci search method, gradient methods. (8)
- UNIT VI:** Computer programming in modular form, use of subroutine libraries, Block diagrams of preliminary aids in programming, capacity optimization. (8)

Text Books:

1. Digital Computation for Chemical Engineering by Leon Lapidis, McGraw Hill.

6CH04 PROCESS EQUIPMENT - DESIGN & DRAWING

SECTION - A

- UNIT I:** Material behaviour under stresses, theories of failures. (7)
- UNIT II:** Fabrication methods and their effects: Design method for atmospheric storage vessels, unfired pressure vessel subjected to internal and external pressure. (7)
- UNIT III:** Vessels for high pressure operations, Agitated vessels. Tail columns, internals of the reactors. (8)

SECTION - B

- UNIT IV:** Design of process equipment accessories and support systems. (7)

UNITV: Complete design and preparation of working drawing for typical process equipment, such as large storage vessels, thick wall pressure vessels. Self supported tall columns, agitated pressure vessels with heat transfer requirements etc. (8)

UNITVI: Design and layout of piping system and preparation of piping diagram for a typical process.
Material selection and piping coding. (8)

Note: Drawings of minimum eight design problems are expected.

Text Books:

- 1) Process Design of Equipments: S. D. Dawande
- 2) Process Equipment Design: M.V. Joshi, McMillan

Reference Books:

- 1) Introduction to Chemical Engineering Design, Mechanical Aspects
- 2) I.S. Code for Unfired Pressure: IS No. 2825 - 1969 pressure vessel
- 3) Process Equipment Design: I.E.Brownell, E.H.Young, John Wiley
- 4) International & Indian Standard codes for Piping

6FECH05 FREE ELECTIVE-II
(1) RENEWABLE ENERGY SOURCES

Objectives:

- To explain concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications
- To analysis the environmental and cost economics of using renewable energy sources compared to fossil fuels.

Course-Outcome:

- At the end of the semester the student will have knowledge about various renewable energy sources and be able to choose the appropriate renewable energy as an alternate for conventional power in any application.

SECTION A

UNIT I : Solar-Energy : Solar radiation its measurements and prediction - solar thermal flat plate collectors concentrating collectors - applications - heating, cooling, desalination, power generation, drying, cooking etc - principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, and water pumping, power generation schemes. (7)

UNITII: Wind-Energy : Atmospheric circulations - classification - factors influencing wind - wind shear - turbulence - wind speed monitoring - Betz limit - Aerodynamics of wind turbine rotor-site selection - wind resource assessment - wind energy conversion devices - classification, characteristics, and applications. Hybrid systems - safety and environmental aspects. (8)

UNIT III: Bio-Energy : Biomass resources and their classification - chemical constituents and physicochemical characteristics of biomass - Biomass conversion processes - Thermo chemical conversion: direct combustion, gasification, hydrolysis and liquefaction - biochemical conversion: anaerobic digestion, alcohol production from biomass - chemical conversion process: hydrolysis and hydrogenation. Biogas - generation - types of biogas Plants- applications. (7)

SECTION B

UNIT IV : Hydrogen and Fuel Cells: Thermodynamics and electrochemical principles - basic design, types, and applications, production methods, Biophotolysis: Hydrogen generation from algae biological pathways, Storage gaseous, cryogenic and metal hydride and transportation. Fuel cell: principle of working, various types, construction and applications. (8)

UNIT V: Other Types of Energy : Ocean energy resources, principles of ocean thermal energy conversion systems, ocean thermal power plants, principles of ocean wave energy conversion and tidal energy conversion, hydropower, site selection, construction, environmental issues, geothermal energy, types of geothermal energy sites, site selection, and geothermal power plants. (8)

UNIT V: Analysis of the cost effectiveness of renewable energy sources, present status, comparison, forecast. (7)

Text Books:

1. Rai G. D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 2007
2. John Twidell, Tony Wier, 'Renewable Energy Sources', Taylor & Francis Publishers, New York, 2005

Reference Books:

1. Sukhatme, S.P., Solar Energy, Tata McGraw - Hill Publishing Company Limited, 2006

2. Khandelwal K.C, Mahdi S.S., Biogas Technology - A Practical Handbook, Tata McGraw Hill, 1986
3. Thomas .b. Johansson, Henry Kelly, Amulya K.N .Reddy, Robert .H. Williams, 'Renewable Energy Sources for Fuels and Electricity', Island Press, Washington DC, 2009
4. Anthony San Pietro, Biochemical and Photosynthetic aspects of Energy Production, Academic Press, 1980

FREELECTIVE-II

6FECH05 (2) WATER TECHNOLOGY

Objectives: To make the students aware about the issues involved in water and water quality aspects and also to learn about physical, chemical and biological techniques available for managing water quality.

SECTION A

UNIT I: Conventional water and waste water treatment methods, their capabilities and limitations, Need for advanced treatment of water and waste water. (7)

UNIT II: Advanced water treatment- Iron and manganese removal, colour and odour removal, activated carbon treatment, carbonate balance for corrosion control, ion exchange, electro-dialysis, reverse osmosis and modern methods and fluoride management. (8)

UNIT III: Advanced waste water treatment- Nutrient control in effluents, Nitrogen and phosphorus removal methods including biological methods, Methods for the removal of heavy metals, oil and refractory organics. (7)

SECTION B

UNIT IV: Microsreening, ultra-filtration, centrifugation and other advanced physical methods- aerobic digestion, anaerobic filtration, rotating biological contractor, novel methods of aeration etc. (7)

UNIT V: Combined physico-chemical and biological processes, Activated carbon treatment, chlorination of waste water, Pure oxygen systems. (8)

UNIT VI: Filtration for high quality effluents, multistage treatment systems, Land treatment and other resources recovery systems. (8)

Text Books:

1. Introduction to Environmental Engineering, By P.A. Veslind, PWS Publishing Company, Boston, 1997
2. Activated Sludge Process: Theory and Practices, By N.F Grey, Oxford University Press, 1990.

Reference Books:

1. Wastewater Treatment and disposal, By S.J. Arceivalla, Marcel Dekker, 1981.
2. Wastewater Treatment Plant Planning, Design and Operation, By S.R. Quasim, Holt, Rinehart & Winston N.Y.

6CH06 CHEMICAL ENGINEERING OPERATION-II LAB (MASS TRANSFER-I)

List of Experiments:

1. To calculate the diffusivity of vapors of volatile liquid into air by Stefan's tube. (Winklemann's Experiment)
2. To find coefficient of mass transfer of naphthalene ball in stagnant air.
3. To find yield of crystallization with and without seeding.
4. To establish Freundlich and Langmuir isotherm.
5. To determine liquid diffusion coefficient of solute diffusing in water.
6. To determine the critical moisture content of given material.
7. To measure humidity of air from humidifier.
8. To study unsteady state adsorption.
9. To compare the mass transfer in stagnant infinite medium in laminar and turbulent flow.
10. To determine gas film mass transfer coefficient by wetted column for G/L system.
11. Use of humidity or psychometric chart.
12. To compare the mass transfer coefficient for different liquids from free surface by evaporation.
13. Separation of NaNO₃ by fractional crystallization.
14. To study the efficiency of tray drier.

Note: The students should perform minimum EIGHT experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

6CH07 COMPUTER PROGRAMMING & APPLICATIONS - LAB

List of Experiments:

1. Design an algorithm, draw a flow chart and write program to perform addition, subtraction, multiplication and division of two numbers by taking two values from users.
2. Algorithm quadratic equation (for root of).
3. Program for solving ordinary differential equation with initial value of Euler's method.
4. To find value of unknown of simultaneous by Gauss elimination method.

5. To find roots of equation using Bisection method.
6. Algorithm for Regula-Falsi method.
7. Find the roots of equation by Newton-Raphsons method.
8. Program for modified Newton-Raphson method.
9. Design algorithm for regression.
10. Algorithm for print the grades of students using if-else-if statement.
11. Design algorithm and flow chart for Runga-Kutta method.
12. Design algorithm and flow chart to find greatest and smallest element.

Note: The students should perform minimum EIGHT experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

6CH08 MINOR PROJECT

The students in a group of not more than four members have to work on a topic which is experimental and analytical in the area of **Chemical Engineering**. Each project shall have a guide. On completion of the work, a project report should be prepared and submitted to the Department. The project work and the report will be evaluated by an internal assessment committee for 25 marks. The university examination for 25 marks will be a Viva-Voce examination conducted by a committee of one external examiner and one internal examiner /Guide appointed by the University.

SYLLABUS PRESCRIBED FOR FOUR YEAR DEGREE COURSE IN B TECH POLYMER (PLASTIC) TECHNOLOGY SEMESTER - V (CREDIT & GRADE SYSTEM)

5PP01 HEAT TRANSFER

OBJECTIVE:

To introduce the concepts of heat transfer to enable the students to design components subjected to thermal loading.

SECTION A

Unit I: Importance of heat transfer in chemical process industries. Modes of heat transfer, steady state conduction in one dimension. Fourier's law. Heat transfer through plane, cylindrical and spherical walls, compound resistance in series, thermal insulation, critical and economic thickness. Extended surface equipments, types, their design & operation, introduction to unsteady state heat transfer.

Unit II : Heat transfer by convection, film concept, individual and overall coefficients and factors affecting them. Natural and forced convection. Dimensional analysis applied to heat transfer. Dittus-Boelter equation. Limitations and application.

Unit III : Heat transfer by parallel and counter current flow, concept of log mean temperature difference, rate of heat transfer. Heat transfer by film wise and drop wise condensation in horizontal & vertical tube.

SECTION B

Unit IV : Heat exchange equipments and their design, double pipe, parallel, counter current, shell and tube heat exchangers, condensers, fouling factors, concepts of transfer units in heat exchangers, NTU concept for heat exchangers.

Unit V : Boiling & Evaporators: Theory of boiling. Classification, types and field applications of evaporators. Single and multiple effect evaporators. Heat transfer through submerged coils, jacketed vessels.

Unit VI: Heat transfer by radiation, concept of black body, Kirchoff's law, Stefan's law, Black and gray body radiation, view factors luminous and non-luminous gases. Heat transfer in packed and fluidized beds.

Text Book:

- 1) Heat Transfer: Sukhatme
- 2) Chemical Engg.: Coulson & Richardson, Vol. I (ELBS, Pergamon Press, 1970)

Reference Books:

- 1) Heat Transfer: Me Adams
- 2) Basic Heat Transfer: Necati Orisik, McGraw Hill Co., Kogakusha-
- 3) Heat Transfer: J.P.Hokman, McGraw Hill Co., Kogakusha.
- 4) Unit Operations of Chemical Engg.: McCab and Smith.
- 5) Introduction to Chemical Engg.: Bedger and Banchemo.
- 6) Heat Transfer: Gebhart, McGraw Hill, 2nd edition, 1979.

SPP02 POLYMER MATERIALS**OBJECTIVE:**

To understand the materials, properties, production method along with the application of various polymer material

SECTION A

Unit I : History and development of polymer materials. Basic raw materials for polymer and their availability, Production, Properties and application of Polyolefin's such as HDPE, LDPE, LLDPE, & PP

UNIT II: Production, properties and application of PVC, characteristics & compounding of PVC, Natural and modified natural polymers such as cellulose, cellulose nitrate. Cellulose Acetate. CAB polymers their manufacture, properties & applications.

Unit III : Production, Properties & applications of Acrylic Plastics such as PMMA & Styrene based Polymers such as PS, HIPS, SAN, EPS, & MBS

SECTION B

Unit IV: Production, Properties & applications of engineering plastics such as Polycarbonate, PPO, PPS, ABS, PET, Polyamide, polyimide's, Fluoro Polymers. Acetal resins.

Unit V : Thermoset Technology, production, properties & applications of Phenolics, Urea, and Melamine resins. Chemistry and Molding powder preparation,

Unit VI: Properties & application of Cellulose and Epoxy resins, unsaturated Polyesters. Chemistry and Molding powder preparation, Polyurethane resins

Text Books:

- 1) Plastic Materials : J.A.Brydson
- 2) Polymer Science & Technology of Plastics & Rubbers : P.Ghosh

Reference Book:

- 1) Encyclopedia of PVC, Vol. I, II & III : L.I.Nass.
- 2) Manufacture of Plastics : Maya Smith.
- 3) Vinyl & Diene Monomers Part I & II : E.C.Leonard.

- 4) Fibers Fillers Plastics & Rubbers : W.J.Roff.
- 5) Plastics Materials Proof & Application (1, 2, 3) : Birley.
- 6) Hand Book of Plastics & Elastomers : Harmansen.
- 7) Plastic Materials Handbook : Athalye.
- 8) Handbook of Plastics Materials & Technology : Rubin.

SPP03 ENGINEERING PLASTICS AND SPECIALTY POLYMER**Objective**

To familiarize the students with specific class of advanced polymers defined on the basis of their specific properties. This paper will emphasize on the study of processing requirements for specialty polymers, engineering and specialty application of these materials in various vital fields like high performance applications, biomedical, aerospace engineering, electronics and other areas and manufacture.

SECTION A

Unit I : Liquid Crystalline Polymers (LCPs): Concept of liquid crystalline (LC) phase, liquid crystalline polymers and their classification. Theories of liquid crystallinity, characteristics of LC state and LCPs, synthesis, structure property relationship, rheology of liquid crystalline polymers, blends of LCPs, self reinforced composites, applications of LCPs.

Unit II: Conducting Polymers Classification of Conducting Polymers, Theory of conduction, semi conductors and conducting polymers, band theory, requirements for polymer to work as conductor, types of conducting polymers - intrinsic and extrinsic, doping of polymeric systems, synthesis, processing and testing of conducting polymers, applications and recent advances.

Unit III: Heat Resistant Polymers: Requirements for heat resistance, determination of heat resistance, synthesis, structure-property relationships, applications of heat resistant polymers like polyamides, polyamides and its derivatives, engineering plastic blends.

SECTION B

Unit IV : Photosensitive Polymers and Polymers as Coating Additives Photosensitive polymers - synthesis, curing reactions, applications in various fields. Membranes, their types, methods of casting and their applications. Water soluble polymers, Polymer as coating additives - types, synthesis, requirements for polymer to work as coating additives and applications

Unit V : Biopolymers and Biomaterials : Biopolymers - Study of natural biopolymers and synthetic biopolymers and their applications like bioassays, biocatalysts, etc., need of biomaterials and biopolymers, biodegradation, environmental impact, biomaterials and their medical applications, orthopedic applications, rehabilitation aids, etc., testing procedures (ASTM). Biodegradable polymers

Unit VI : Polymers in Miscellaneous Specialty Applications
Polymers in agricultural applications: Polymers in automobile, aerospace, light emitting polymers, polymers for ion exchange resins and membranes.

Text Books:

- 1) Recent Advances in Liquid Crystalline Polymers; L. Lawrence Chapoy, Ed. Elsevier Science, New York, 1985
- 2) Engineering Polymers; R.W. Dyson, Chapman and Hall, New York, 1990

Reference books:

1. Polymers for High Technology Electronics and Photonics; M.J. Bowden and S.R. Tumer, Amer. Chem. Soc., 1987
2. Additive for coatings, John Bieleman, Wiley-VCH, 2000
3. Additives in water borne coatings, Gerry Davison, Bruce Lane, Royal society of Chemistry, 2003
4. Encyclopedia of Polymer science and Engineering Vol.1-17, Jacqueline I. Kroschwitz, 2007.

5PP04 INSTRUMENTATION AND CONTROL

OBJECTIVE:

To understand the concepts of different instrument which are used in Industries also to enable the students to design components during the process.

SECTION A

Unit I : Measuring Instruments: Qualities of measurement, elements of instrument, static & dynamic characteristics, measurements of temperature and levels.

Unit II : Measurement of pressure, vacuum, humidity & pH in process industry.

Unit III : Methods for composition analysis. Principle and techniques of instruments for composition analysis in process industry, such as chromatography, spectroscopy, refractometry etc.

SECTION B

Unit IV: Flow measuring instruments: Flow measuring devices for incompressible and compressible fluids. Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. Pneumatic actuators.

Unit V: Introduction to Simple system analysis: Laplace Transformation. Block diagrams, linearization. First and higher order system.

Unit VI: Frequency response, distributed parameter system, dead time. Feed back control, servo and regulator control. Time domain closed loop responses, closed loop frequency response.

Text Books :

1. Industrial Instrumentation: Eckman, Wiley Eastern
2. Instrumental Methods of Chemical Analysis : Erwing, McGraw Hill.

BOOKS RECOMMENDED:

- 1) Instrumentation & Process Measurements : W.Bottom, Orient Longman.
- 2) Industrial Control & Instrumentation : W.Bottom, Orient Longman.
- 3) Outlines of Chemical Instrumentation & Process Control : A. Suryanarayan, Khanna Pub., New Delhi.

FREE ELECTIVE – I

5FEPP05 (1) POLYMER SCIENCE & TECHNOLOGY

OBJECTIVE:

To understand the concepts polymer Technology.

UNIT I: History of Polymer, Introduction to polymers, classification & types of polymers. Nomenclature. Thermoplastics and thermosets. Linear, branches and cross linked polymer Block and graft copolymer. Avg. Mol. wt, Number Avg. Mol. Wt., degree of polymerization, poly dispersity, and mol. Wt. distribution, size of polymer molecules, Chemistry of Polymerization

Unit II : History and development of polymer materials. Basic raw & materials for polymer and their availability, Production, Properties and application of Polyolefin's, Vinyl halides, PVC

Unit III: Polymer processing techniques: Injection molding, compression molding, transfer molding

Section II

Unit IV : Polymer Processing Techniques: Extrusion molding, Blow molding, Thermoforming.Etc.

Unit: V: Polymer Degradation and recycling: Types of degradation, Thermal degradation, Mechanical Degradation, Degradation by ultrasonic waves, photo degradation, Biodegradation.

Unit VI: Polymers in agricultural applications: green houses, mulches, control release of agricultural chemicals, seed coatings, etc.,

polymers in construction and building applications, polymer concrete, polymeric materials used in communication applications, polymer composites in aerospace and other light weight applications, polymers in cosmetics and food applications,

Text Book:

1. Plastic Materials : J.A.Brydson
2. Polymer Science: V.R. Gowariker

Reference Book:

- 1) Manufacture of Plastics: Maya Smith.
- 2) Fibers Fillers Plastics & Rubbers: W.J.Roff.
- 3) Plastics Materials Proof & Application (1, 2, 3) : Birley.
- 4) Hand Book of Plastics & Elastomers : Harmansen.
- 5) Plastic Materials Handbook: Athalye.
- 6) Handbook of Plastics Materials & Technology : Rubin.
- 7) Polymer Science & Technology of Plastics & Rubbers : P.Ghosh.

FREE ELCECTIVE - I

5FEPP05 (2) RUBBER TECHNOLOGY:

Objective

This course the details pertaining to raw materials, formulations, processing, testing, applications have been presented. A sound understanding of these polymeric materials would equip the students for careers in rubber industry.

SECTION -A

Unit I : Introduction of elastomer , selection criteria for elastomers for intended application origin of rubber , latex technology, compounding, manufacturing techniques such as Dipping and washing , coagulation, slush molding and rotational casting, latex foam rubber ,properties of raw natural rubber , special types of rubber

Unit II : Mastication and compounding behavior , Principles of compounding, mechanism of reinforcement , method of incorporation , reinforcement phenomenon in unvulcanisate system, reinforcement phenomenon in vulcanisates, Requirements of textile for reinforcements of rubber products, machinery and methods used for compounding

Unit III : Materials for compounding and reinforcement, chemicals and additives used in rubber compounding , need for addition, Selection criteria and properties of carbon black, non black fillers, fibrous fillers , plasticizers, softeners, extenders , special types of additives, anti aging , antioxidants ,antiozonants , anti static

agents, blowing agents, colorants, processing aids, flame retardants

SECTION -B

Unit IV: Manufacturing process sequence in rubber industry such as mixing, forming and vulcanization, machinery used for different operation, internal mixers, Processing of rubbers by Extrusion process, calendaring process, Injection molding Compression molding, finishing of rubber compounds

Unit V : Tyre technology – Tyre components , processing of elastomer for pneumatic tyre and tube , its design consideration and aspects , tyre building process , preparation of raw tyre for vulcanization, molding and vulcanization , instrumentation and control system

Unit VI: Different test methods for determination of free sulfur, ash content, moisture contents Test methods for hardness, abrasion resistance, wear resistance, tear resistance, weathering resistance, heat resistance, compression set, and tensile strength

Text book:

1. Rubber Technology Edited by Maurice Morton Kluwer, Academic Publishers, 2010
2. Rubber Technology and Manufacture by C M Blow, Butterworth-Heinmann, 2nd Edition, 1982

References books:

1. Rubber Compounding Chemistry and Application by Bredan Rodgers Publisher: CRC Press; 1 edition, 2004
2. Rubber Compounding by Fred W Barlow, Mercel Dekker Inc, 1993
3. The Physics of Rubber Elasticity by L. R. G. Treloar, Publishers: Oxford University Press Inc, 2005
4. Natural Rubber Science and Technology by A. D. Roberts, Oxford Science Publication, 1988
5. Engineering with Rubber: How to design Rubber components by Alan N Gent Publishers: HANSER PUBLISHERS, 2001
6. Practical Rubber Compounding and Processing by B. W. Evans Publishers: Applied Science Publication, 1981
7. Rubber to Metal Bonding by B. G. Crowther, RAPRA TECHNOLOGIES , 1996
8. Advances in the bonding of rubber to various substrates by RAPRA TECHNOLOGIES (2001)
9. Rubber Handbook by Babbit (Author) , R T Vanderbilt Publishers, 13th edition,1990

SPP06 COMMUNICATION SKILLS:

Unit I : Comprehension over an unseen passage. Comprehension - A - word study :- Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage. Comprehension - B - Structure study :- Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc. Active and passive forms, negative and interrogative, punctuation and capitalization. Unit

UNIT II : Theoretical background - importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content. Non-verbal communication, types of graphics and pictorial devices. (10 Hours)

UNIT III: Specific formats for written communication like – business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day to day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews. Methodology of conduction of meetings, seminars, symposia, conference and workshop.

BOOKS RECOMMENDED :

- 1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
- 2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
- 3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Publication Pvt. Ltd.
- 4) F.Frank Candlin : General English for Technical Students, University of London Press Ltd.

SPP07 HEAT TRANSFER – Lab**List of Practicals:**

1. To study the temperature distribution, heat transfer and effectiveness in parallel flow heat exchanger.
2. To study the temperature distribution, heat transfer and effectiveness in counter current flow heat exchanger.
3. To study heat transfer through lagged pipe.
4. To determine thermal conductivity of insulating powder
5. To determine the emissivity by using the emissivity measuring apparatus.
6. To determine thermal conductivity by two slab guarded hot plate method.
7. To study heat transfer through composite wall.
8. To study Stefan Boltzman's constant
9. To study temp distribution, heat transfer in forced convection.
10. To study temp distribution, heat transfer in natural convection.
11. To study temp distribution, heat transfer in rectangular fin.
12. To study temp distribution, heat transfer in horizontal condenser.
13. To study temp distribution, heat transfer in vertical condenser.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

SPP08 POLYMER MATERIAL - Lab**List of Practicals:**

1. To determine tensile strength of a given plastic material
2. To determine percentage elongation
3. To determine cross breaking or flexural strength of a given plastic specimen
4. To determine static & dynamic coefficient of friction of plastic film.
5. To determine vicat softening temperature of plastic specimen
6. To determine dart Impact strength of plastic sheet or film with the help of dart Impact tester.
7. To determine melt flow Index by extension plastometer.
8. To determine Izod Impact strength of given plastic material.
9. To determine temperature deflection under load of given plastic specimen
10. To determine haze percentage of specimen by using Haze Meter.
11. To determine ESCR of given plastic specimen with environmental stress cracking resistance.
12. To determine apparent bulk density and funnel flow of given material.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

SPP09 INSTRUMENTATION & CONTROL - Lab

List of Practicals:

1. To determine refractive index for mixtures and also to calculate molar refraction of liquid mixture and prepare plot of refractive index Vs Compositions using Abb's refractometer
2. To calibrate pressure gauge using dead weight pressure gauge tester.
3. To verify whether the temperature switch is accurate within the specified ranges and to calibrate thermometer against temperature switch.
4. To find amount of NaOH require for neutralization of given amount of HCL Using a PH Meter
5. To determine response of the bare measuring thermometer for
 - i) positive step change
 - ii) Negative step change.
6. To calibrate rotameter.
7. To study the response of single tank
8. To determine gas flow rate by gas flow meter and to compare the reading other sources.
9. To study thermocouple.
10. To find amount of sodium hydroxide required. Exactly to neutralize a known amount of hydrochloric acid using a khohlrauseh conductivity bridge and hence to verify the same titrate value with volume titration.
11. To measure wind velocity using van anemometer.
12. To measure the humidity (absolute, relative) using psychomotor.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

SPP10 COMMUNICATION SKILLS LABORATORY

Objective:

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation. The sample list of experiments is given below. This list can be used as guideline for

problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter

6PP01 CHEMICAL ENGG. OPERATION –II (Mass Transfer)

SECTION A

Unit I: Introduction to mass transfer: Various industrially important mass transfer operations, their classification. Fundamental of mass transfer, flux, driving force, resistance, rate of mass transfer, co-current, cross current, counter current operations, Batch and continuous operations.

DIFFUSION: Molecular diffusion, Fick's law, equimolecular counter current diffusion, unicomponent diffusion in stagnant medium: stefen's law, Predication of diffusivities based on physical properties, Experimental determination of gas diffusivities winkleman's experiment. Liquid diffusivities. Gas diffusion through polymers, factors affecting gas permeability of polymers.

Unit II: Interphase mass transfer: Concept of equilibrium curves, mechanism of mass transfer. Two film theory and penetration theory. Mass transfer coefficient, relation between individual and over all mass transfer coefficient, concept of controlling film resistance. Studies in turbulent mass transfer, dimensionless groups such as sherwood No., schmidt No., stanton no., grashoffho, JD factor.

Unit III: Flow through packed bed limiting flow rates, loading and flooding, fluidised bed, principle of gas absorption, absorption factor, stripping factor material balance in absorption column. Equipments for gas absorption, scrubbers.

SECTION B

Unit IV & V: Distillation - Vapour liquid equilibria, Raoult's laws, & Henry's law, relative volatility, methods of distillation. -Differential distillation, (Rayleigh's equation), flash distillation, Description of fractionating column, McCabe Thiele method for calculating number of plates, Effects of reflux ratio on number of plates, fenske's equation, murphree plate efficiency and overall

efficiency. Introduction of Azeotropic and steam distillation. (Detailed design for isotropic and steam distillation is not expected)

Unit VI: Humidification and Drying: Basic definitions, psychometric chart, theory of humidification, equipments for humidification, cooling tower. Theory of drying, rate of drying, equipments for batch and continuous drying.

Text Books:

1. Unit Operation of Chemical Engg.: McCabe and Smith
2. Chemical Engineering Vol. 1: Coulson and Richardson.

Reference Books:

- 1) Principles of Unit Operation: A.S.Foust.
- 2) Unit Operation: C.G.Brown
- 3) Introduction to Chemical Engineering: Badger and Banchemo.
- 4) Mass Transfer Operation: R.E.Trebal.
- 5) Momentum Transfer Operation: S.K.Gupta
- 6) Physical Chemistry of Polymers: A. Tager.
- 7) Fundamentals of Polymer: Anil Kumar and R.K.Gupta.

**6PP02 ELASTOMER TECHNOLOGY
SECTION A**

Unit I : Introduction of Elastomer, introduction of rubber , basic raw materials , natural rubber, other forms of natural rubber, properties of raw natural rubber, storage hardening and crystallization of natural rubber , mastication and compounding behavior , Manufacturing process sequence in rubber industry such as mixing, forming and vulcanization.

Unit II: Vulcanization of rubbers , vulcanization by sulfur, peroxides and by other methods , non sulfur vulcanization, kinetics of vulcanization , chemical reaction, Factors affecting rate of vulcanization , vulcanization conditions , techniques of vulcanization.

Unit III: Processing of Elastomer for pneumatic tire and tube its design aspects and consideration, tyre building process, difrent tyre components , Retreading of tyres Raw material , compounding , processing , properties and application of SBR, butyl rubber, Nitril Rubber , EPM and EPDM Rubber , polysulphides.

SECTION B

Unit IV: Additives in plastics & its requirements, types of filler and reinforcement, choice of fillers and properties. Theory of plasticizers. Types and requirement of plasticizers. Selection and properties of lubricants.

Unit V : Selection and properties of other additives such as Antioxidant Antiozonates. Antistatic agents. UV stabilizers. Ant blocking agent, Processing aids, colorants', Foaming agents, Toughening agents and Flame retardants.

Unit VI: Introduction to Adhesives, its classification & requirements. Formulation and application of adhesives in various fields, Manufacture and testing of adhesives. Recent advances in adhesive technology.

Text Books :

1. Introduction to Rubber Technology: Morris Morton
2. Plastics Materials: H.A.Brydson

Reference Books:

- 1) Rubber Technology & Mfg.: C.M.Blow
- 2) Science and Technology of Rubber: E.R.Eircich
- 3) Polymer Processes: Schidknechi
- 4) Rubber Materials & their Compounds: Brydson
- 5) Plastics Additives, An Introduction Guide: Flick
- 6) PVC Technology: Titow
- 7) H.B. of Plastics & Elastomers: Harper
- 8) Plastics Additives Handbook Illrd Edn.: Gachter
- 9) Adhesive Technology Handbook: Landrock
- 10) H.B. of Adhesives: Skiest
- 11) Fundamental of Adhesion: Lee

6PP03 COMPUTER PROGRAMMING AND APPLICATIONS

Note: Application of the following techniques for problems of interest in chemical engineering, writing and testing of programs written in C Language.

SECTION A

Unit I : Numerical solution of first order differential equations with initial condition, Euler's method, Runge-Kutta method.

Unit II: Systems of linear equations, solution by the method of determinants, matrix inversion for the solution of linear equations, Gauss elimination method.

Unit III: Roots of algebraic and transcendental equation, iteration methods, Regula-Falsi method, Newton-Raphson method, roots of simultaneous and solution set of transcendental and algebraic equations. Development of equations for heat transfer, fluid mechanics and reaction engineering problems.

SECTION B

Unit IV : Regression analysis - Least Square, error approach, approximation by Chebychev orthogonal polynomial.

Unit V : Elements of optimization techniques, single variable function, optimization-direct search, with and without acceleration, method of regular intervals and fibonacci search method, gradient methods.

Unit VI : Computer programming in modular form, use of subroutine libraries, Block diagrams of preliminary aids in programming, capacity optimization.

TEXT BOOKS:

1. Digital Computation for Chemical Engineering by Leon Lapidis, McGraw
2. Numerical methods and programming by S.S. Shastri

6PP04 POLYMERENGINEERINGTHERMODYNAMICS

Unit I : Review of Fundamental Concepts: System, surrounding, boundary, thermodynamic processes, thermodynamic Junctions and variables. Extensive and intensive properties, Definitions and properties of state function. Concepts of enthalpy and free energy. Coefficient of thermal expansion, compressibility coefficient relation between α and β . Relation between C_p and C_v . Brief definitions of First, Second and Third law of Thermodynamics. State of equilibrium, Free energy functions and their properties. Variation of free energy with pressure at constant temperature, temperature dependence of free energy. Thermodynamic equilibrium and free energy functions, criteria for equilibria at Constant T and V, Criteria for equilibria at constant T and P.

Unit II: One Component System: Physical equilibria involving phase transitions, the Clapeyron equation, application of Clapeyron equation, The Clausius - Clapeyron equation. System of Variable Composition: Partial molar quantities, determination of partial molar quantities, Gibbs- Duhem equation, Chemical potential, Chemical potential and other thermodynamic functions, effect of temperature and pressure on chemical potential of a pure substance, chemical potential in an ideal gas mixture.

Unit III : Thermodynamic functions of mixing: Free energy of mixing, entropy of mixing, volume of mixing, enthalpy of mixing. Properties of Liquid solutions: Ideal solutions and Raoult's law. Vapour-Liquid equilibria, Chemical potential in an ideal liquid solution, mixing properties of ideal solution, solubility behaviour of ideal solution.

Colligative properties:

Lowering of vapour pressure, elevation of boiling point, freezing point depression, Osmosis and osmotic pressure, Determination of molecular weight of *non* volatile solute, Ebulliometric constant.

SECTION B

Unit IV & V : Polymer - Low molecular liquid systems: &Ideal, Non-ideal, Regular solutions, True solutions of Unit Polymers. Dissolution and swelling of polymers, unlimited swelling, limited swelling, factors affecting dissolution and swelling of polymers. Thermodynamics of polymer solution, Basic concepts of Flory - Huggins theory, criteria for polymer solubility, solubility parameter, Phase equilibrium of polymer - solvent system, Binary systems, LCST, UCST. Gels of polymers.

Unit VI : Chemical Equilibria Formulation of equilibrium law, equilibrium law for ideal gases, Free energy change in chemical reaction, chemical affinity and thermodynamic functions, Equilibrium constant, Relation between K_p , K_c and K_x . Variation of equilibrium constant with temperature, variation of equilibrium constant with pressure. Equilibria for condensation polymerization, Equilibria of radical polymerization.

Text Books:

1. An Introduction to Chemical Thermodynamics - Rastogi & Mishra, VikasPub.
2. Physical Chemistry of Polymer: A.Tager, Mir Pub.

LIST OF BOOKS:

- 1) An Introduction to Chemical Engg. Thermodynamics - J.M.Smith & H.C.Van Ness, Kogakusha, 1976.
- 2) The Principle of Chemical Equilibria and Applications in Chemistry and Chemical Engg. - K.Denbig, Cambridge Uni. Press, ELBS.
- 3) Fundamentals of Polymer Science and Engineering: Anilkumar and S.K.Gupta.
- 4) Text Book of Polymer Science: Billimeyar.
- 5) Polymer Chemistry: An Introduction: Seymour.
- 6) Polymer Science & Tech. of Plastics & Rubbers: P.Ghosh.

6FEPP05 FREE ELECTIVE – II
(1) PACKAGING TECHNOLOGY

Objective

Plastic material offer unique advantage in the area of packaging from aesthetics and functional point of view. Objective of this course is to introduce the students to the emerging area of plastic packaging technology.

SECTION I

Unit I : Introduction Need for packaging, packaging done by nature, purpose of packaging, types of packaging Packaging materials: glass, metal, wood, plastics etc, and complete detail of material selection criteria.

Unit II : Packaging Engineering New product development, market, self life, quality assurance, logistic, graphic design, regulation, temperature evidence packaging, child resistance packaging, quality management system, verification & validation protocols, life cycle assessment, waste hierarchy, importance of 3 R (Reduce, reuse & recycle).

Unit III : Package Design Approach Product–packaging relationship, product–package characteristics, compatibility factors, product type vs packaging requirements, product characteristics– physical state, centre of gravity, size / weight, volume. Product characteristics– chemical: effect of gases, moisture, atmospheric gases, product characteristics – biological: sensitivity to microbial factors. Product characteristics – physico chemicals: effect of moisture, vapor, oxygen & other gases

SECTION II

Unit IV: Packaging Material Characteristics: Packaging material properties – physical: influence of molecular / fiber directions, tensile, breaking load, tension, tear, torsion, puncture, burst, packaging, material Properties – chemical: pH, chloride / sulphate content, imbedded and un-reacted chemicals, packaging material properties – biological: sensitivity to micro organisms, packaging material properties – physic chemical: absorption & diffusion of moisture and gases – barrier properties.

Unit V: Packaging Material Evaluation Physical & mechanical properties: weight, dimensions, strength properties, stiffness, tear, tensile and others, chemical properties: alkalinity, acidity, resistance biological properties, sensitivity to microbes, chemicals, presence of chloride, sulphate, lignin, ash, flammability, physiological properties – odor / flavors.

Unit VI : Packaging Machines Bottle filling lines which includes bottle washing, sterilization, filling, screw capping/crown corking, induction sealing, labeling etc., form fill seal machines: types (vertical & horizontal), flow rap machine, retort machine, tetra packs, wooden packaging, miscellaneous packaging technique, bag in box, child resistance pack, packaging in canes etc, biodegradable and ecofriendly packaging, advantages and disadvantages, packaging used for export, advancements and developments and application.

Text Books:

1. Packaging Handbook–A.S. Athalye, Tata McGraw Hill, New Delhi, 1992
2. Fundamentals of Packaging Technology – F.A. Paine (Blackie & Sons Publication) 1967

Reference Books:

1. Packaging, Materials and Containers – F.A. Paine (Blackie & Sons Publication), 1967.
2. Plastics in Packaging – A.S. Athalye, Tata McGraw Hill, New Delhi, 1992
3. 5.. Plastic Packaging- Susan E.M. Selke (Hanser Gardner Publication), 2004
4. Plastics Packaging – Properties, Processing, And Applications.[2nd Edition] By Susan E. M. Selke, John Culter, 2010.
5. Plastics Materials for Packaging By Barnetson [Rapra Publications], 1996
6. Understanding Plastics Packaging Technology By Susan E. M. Selke, John Culter,
7. Rigid Plastics Packaging – Materials, Processes And Applications By F. Hannay [Rapra Publications], 2002.

6FEPP05 COMPOSITE TECHNOLOGY

Unit I : Introduction to Composites, Classification of composites (on the basis of matrix materials-polymer, metal, wood, ceramic etc), Classification of Composites (on the basis of reinforcements types- particulate, sheets etc) , Fundamentals of Composites (matrix, reinforcement and interphase) and their role in formation and working of composites, Structural Types of reinforcements(particulate, sheets, whiskers etc) , Selection Criteria for material selection and composites formation, Factors affecting composites (Wet ability , Bonding, Compatibility ratio, surface tension etc.)

Unit II: Manufacturing, Chemistry, Properties and Application of various materials used as matrix (polymer-thermoplastic, thermosets, Elastomer, ceramics etc) Mechanical, thermal, electrical, environmental and viscoelastic etc properties in relation to matrix and processing.

Unit III : Manufacturing, Chemistry, properties and application of various materials used as reinforcements (Natural fibers, synthetic fibers - glass fibers, aramid fibers etc, whiskers, sheets, wovens etc.), Types of Fiber orientations- role and properties. Role and behavior of interphase in composites. Mechanical, thermal, electrical, environmental and viscoelastic etc properties in relation to reinforcements and processing.

Unit IV : Additives used in composites- properties and functions and examples (fillers, coupling agents, antioxidants, anti-ozonants, UV and light stabilizers, anti-static agents, dyes and pigments etc) Processing techniques for Composites- Open Moulding Techniques (Hand layup, Spray layup, Vacuum bag Molding, Encapsulation etc.

Unit V : Processing techniques for Composites- Close Molding Techniques (Filament winding, Pultrusion, Resin transfer molding etc). Advanced Composites, Advanced materials used for composites. Modifications and Advancements of advanced Composites over conventional composites.

Unit VI: Designing aspects of Composites with relation to processing (designing for hand layup & spray layup). Detail application wise study of different composite examples in different fields- Automobile, Aerospace, electrical and electronics, Chemical Industries, Civil and Construction Industry and Textile Industry etc.

Text Books:

1. Polymer Engg. Composites, M.O. W.R.Richardson applied science London 1976.
2. SPI Handbook of Tech. and Engg. of Reinforcements for Plastics and Composites, J.G.Mohr.S.S.Oleesky, G.D.Shook, L.S.Meyer, Van Nostrand Renhold Co., New York 1973.

References Books:

1. Polymer Composite by Margolies.
2. Encyclopedia of composites by Nass
3. Composite material By S.P.Agrwal

**6PP06 CHEMICAL ENGG. OPERATION –II
(MASS TRANSFER) – LAB**

List of Experiments:

- 1) To calculate diffusivity of vapours of volatile liquid into air by stefan's tube.
- 2) To determine the liquid diffusion of salt diffusing in water.
- 3) To compare the mass transfer coefficient for different liquids from free surface.
- 4) To prepare the b.p. diagram and plot x-y data. On equilibrium diagram.
- 5) To determine gas film mass transfer coefficient by wetted ball column
- 6) To find mass transfer coefficient of naphthalene balls in air.
- 7) Verification of rayleigh's equation for different (batch) distillation.
- 8) To determine vaporization efficiency and thermal efficiency in case of steam distillation.
- 9) To determine critical moisture content of a given material.
- 10) To determine gas permeability of plastic film.

6PP07 ELASTOMER TECHNOLOGY -LAB

List of Experiments:

1. To determine of plastic / Films.
2. To find out point and softening range of polymer
3. To determine the resistance of liquid (swelling) of rubber sample
4. To determine tensile strength of a given rubber material before and after emulsion
5. To determine percentage elongation of a given rubber sample before and after emulsion
6. To determine flex strength of a given plastic material
7. To determine specific gravity of a given rubber sample
8. To study abrasion resistance of a given rubber sample
9. To determine moisture content and ash content of given sample
10. To determine the compressive strength of a given rubber sample
11. To determine the bursting strength of a different given sample
12. To evaluate adhesion between plies of fabric bonded with rubber by dead load method.
13. To determine dielectric strength of plastic
14. To study the plasticity of rubber sample by rapid plastometer.
15. Industrial report.

6PP08 COMPUTER PROGRAMMING & APPLICATION - LAB

List of Experiments:

1. Design an algorithm, draw a flow chart and write program to perform addition, subtraction, multiplication and division of two numbers by taking two values from users.

2. Algorithm quadratic equation (for root of).
3. Program for solving ordinary differential equation with initial value of Euler's method.
4. To find value of unknown of simultaneous by Gauss elimination method.
5. To find roots of equation using Bisection method.
6. Algorithm for Regula-Falsi method.
7. Find the roots of equation by Newton-Raphsons method.
8. Program for modified Newton-Raphson method.
9. Design algorithm for regression.
10. Algorithm for print the grades of students using if-else-if statement.
11. Design algorithm and flow chart for Runge-Kutta method.
12. Design algorithm and flow chart to find greatest and smallest element.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

6PP09 MINOR PROJECT

The students in a group of not more than four members have to work on a topic which is experimental and analytical in the area of **POLYMER TECHNOLOGY**. Each project shall have a guide. On completion of the work, a project report should be prepared and submitted to the Department. The project work and the report will be evaluated by an internal assessment

committee for 25 marks. The university examination for 25 marks will be a Viva-Voce examination conducted by a committee of one external examiner and one internal examiner /Guide appointed by the University.

**SYLLABUS PRESCRIBED
FOR BACHELOR OF TECHNOLOGY
(CHEMICAL TECHNOLOGY)
FOOD TECHNOLOGY, PULP & PAPER TECHNOLOGY,
OIL & PAINT TECHNOLOGY AND
PETROCHEMICAL TECHNOLOGY
SEMESTER PATTERN
FIFTH SEMESTER
5CT 01 HEAT TRANSFER**

SECTION-A

- Unit I** : Importance of heat transfer in chemical process industries. Modes of heat transfer, steady state conduction in one dimension. Fourier's law. Heat transfer through plane, cylindrical and spherical walls, compound resistance in series, thermal insulation, critical and economic thickness. Extended surface equipments, types, their design & operation, introduction to unsteady state heat transfer.
- Unit II** : Heat transfer by convection, film concept, individual and overall coefficients and factors affecting them. Natural and forced convection dimensional analysis applied to heat transfer. Dittus-Boelter equation. Limitations and application.
- Unit III** : Heat transfer by parallel and counter current flow, concept of log mean temperature difference, rate of heat transfer. Heat transfer by film wise and dropwise condensation in horizontal & vertical tube.

SECTION-B

- Unit IV** : Heat exchange equipments and their design, double pipe, parallel, counter current, shell and tube heat exchangers, condensers, fouling factors, concepts of transfer units in heat exchangers, NTU concept for heat exchangers.
- Unit V** : Boiling & Evaporators : Classification of types and field applications of evaporators single and multiple effect evaporators. Heat transfer through submerged coils, jacketted vessels.
- Unit VI** : Heat transfer by radiation, concept of black body, Kirchoff's law, Stefan's law, Black and gray body radiation, view factors luminous and non-luminous gases. Heat transfer in packed and fluidised beds. Recent developments in heat transfer.

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED :

- 1) Heat Transfer : Mc Adams
- 2) Heat Transfer : Sukhatme
- 3) Basic Heat Transfer : Necati Orisik, McGraw Hill Co., Kogakusha.
- 4) Heat Transfer : J.P.Hokman, McGraw Hill Co., Kogakusha.
- 5) Unit Operations of Chemical Engg. : McCab and Smith.
- 6) Introduction to Chemical Engg. : Bedger and Banchemo.
- 7) Chemical Engg. : Coulson & Richardson, Vol. I (ELBS, Pergamon Press, Latest Edition)
- 8) Heat Transfer : Gebhart, McGraw Hill, 2nd edition, Latest Edition
- 9) Fundamentals of Engg. : R.C.Sachdeva, Wiley Eastern.
- 10) Heat Transfer : R.C.Sachdeva.
- 11) Heat & Mass Transfer : S.D.Dawande, Central Techno Pub., Nagpur

**5CT 02 MECHANICAL OPERATIONS
SECTION - A**

- Unit I :** Relevance of mechanical operations in industry.
1. Size reduction, stages of reduction, Equipments operating variables, laws of energies, energy requirements.
2. Screening: Screen analysis, particle size distribution.
- Unit II :** 1. Classification: Equal falling particles, equipments, jigging, tabling.
2. Gravity settling, drag force, terminal settling velocity.
3. Sedimentation : Continuous thickeners.
- Unit III :** 1. Storage and handling of solids, transportation
2. Mixing, Mixers, agitation, types of equipments.

SECTION - B

- Unit IV :** 1. Filtration : Theory, operation, types, Flotation agents, flotation cells.
2. Filter Calculations, filtration equation for compressible and non-compressible cakes, specific cake resistance.
3. Filtration - Constant pressure and constant rate and their equipments.

- Unit V :** 1. Centrifuges: Theory, Equipments, types and calculations.
2. Cyclones: Hydrocyclones, liquid scrubbers and electronic precipitators.
- Unit VI :** 1. Adsorption, theory, type and application, Langmuir's Freundlich's equation, nature of adsorbents, industrial adsorbents.
2. Adsorption on fixed bed, fluidised beds. Adsorption equilibria calculations for vapour, gas & liquid adsorption. Adsorption, operation such as single stage, multi stage, cross current & multistage counter current operation & equipments.
3. Recent developments in mechanical operation equipments.

PRACTICALS: based on above syllabus.

BOOKS RECOMMENDED:

1. Momentum Transfer Operation: S.K.Gupta, TMC, Latest edition.
2. Unit Operations of Chemical Engineering: McCabe and Smith, TMC
3. Chemical Engineering Vol. I : Coulson & Richardson, Pergamon, Latest edition.
4. Principles of Unit Operations: A.S.Foust, et-al.
5. Unit Operations: C.G.Brown.
6. Introduction to Chemical Engg. : Beder & Bachero.
7. Mass Transfer Operations: R.E. Treybal
8. Mechanical Operations Vol-I : R.S.Hiremath & A.P.Kulkarni.

**5CT03 CHEMICAL ENGINEERING
THERMODYNAMICS**

SECTION-A

- Unit I :** Scope of thermodynamics and its importance to chemical Engineers, Basic concepts, extensive & intensive properties. state function & chemical systems. Definition, symbols & interrelation, concepts of Entropy, Enthalpy & internal energy. First law of thermodynamics, Equations of state, critical properties, Vander Wall's constants, Virial expansions, Redlich-Kwong equation, Beattie-Bridgeman equation.
- Unit II :** First law applied to thermodynamic processes & calculation of Workdone, free energy & heat changes. Maxwell relation equation, second law and third law of thermodynamics. Thermodynamics relations based on second law. Relation between C_p & C_v , compressibility factor & coefficient of thermal expansion, concept of residual entropy & entropy of equilibrium.

Unit III : Partial molar and apparent molar properties, Gibbs Duhem equation, Chemical potential, effect of temperature and pressure fugacity, excess thermodynamic properties and thermodynamic properties of mixing. Gibbs-Duhem-Morgules equation, Konovalov laws. Colligative properties. Ebulliometric constant. Determination of Molecular Weight of unknown chemical substances. Solubility law.

SECTION-B

Unit IV : Vapour liquid equilibrium, T-X-Y diagrams & X-Y diagram for ideal & non ideal system. Raoult's law and Henry's law. Deviations from Raoult's law. Comparison of ideal & non-ideal systems. Phase equilibria in non reaching multi-components, Binary, ternary systems. Graphical representation of L/L, L/S & G/S systems. Right angled triangular diagrams. Equilateral triangular diagrams, Janecke diagram, Effect of temp. & pressure on ternary equilibrium, Phenol-Wafer systems. auiline-water-chlorobenzene systems.

Unit V : Statistical thermodynamics, thermodynamics probability, its relation with Entropy, partition function and its relation with thermodynamics functions, the Boltzman distribution law, Distribution law for chemically reactive system. Thermodynamics charts & their uses. Searching of thermodynamics data.

Unit VI : Chemical Equilibrium, feasibility of chemical reaction, free energy change, Reaction co-ordinate, equilibrium constant, Effect of temp. & pressure, Relation between K_p , K_c & K_v , Le-Chatelier's principle, Endo-Exothermic relations, Heterogeneous equilibria, various methods of calculating free energy charge. Equilibrium conversions, case study of feasibility report for manufacture of industrial chemicals.

Practicals :- based on above syllabus.

Books Recommended :

- 1) An Introduction to Chemical Thermodynamics : R.P.Rastogi, R.R.Misra.
- 2) Chemical Engineering Process : Houghen-Watson.
- 3) Introduction to Chemical Engg. Thermodynamics : J.M.Smith, H.C.Vauhess
- 4) Thermodynamics for Chemical Engg. : H.C.Weber, J.P.Meissner
- 5) Engineering Thermodynamics : P.K.Nag.

6) Chemical Thermodynamic : M.R.Awode, Dattson, Nagpur.

SPECIAL TECHNOLOGY-II (RELATED TO CONCERNING TECHNOLOGY) 5FT04 (i) FOOD TECHNOLOGY-II BIO-CHEMISFRY AND NUTRITION

Organisation cell and cellular constituents. Introduction and classification of enzymes, specificity, enzymes Kinetics, activnetrs and inhibitors. Assay techniques, Isolation of enzymes from sources and their application.

Bio-energetics, Digestion and metabolism of carbohydrates, proteins and fats. Photosynthesis, Nucleic acids and their functions.

Vitamins: Classification, sources, Chemistry, functions and deficiency symptoms. Assay of vitamins.

Minerals: Macro and micro-minerals, sources, functions and efficiency symptoms.

Nutrition: Functions of foods Energy, value of foods. BMR and its measurement, Energy requirement of individuals. Recommended dietary allowances of proteins, fats, carbohydrates, vitamins and minerals. Nutritional evaluation of proteins. Factors influencing nutritive value of foods. Loss of nutrients during processing. Enrichment and fortification of foods. Formulation of diets and foods for specific needs.

Antinutritional Factors of Foods :

Toxic compounds, enzyme inhibitors, alkaloids etc.

Techniques of biochemical analysis like spectrophotometry Chromatography, electro-phoresis Light and electro microscopy. Histochemical techniques, isotopic methods.

Recent Advances in the field.

Books Recommended :

1. Outlines of Biochemistry by E.E.Conn & P.K.Stump, Wiley Eastern Pvt.Ltd., New Delhi.
2. Biochemistry of Foods by Eskin, N., A.M.Handerson, H.M. & Town End RJ., Academic Press, New York.
3. Cell Physiology by A.C.Giese, Sanders & Company, Toppan, Japan.
4. Integrated Biology by L.Hill, D.Bellamy, I Chester, Jones Chapman & Hall Ltd., London, EC4.
5. Principles of Enzymology for the Food Science by Whitaker J.R., Marcel Dekker, INC, New York.

6. Applied Nutrition by R.Rajalaxmi, Oxford & IBH Publishing Co., New York.
7. Heinz Handbook of Nutrition by Benjamin T. Burton, McGraw Hill . Book Company, New York.
8. Nutrition - An Integrated Approach by R.C.Pyke & M.L. Brown, Wiley Eastern Pvt.Ltd., New Delhi.
9. Hawk's Physiological Chemistry, Edited by Bernard L.Oser, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
10. Biochemistry: White A. Handler P., Smit E.L., McGraw Hill, Tokyo.
11. Text Book of Biochemistry : H.R.Mahler and E.H.Chordes, Harper & Row Publisher, New York.

SPECIAL TECHNOLOGY-II (PRACTICAL)- LAB

5FT10 FOOD TECHNOLOGY

A.BIOCHEMISTRY

1. Estimation of carbohydrates and proteins by various methods.
2. Estimation of minerals, Phosphorus, Iron, Calcium.
3. Estimation of vitamin C and effect of heat.
4. Qualitative demonstration of enzyme with salivary amylase.
5. Study of rate of enzyme reaction, effect of environmental factors on rate of enzyme action.
6. Detection of trypsin inhibitor.
7. Chromatographic separation of carbohydrates and aminoacids.
8. Simple histological studies on plant tissue.

B. MICROBIOLOGY

1. Preparation and sterilisation of nutrient media.
2. Cultivation and morphological study of common species of bacteria yeasts and moulds.
3. Isolation of pure culture from natural sources.
4. Immunelation of bacteria Haemoeytometer, standard plate count MBRT tests for milk.
5. Bacteriological analysis of water.
6. Microbial spoilage of various foods and effect of extrinsic and intrinsic factors on food spilage.

BOOKS RECOMMENDED:

1. Microbiological Methods, C.H.Collins & P.M. Lyme. Butterworth Co.Ltd., London.
2. Microbes in Action - A Laboratory Manual of Microbiology; H.W.Seeley (JR.) and P.J.Von. Denmark - Taraporewala I.,W. Pvt. Ltd., Bombay.
3. Introduction to Practical Biochemistry: D.T.Plummer, Tata McGraw Hill Co., New Dellii.

4. Hawk's Physiological Chemistry Edited by Bernard L.Oser, Tata McGraw Hill Pub. Co. Ltd., New Delhi.

SPECIAL TECHNOLOGY-II

5PT04 (ii) PULP & PAPER TECHNOLOGY TECHNOLOGY OF PULPING PROCESSES

Collection grading and storage of various raw material, wood preparation for pulping, units for measuring wood handling wood barking chipping. screening. chip. handling and storage. relationship between wood and quality.

Introduction to pulping. Fiber separation commercial processes. types of pulping processes. advances and trends in pulping.

Manufacture of mechanical pulp: Types. grades and uses of mechanical pulp stone ground wood process, types of grinders. theory of grinders. theory of grinding. variable in ground wood process, characteristics of groundwood pulp, pulp mill operations control, practice and testing methods, whole wood fiber manufacture. ground wood from pretreated wood, refiner mechanical pulping scheme, thermomechanical pulping.

Semichemical pulping and Semimechanical pulping; Neutral sulfite semichemical pulping, bisulfite semichemical pulping, craft semichemical pulping. cold soda semichemical pulping, hot sulfite chemomechanical semichemical pulp.

Sulfite pulping. Description of various sulfite processes, sulfite liquor preparation. variables in sulfite pulping. mechanics and kinetics of sulfite pulping. delignification, digestion in sulfite process. characteristics of sulfite pulp.

Alkaline pulping: General description of alkaline pulping process. alkaline digestion. chemical reactions during alkaline digestion. Variables in alkaline pulping process, digester operation. material and heat balance bamboo. reeds. hemp. jute, etc.

Recent advances in the field.

BOOKS RECOMMENDED :

1. Pulping processes by A.Rydholm. Interscience Pub., John Wiley & Sons Inc., New York. London. Sydney.
2. Pulp & Paper: Chemistry & Chemical Technology, 3rd Edn., Vol I by James P.Casey, John Wiley & Sons, New York.
3. Pulp and Paper Manufacture, 2nd Edn., Vol I by Ronald G.McDonald.
4. Pulp and Paper Science Technology. Vol. I by C.E.Libby. McGraw Hill Co.
5. Hand book of Pulp & Paper Technology. 2nd Edn.. by Bitt Van Nostrad. Reinhold Co.. New York, London.

SPECIAL TECHNOLOGY-II(PRACTICAL)-LAB**5PC10 PULP & PAPER TECHNOLOGY**

Analysis of fibrous materials; Pulp analysis: Determination of moisture ash content, permanganate number, copper number, kappa number of pulps 2, B, V, cellulose, solubility of pulp in alkali.

Analysis of non-fibrous materials: Analysis of black, green and white liquors, bleaching powder, soda ash, caustic soda, lime stone etc.

Books Recommended :

1. Technology of Textile Properties by M.A.Taylor,
2. Textile Analysis by S.K.
3. Identification of Textile Materials, 7th Edn., Textile Inc., Manchester,7.
4. Analytical methods for a Textile Lab., 2nd Edn., AATCC monog No.3 Research Triangle Park. North Carolina, Printed in U.sA
5. ISI Standards for Textile Testing
6. Textile Testing by Sinkale.

**5OT04 SPECIAL TECHNOLOGY-II
CHEMISTRY AND BIOCHEMISTRY OF FATS
(iii) (OIL & PAINT TECHNOLOGY)**

Techniques of separation of fats and fatty acids : Low temperature crystallization, esterification, urea adducts, counter distribution, chromatographic methods of separation with special reference to thin-layer chromatography and gas-liquid chromatography.

Methods for quantitative investigation on the component, fatty acids of natural fats and processed fats.

Lipase hydrolysis, X-ray diffraction and polymorphism of glycerides and other fatty acids and their derivatives. Dilatimetric measurements and their significance.

Infrared (IR), Ultraviolet (UV), Nuclear Magnetic Resonance (NMR) and mass spectroscopy for the analysis of fatty materials.

Reichert-Missel and Polanske and Krischner values. Advanced method of analysis of fats, fatty acids and glycerides. .

Chemical reactions pertaining to the manufacture of fatty acid derivatives including metal salts other than alkali metals.

Quantitative investigation of component triglycerides of natural fats. Theories of fatty acid distribution in natural fats. Effect of fatty acid distribution on the physical properties. Polymorphism of fats and fatty acids. Biosynthesis of fatty acids, phospholipids and triglycerides in plants and animals. Elongation and desaturation of acyl chains. Biological utilization of fats. Fat assimilation;

Essential fatty acids.

Recent advances in the field.

Books Recommended :

1. Industrial Oil and Fat Products: A.E.Bailey : Interscience Publishers, New York, Latest Edition.
2. Fatty Acids: K.S. Markley (5 Volumes), Interscience Publishers, New York, Edn., Latest Edition.
3. Structure and Utilization of Oil Seeds : J.G.Vaughon.
4. Melting and Solidification of Fats : A.E.Bailey, Interscience Publishers, New York, Latest Edition..
5. The Analysis of Fats and Oils: V.C.Mehlenbacher : The Garrard Press Champaign, Edn., Latest Edition..
6. Progress on the Chemistry of Fats and other Lipids: T.T.Homan, W.O. Lundberg and T.Malkia, Pergamon Press, New York, Latest Edition (7 Vols.)
7. The Chemical Constitution Natural Fats: Wiley Books Publishers, New York, Latest Edition..
8. Vegetable Fats and Oils: G.S.Jamiesan, Renhold Publishers, New York, Latest Edition..
9. Vegetable Fats and Oils: E. W.Eckey : Renhold Publishers, New York, Latest Edition..
10. Gas-Liquid Chromatography - Theory and Practice: S.Dal Nagore and R.S.Juvent; Interscience Publishers, New York, Latest Edition.
11. Lipid Chromatographic Analysis: C.V.Marinelt.
12. Fatty Acid Synthesis and Application: N.E.Bednareyk & W.L.Erickson.
13. The Lipids: H.D.DaueI : Interscience Publishers, New York, Latest Edition.
14. Analysis and Characterization of Oil, Fats Products : H.A.Bookenoogen.
15. Thin-layer Chromatography: Babbit.

SPECIAL TECHNOLOGY - II (PRACTICAL) - LAB**5OT10 OIL & PAINT TECHNOLOGY**

Analysis of nickel catalyst and acids oils, Preparation of mixed fatty acids and determination of composition. Analysis of commercial fatty acids. Preparation of pure fatty acids. Determination of mono, di and triglycerides. Analysis of soaps and detergents. Detection of Adulteration. Analysis of Oils by thin layer and column chromatography.

SPECIAL TECHNOLOGY-II**SPC04 (iv) PETRO CHEMICAL TECHNOLOGY-II****PETROLEUM REFINING TECHNOLOGY**

Petroleum refining industry in India, practice and prospectus : Commercial petroleum products, quality requirements. Indian specifications.

Testing methods and their significance: crude assay, refining processes, integration of these processes: typical refining schemes in India. Descriptive account of atmosphere, vacuum distillations, use of process steam, steam stripping vacuum producing systems etc.

Industrial practice of various conversion processes, such as catalytic cracking, hydro-cracking, cooking visbreaking, polymerization, alkylation, hydro-desulphurisation etc. and their role and place in Indian refineries.

Production of cube base stocks, solvent extraction, dewazing, finishing and blending; Finishing processes in a modern refinery.

Petroleum speciality products.

Descriptive account of various aspects of a refinery such as instrumentation and automatic control, refinery utilities off site facilities refinery layout, corrosion, safety, energy saving, environmental aspects etc; conservation of petroleum products, Techno-economic aspects of optimum refining schemes.

Recent Advances in the field.

Books Recommended :

1. Petroleum Refinery Engg., W.L. Nelson : Mc Graw Hill Kogakusha, 4th Edn., Latest Ed.
2. Modern Petroleum Technology, Applied Science. G.D.Hobson and W.Pol Publisher 4th Edn., Latest Ed.
3. Petroleum Processing, Principles and Applications, R.J. Hengatabes, McGraw Hill, Latest Ed.
4. Petroleum Refining, Technology and Economics: J.H.Gary and G.E., Hand-work, Merceidekker, New York, Latest Ed.
5. Petroleum Processing Handbook : W.E.Bland and P.L.Daviason. McGraw Hill, Latest Ed.
6. Petroleum Refinery Manual : M.M.Noel, Rinebold, New York, 1959.
7. V.B.Guthrie, Petroleum Products Handbook, McGraw Hill, 1960.

SPECIAL TECHNOLOGY-II (PRACTICAL)-LAB**SPC10 PETRO-CHEMICAL TECHNOLOGY-II**

Analysis and testing of petroleum and petroleum products.

ASTM distillation of motor gasoline, kerosene and high speed diesel, viscosity index. demulsification number and forming characteristics of lubricating oils; Existent gum in motor gasoline; oxidation tests for lubricating oils, oxidation stability of gasoline, water washout characteristics and roll stability of grease. Ductility of bitumen; Electric strength-transfoer oil, PONA analysis by FIA method, aniline point method liquid vapour pressure, Heat of combustion of liquid hydrocarbon fuels, calorific value of gases, mercaptan sulphur content, salt content, Sulphur by lamp and bomb methods, P, Ca and Cl lubricating oils, study of Vapour-Liquid equilibrium for binary systems using Othmer still study of ternary equilibrium systems and representation triangular diagrams.

5 FE CT05 FREE ELECTIVE -I**(2) ECONOMICS AND MANAGEMENT****SECTION-A**

- Unit I** : Nature and Scope of Economics, introduction to managerial economics.
Demand concepts : Demand specification, types of demand.
Demand analysis : law of diminishing utility, Consumer's surplus.
Demand forecasting : Concept of forecasting, types of forecasts (8)
- Unit II** : Production Concept, production function, Laws of return, scales of production, factors of production, production planning and control : Its meaning, essential factors for the success of production planning and control. (8)
- Unit III** : Meaning of Management, Principles of management, meaning and principles of scientific management, levels of management, delegation and authority, Organisation, forms of organisation. (8)

SECTION-B

- Unit IV** : Sources of Finance Banking and Credit structure in India : Financial institutions, promotional policies and programmes of industrialisation, functions of Commercial Banks, functions of Central Bank. (8)

- Unit V :** Economic and Social Environment : Brief idea about economic environment of business, socio-cultural environment, Health hazards of chemical industries, awareness about AIDS & other diseases.
Brief idea about economic recession & its effect.
Introduction to World Trade,
Globalisation, Liberton and their effects.
Introduction to Patenting & intelleatual property protection
(8)
- Unit VI :** Entrepreneur and Entrepreneurship :
Entrepreneurial competencies, institutional interface for small scale enterprises, opportunity scanning and identification.
Market assessment for SSE, choice of technology and selection of site, Ownership structure and organisational framework, preparation of business plan, main features of Indian factories act & minimum wage act.
Brief idea of Taxation in India. (8)

BOOKS RECOMMENDED :

- 1) Managerial Economics : K.K.Seo, Richard D. Irwin Inc.
- 2) Engineering Economics : J.L.Riggs, McGraw Hill, New York, Latest Edition.
- 3) Managerial Economics : Adhikary M., Khosla Pub. House, New Delhi.
- 4) Small Business Management Fundamentals : Dan Strenhoff and J.F.Burgess, McGraw Hill Book Company.
- 5) Effective Small Business Management : Richard M.Hodgills, Academic Press Incorporated, Harcourt, Brace Jovanovich.
- 6) Marketing Management for Small Units : Jain Vijay K., Management Publishing Co., Latest Edition.
- 7) Marketing Management :- Analysis, Planning, Implementation and Control : Kotler, Phillip, Prentice Hall of India Pvt. Ltd., Latest Edition.
- 8) Modern Economics Theory : K.K.Dewett.

5 CT06 COMMUNICATION SKILLS

- Unit I :** Comprehension over an unseen passage.
Comprehension - A - word study :-
Synonym, antonym, meanings, matching words, adjectives,

adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.

Comprehension - B - Structure study :-

Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc.

Active and passive forms, negative and interrogative, punctuation and capitalization. (10 Hours)

- Unit II :** Theoretical background - importance of communication, its process, model of communication its components & barriers.

Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content.

Non-verbal communication, types of graphics and pictorial devices. (10 Hours)

- Unit III :** Specific formats for written communication like - business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc.

Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews.

Methodology of conduction of meetings, seminars, symposia, conference and workshop. (10 Hours)

BOOKS RECOMMENDED :

- 1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
- 2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
- 3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Publication Pvt. Ltd.
- 4) F.Frank Candlin : General English for Technical Students, University of London Press Ltd.

5 CT 11 COMMUNICATION SKILLS LABORATORY**Objective :**

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language, actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation.

The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

TEXT BOOK : Norman Lewis : Word Power Made Easy

<http://www.teachingenglish.org.uk>

**SIXTH SEMESTER
FREE ELECTIVE-II**

6 FECT 05 (3) CHEMICAL TECHNOLOGY

Study of the following processes :

1. Nitration: Nitrating agents. Kinetics and mechanism of aromatic nitration. Thermodynamics of nitrations. Equipments for nitration. Mixed acids for nitration and typical industrial nitration processes e.g. preparation of nitrobenzene, chloronitronaphthalene and acetanilide.
2. Sulphonation and Sulfation : Sulphonation and sulfating agents: Kinetics, mechanism and thermodynamics. Industrial equipment and techniques. Technical preparation of sulphonates and sulphates. Sulphation of lauryl alcohol, dimethyl ether etc.
3. Hydrogenation: Catalytic Hydrogenation. Kinetics and thermodynamics of hydrogenation reactions. Apparatus and material of construction, hydrogenation of fatty oils. Synthesis of methanol. Hydroforming of naphtha. Hydrogenation of heavy oils.

4. Halogenation: Thermodynamics and Kinetics of halogen. Pathohalogenation. Equipment and design for halogenation. Technical preparation of halogen compounds e.g. allyl chloride. D.D.T...B.H.C....Chlorobenzene dichlorodifluoromethane. vinyl chloride etc.
5. Oxidation : Liquid and Vapour phase oxidation. kinetics and thermochemistry. apparatus for oxidation. Technical oxidation of isoeugenol. acetaldehyde. Cyclohexane Iso-propylbenzene. naphthalene refinery, electro-plating, tanning, coal mining and radio waste.
6. Wastewater Treatment : Classification of wastewater. Methods of treatment. sludge treatment and disposal. treatment of effluent water from textiles rayon. pulp. dairy, distillery Petroleum refinery, electro-plating, tanning, coal mining and radio active waste.
7. Water : Source of water. Impurities in water. Requirements of water by different industries. treatment of water for industrial and domestic purpose. boiler feed water treatment. reuse of water. Water conservation.
8. Industrial gases : CO, CO₂, CO, H₂, O₂, N₂, SO₂, C₂H₂ synthesis gas, rare gases : Helium nitrous oxides.
9. Industrial Acids : Sulphuric, Nitric and hydrochloric acid.
10. Marine Chemicals : Salt from sea water. by product of salt industry viz, Bromine and Iodine.
11. Fertilizers: Ammonia Nitrogenous of fertilizers. Phosphatic fertilizers. Potassic fertilizers. Compound and complex fertilizers. Miscellaneous fertilizers,
12. Electrolytic and Electro-chemical Industries: Chlorates, perchlorates. Primary and Secondary cells, artificial abrasives. Calcium carbide Refractory carbides. borides, silicides and nitrides.

BOOKS RECOMMENDED:

1. Unit Processes in Organic Synthesis by P.H.Groggins. Vth Edn.. International Students Edn.. McGraw Hill Co.
2. Chemical Technology - Vols I, II, III by D.Venkateswarlu, Chemical Engg. Education Development Centre. I.I.T. Madras, Latest Edition.
3. Chemical Process Industries by R. N. Sherve and J. A. Brink. McGraw Hill, Co., Latest Edition.
4. Chemical Technology in two parts. Edited by I.P.Mukhlyanov, Mir Publishers Moscow, Latest Edition.

6 CT01 PROCESS EQUIPMENT -DESIGN & DRAWING**SECTION-A**

- Unit I** : Material behaviour under stresses, theories of failures. (8)
- Unit II** : Fabrication methods and their effects : Design method for atmospheric storage vessels, unfired pressure vessel subjected to internal and external pressure. (8)
- Unit III** : Vessels for high pressure operations, Agitated vessels. Tail columns, internals of the reactors. (8)

SECTION-B

- Unit IV** : Design of process equipment accessories and support systems. (8)
- Unit V** : Complete design and preparation of working drawing for typical process equipment, such as large storage vessels, thick wall pressure vessels. Self supported tall columns, agitated pressure vessels with heat transfer requirements etc. (8)
- Unit VI** : Design and layout of piping system and preparation of piping diagram for a typical process. Material selection and piping coding. (8)

PRACTICALS : Based on the above syllabus.

BOOKS RECOMMENDED :

- 1) Process Equipment Design : I.E.Brownell, E.H.Young, John Wiley, Latest Edition.
- 2) Process Equipment Design : M.V.Joshi, McMillan, Latest Edition.
- 3) Introduction to Chemical Engg. Design, Mechanical Aspects
- 4) I.S.Code for Unfired Pressure : IS No. 2825 - 1969 pressure vessel.
- 5) Process Equipement Design & Drawing : S.D.Dawande.
- 6) International & Indian Standard codes for Piping.
- 7) Process Design of Equipments, 3rd Ed, S.D. Dawande, Vol I & II, Central Techno Pub., Nagpur

6 CT 03 INSTRUMENTATION & CONTROL**SECTION-A**

- Unit I** : Measuring Instruments : Qualities of measurement, elements of instrument, static & dynamic characteristics, measurements of temperature and levels.

- Unit II** : Measurement of pressure, vacuum, humidity & pH in process industry.
- Unit III** : Methods for composition analysis. Principle and techniques of instruments for composition analysis in process industry, such as chromatography, spectroscopy, refractrometry etc.

SECTION-B

- Unit IV** : Flow measuring instruments : Flow measuring devices for incompressible and compressible fluids. Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. Pneumatic actuators.
- Unit V** : Introduction to Simple system analysis : Laplace Transformation. Block diagrams, linearization. First and higher order system.
- Unit VI** : Frequency response, distributed parameter system, dead time.
Feed back control, servo and regulator control. Time domain closed loop responses, closed loop frequency response.

BOOKS RECOMMENDED :

- 1) Industrial Instrumentation : Eckman, Wiley Eastern
- 2) Instrumental Methods of Chemical Analysis : Erwing, McGraw Hill.
- 3) Instrumentation & Process Measurements : W.Bottom, Orient Longman.
- 4) Industrial Control & Instrumentation : W.Bottom, Orient Longman.
- 5) Outlines of Chemical Instrumentation & Process Control : A. Suryanarayan, Khanna Pub., New Delhi.
- 6) Donald R. Cougha Nowr : Process Systems Analysis and Control, McGraw Hill Pub., New York.
- 7) Vyas R.P. : Process Control and Instrumentation, Central Techno Pub., Nagpur.
- 8) Patranabis D. : Principles of Industrial Instrumentation, 2nd ed., Tata McGraw Hill Pub. Co., New Delhi.
- 9) Patranabis D. : Principles of Process Control, Tata McGraw Hill Pub. Co., New Delhi.
- 10) Gaikwad R.W., Misal S.A. : Process Dynamics & Control, Central Techno Pub., Nagpur.
- 11) Stephanopoulos G. : Chemical Process Control and Introduction to Theory & Practice, PHI, Latest Edition.
- 12) Considine D.N. : Process Instrumentation & Control Handbook, McGraw Hill.

6 FT04 SPECIAL TECHNOLOGY-III
(i) FOOD TECHNOLOGY-III
MICROBIOLOGY AND PRINCIPLES
OF FOOD PRESERVATION

Brief historical background, classification and terminology of micro-organisms. Study of morphology and physiology of bacteri-yeasts moulds and actinomycetes, introduction to viruses and bacteria. Methods of isolation, cultivation and enumeration of micro-organisms, Nutrition, reproduction and metabolism. Synchronised and balanced growth and continuous cultivation of microorganisms.

Control of microorganisms by physical and chemical methods, Sterilisation and disinfection, irradiation antibiotics, evaluation of antimicrobial agents, Microbiology of air, water and sewage. Immunological methods. Bacteriological analysis of foods, Role of microorganisms in food spoilage.

Principles of food preservation. Preservation of food by means of low temperature. Freezedrying thermal processing irradiation, dehydration chemicals antibiotics and C.A.storage. Sources and prevention of contamination. Food Production and Microbial toxins, Principles of a amitation in food technology and safety of foods. Fermented food like bread, cheese, yogurt, vinegar, alcohol, pickles.

Recent advances in the field.

BOOKS RECOMMENDED:

1. Food Microbiology: W.C.Frazier, Tata McGraw Hill Pub., Co., Bombay.
2. Microbiology: MJ.Pelkzar, Ried R.D., E.C.S.Chan, Tata McGraw Pub., Co. Ltd., New Delhi.
3. Fundamentals of Microbiology: M.Frobisher, W.B.Saunders Co., Philadelphia.
4. Microbiology: P.L.Carpenter, W.B.Saunders Co., Philadelphia.
5. Microbiological Methods: C.H.Collins & P.M.Lyne, Butterworth and Co., London.
6. Food Processing Operations: M.A.Goslyn & J.Hold, The AVI Pub. Co., INC, Westport.
7. Principles of Food Science, Vol. II : G.Borgestrom the MacMilan Co. Ltd., London.
8. Technology of Food Preservation: Destosier, Norman W., AVI Pub. Co., INC, London.
9. Practical Food Microbiology and Technology: H.H. Weiser, The AVI Pub. Co., Westport (Coun.)

SPECIAL TECHNOLOGY PAPER-III
6 PT 04 (ii) PULP & PAPER TECHNOLOGY
PULPING PROCESSES-II

Pulp Washing, Bleaching and Recovery of Spent Chemicals :
 Washing of Pulp : Delibration of sulphate pulp, brown stock washing, screening and clearing of sulphate pulp, washing of sulphite pulp, screening and clearing of sulphite pulp, screening and clearing of other pulps.

Recovery of spent chemical : Liquor recovery in alkaline pulping, evaporation of kraft liquors, recovery furnace, recausticizing treatment to digester and evaporator condensates, recovery of alkalining sulphate, turpentine, tall oil and other alkaline pulping by products.

Recovery process in sulfite pulping, Calcium, Magnesium, Amonia and Sodium bases recovery, other sulfitex recovery methods, recovery of by-products from sulfite process, whole spent liquor and ligoo sulfonates. Vaniline and alcohol from sulfite spent liquor, fermentation of sulfite spent liquor to produce proteins.

Bleaching: History of Bleaching, bleaching of mechanical pulps, semichemical pulps, chemi-mechanical and chemical pulps, multistage bleaching, control procedures in bleaching process, colour reversion of bleaching pulps, environmental aspects of Bleaching chemicals.

Recent advances in the field.

Books Recommended:

1. Pulping Processes by S.A.Rydholm.
2. Pulp & Paper : Chemistry and Chemical Technology, 3rd Edn., Vol. I by James P.Casay
3. Pulp & Paper Manufacture, 2nd Edn., Vol.-I by R.P.Mc Donald.
4. Hand Book of Pulp & Paper Technology, 2nd Edn., by K. W. Britt.

6CT02 COMPUTER PROGRAMMING AND APPLICATIONS

Note : Application of the following techniques for problems of interest in chemical engineering, writing and testing of programs written in C Language.

SECTION-A

- Unit I** : Numerical solution of first order differential equations with initial condition, Euler's method, Runge-Kutta method.
- Unit II** : Systems of linear equations, solution by the method of determinants, matrix inversion for the solution of linear equations, Gauss elimination method.
- Unit III** : Roots of algebraic and transcendental equation, iteration methods, Regula-Falsi method, Newton-Raphson method, roots of simultaneous and solution set of transcendental

and algebraic equations. Development of equations for heat transfer, fluid mechanics and reaction engineering problems.

SECTION-B

Unit IV : Regression analysis - Least Square, error approach, approximation by Chebychev orthogonal polynomial.

Unit V : Elements of optimization techniques, single variable function, optimization-direct search, with and without acceleration, method of regular intervals and fibonacci search method, gradient methods.

Unit VI : Computer programming in modular form, use of sub-routine libraries, Block diagrams of preliminary aids in programming, capacity optimization.

PRACTICALS : Based on above theory.

TEXT BOOK : Digital Computation for Chemical Engineering by Leon Lapidis, McGraw Hill, Latest Edition.

6 OT 04 SPECIAL TECHNOLOGY-III (iii) OIL & PAINT TECHNOLOGY OF OIL BEARING MATERIALS

Domestic and World production of oil seeds and oils, storage, sampling, Grading of oil seeds and oils. Pre-Extraction treatments of oil seeds. Mechanical expression, solvent extraction and other methods of recovery of oils and fats. Economic aspects of these processes, processes and plants employed for refining, bleaching, deodorisation and hydrogenation of oils and fats.

Manufacture of butter, Ghee, margarine, vanaspati and confectionary fats. Transesterified oils, fats, winterization of oils. Manufacture and evaluation of ancillary materials such as activated earths, activated carbons, nickel catalyst for hydrogenation. Cooking and salad oils, plastic shortening agents.

Environmental aspects in Oils seeds and oil processing units. Effective control according to Indian Standard specification.

Non Glyceride Constituents, general method of upgrading and utilization of oils and fats, oil-cakes and other products. Synthetic fatty acids and glycerides. Recent advances in the field.

BOOKS RECOMMENDED :

1. Cottonseed and Cottonseed Products : A.B.Bailey, Interscience Publishers, New York, Latest Edition.
2. Industrial Oil and Fat Products: A.E.Bailey, Interscience Publishers, New York, Latest Edition.

3. Soyabeans and Soyabean Products: K.B.NarkIev, Interscience Publishers, New York, Latest Edition.
4. Hydrogenation of Fatty Oilseeds : Waterman, Lquosevier Publishers, New York, Latest Edition.
5. Fatty Acids: K.S.Markely (5 Vols.), Interscience Publishers, New York.
6. Continuous Processing of Fats : M.K.Schwitzer, Latest Edition.
7. Refining of Oils and Fats for Edible Purposes: A.J.C. Anderson, Academic Press, New York.
8. Vanaspati Industry: G.S.Hattangadi
9. Practical Treaties on Vegetable Ghee Manufacture: Varma & Jaidev.
10. Solvent extraction of Vegetable Oils: H.Y.Parkb.
11. Refining and Technology of Oils and Fats: T.N.Mahatte, Small Business Publication, New Delhi.
12. Food Oils and their Uses: T.J.Weiss, Latest Edition.
13. Bleaching Earths: M.K.H.Siddiqui, Latest Edition.
14. Progress in the Chemistry of Fats and other Liquids: R.T.Holman, M.O.Luadberg & T.Malkin, Pergamon Press, New York (7Vols.)
15. Vegatable Fats and Oils: E. W.Eckay, Rinehold Publishers, New York, Latest Edition.
16. The Chemistry, Flavouring and Manufacture in Chocolate, Confectionary and Cocoa: H.PJenson, Blackiston Publishers, Philadelphia, Latest Edition.
17. The Butter Industry: O.F.Huzoker, Latest Edition.
18. Margarine: A.J.C.Anderson, Academic Press, New York, Latest Edition.

SPECIAL TECHNOLOGY-III

6 PC04 (iv) PETROCHEMICAL TECHNOLOGY-III PETROLEUM REFINERY ENGINEERING CALCULATIONS

ASTM, TBP, EFV distillation curves, computation of the curves from any one type by methods such as those of Nelson, Simister etc. Computation of various properties of petroleum fractions such as VABP, MABP, thermophysical properties from refinery engineering chart. Phase behaviour of multicomponent hydrocarbon systems retrograde phenomena, K values and their estimate for complex mixtures K values correlations; Flash equilibrium calculation for multi component system by method of successive approximations and simple methods such as that of McHenry; Calculation of bubble and dew points for complex mixtures, construction of phase diagram, successive flash for complex mixtures, multicomponent fractionation.

Separation criteria in crude oil fractionation, comparison with the simplest light hydrocarbon fractionation. Watkins method of covering crude TBP to product TBP curve, concept of overflash.

Energy balance in a topping tower, types of reflexes and calculations involved, estimation of top side draw bottom and stripper temperatures. Brief account of topping tower design procedures: according to Nelson, Watkins, Van Winkle (psudeo component design method), tray design.

Entrainers and solvents for hydrocarbon separation by azeotropic and extractive distillations. Types of pipe still heaters, calculation of radiant absorption rates, Wilson Lobo, Hetel equation, Labo Evans method piple still design.

Problems illustrating the use of solvent extraction, absorption and stripping in refinery operations and natural and refinery gas processing; multicomponent absorbers and strippers, calculation by Kremser-Brown absorption factor procedure.

Heat exchangers in refinery design and operational problems, fluid mechanics and refinery applications. Use of combustion charts.

Recent advances in the field.

(The subject has to be covered entirely by Numerical)

Books Recommended:

1. Petroleum Refinery Engineering : W.L.Nelson, McGraw Hill, Kogakusha, 4th Edn., Latest Edition.
2. Petroleum Refinery Distillation: R.N. Watkins, Gulf Pub. Co., Texas, Latest Edition.
3. Data Book on Hydrocarbons: J.B.Maxwall, K.E.Kriegar Pub. Co., New York, Latest Edition.
4. Distillation: M. Van Winkle, McGraw Hill, Latest Edition.
5. Handbook of Natural Gas Engineering: D.L.Katz & Others, McGraw Hill, Latest Edition.
6. Applied Hydrocarbon Thermodynamics: W.C.Edmister, Gulf Pub. Co., Latest Edition, Vol. I & II.
7. Surface Operations in Petroleum Production: G.Y.Chilingar & C.M.Beeson, Elsevier, New York, Latest Edition.
8. Petroleum Processing Handbook: W.F.Bland & R.L.Davidson, McGraw Hill, Latest Edition.
9. Chemical Engg. : J.M.Coulson and J.F.Richardson, Pergamon Press 3rd Edn., Vols. I & II, Latest Edition.
10. Equipment Design Handbook for Refineries and Chemical Plants: Frank L.Evans, Jr., Gulf Pub. Co., Houston, Texas, Latest Edition.

6 CT 09 MINOR PROJECT

Students are required to prepare and submit report on mini project on Software Development / Market Survey / Design / Fabrication / Site Visit / Some Experimental Investigation / Validation in the relevant field under the guidance of teacher.

FOUR YEAR DEGREE COURSE IN BACHELOR OF TEXTILE ENGINEERING SEMESTER - V (CREDIT & GRADE SYSTEM)

5TX01 YARN MANUFACTURING-III

Section- A

Unit I : Speed Frame- History of development, object, construction & working of speed frame. Top arm drafting system, Construction Flyer, Spindle and presser for twisting & winding operation. Objects, construction and working of Differential Mechanism and Building Mechanism. Various Parameters affecting roving quality and production. Gearing and production calculations of speed frame. Faults in roving. Features of modern speed frame.

Unit-II : Ring Frame- Object, construction & working of ringframe, Details of Creel, Drafting system, Balloon control ring, lappet, Travelers, Rings, Aprons, top roller cots, spacers of ringframe. Compact Spinning- Introduction, Pneumatic compact spinning, Magnetic compact spinning, yarn properties of compact yarn. Comparison of normal ring and compact yarn.

Unit-III : Ring Frame - Spinning Geometry- Spinning Angle, Spinning triangle, Angle of Wrap. Formation of twist and its effects. Ring and traveler combination effect. Change places in ring frame. Gearing & Building Mechanism of ring frame. Building of cops, Types of spindles, Spindle drives. Draft and production calculation. Development in Ring Spinning.

Section - B

Unit-IV : Ring Frame- Drafting, types of drafting system, types of draft. Drafting force, Roller slip, Floating fibres, Drafting waves, Drafting capacity. Different Weighing methods, its advantages & limitation, Factors affecting on roller setting and drafting performance. End Breakages-Causes, Effect & Control. High speed drafting in ring spinning. Hairiness –causes control and effect. Yarn Faults- causes, effects and control.

Unit-V : Doubling- Object of doubling, twist and twist direction effects, Tension effects, Balanced and unbalanced yarn, Properties of folded yarn, Doubling methods –dry, wet, Doubling machine – Ring doubler, Up twister, Two stage twisting machine, Two For One twister and Three for One twister, Comparison of doubling machines. Fancy yarns- Introduction, types. Method of production, yarn properties, end uses.

Unit-VI : Blending- Object of blending, Type of Blending ,Measures & selection of blend constitutes. Mechanism of blending. Blend Ratio, it's effect on yarn properties. Blend Irregularities, Modern blending machines.

Reference Books:

1. Short Staple Spinning –W.Klein
2. Cotton Spinning-William Taggart
3. Cotton Spinning-Gillbert R. Merill
4. Manual of cotton spinning –Butter Worth Series
5. Essentials calculations of Practical Cotton Spinning – Pattabhiram
6. Spinning of Manmade fibres and Blends on Cotton System- K.R.Salhotra
7. Practical Cotton Spinning – Pattabhiram
8. Spun Yarn Technology-Subramaniam
9. Ring Spinning- Dr. A.R. Khare

5TX02 FABRIC MANUFACTURING-III

Section -A

Unit I : Knitting: - Introduction, Woven and Knitted fabric comparison, general terms and principles of knitting technology, basic mechanical principles of knitting technology, elements of knitted loop structure, stitches produced by varying the sequence of the needle loop intermeshing, type of knitting .

Unit II : Weft knitting- Comparison of weft knitted and woven fabrics. Weft knit structures:- classification, technical terms, symbolic representation, anatomy of loop-stitch, cross-over points and configuration, laddering effect, characteristics of single jersey of plain structure, rib-knit structure, interlock-knit purl-knit. Weft knitting machines- plain knit, circular rib, circular interlock, purl. Float and tuck stitches- structure, effect of float and tuck structure.

Unit III : Warp knitting- Comparison of warp knitted and woven fabrics. Basic warp knitting principle- Construction of warp knitted fabrics, warp beams, guide bar. Warp knit structure:- classification, technical terms, symbolic representation, underlap and overlap, closed lap and open lap stitches. Warp knitting machine- classification, knitting elements and cycle on tricot machine, compound needle elements and its knitting cycle, difference between Tricot and Raschel machine.

Section - B

Unit IV : Nonwovens - History, definition, characteristics features and properties of nonwoven fabric, Comparison of nonwoven and

woven fabrics, differences in geometrical arrangement of fabrics in web, binding element and bonding structure. Classification of nonwoven fabrics by Albercht, by Krema and Meyer, by DIN standards, by their structure.

Unit V : Raw material for nonwoven production, function of fibre in nonwoven fabrics, effect of fibre properties on properties of nonwoven fabrics, application of industrial fibre in production of nonwoven, special fibre for nonwoven production, Brief overview of fibre preparation for nonwoven web formation. Different web formation technologies: - Airlaid web formation, Airlaying technology and Wet-laid web formation.

Unit-VI : Bonding technologies: - Mechanical bonding- needle punching, hydroentanglement, stitch bonding. Thermal bonding- contact, air and impingement, radiation/infra-red and ultrasonic. Chemical bonding- mechanism, method and drying, Fabrics for specific end use,

Reference Books :

1. Knitting technology by Ajgaonkar
2. Mannual nonwovens by Radko Kerma
3. nonwoven manufacture by Bannerjee

5TX03 TEXTILE TESTING –I

Section- A

Unit- I : Introduction & Objects Of Testing. Tested Quality Schemes Like Wool Mark, ISI Mark.Introduction to Standards like ASTM, ISO, etc. Element of Statistics: Frequency Distribution Graphical Presentation Of Data, Measures of Location Like Mean, Mode, Median, Quartiles, Percentiles. Calculation Methods Measures Of Dispersion: Range, Quartile Deviation, Percentage Mean Deviation, Standard Deviation, CV%, Variance. Comparison of frequency distributions, Normal distribution.

Unit -II : Population values & sample values, Sampling Distribution, Standard Error, significance testing of mean & s. d., Level of confidence. Number of tests to be carried out, ANOVA (one way & two way) Quality Control Charts, X -chart, R-chart. Binomial & Poisson distribution, Correlation & Regression analysis.

Unit -III : Selection of sample for testing, Random sample, Biased sample, length & extent biased sample, sampling for raw cotton testing, Terms used in sampling, Fibre sampling from combed slivers, roving and yarns, Yarn sampling, fabric sampling.Moisture relations:

Introduction, Moisture Regain & content, measurement of atmospheric condition, regain- humidity relations & hysteresis. Absorption & desorption curves, effect of regain on fibre properties, Measurement of regain.

Section- B

Unit -IV : Fibre length measurement, Methods, Fibre sorter, Shirley Comb sorter, Analysis of Sorter diagrams, Uster staple diagram apparatus, Shirley photoelectric stapler, Fibrograph, Digital Fibrograph. Fibre fineness: Definition, Technical significance, principles of measurements. Gravimetric methods, optical methods. Microscopic methods, air flow methods, vibration methods, micronaire value, The Sheffield micronaire.

Unit -V : Maturity of Cotton : Introduction, Maturity ratio, Maturity Coefficient, Std. fibre wt. per cm., Determination of fibre maturity: NaOH Method, Dye Method, Air Flow Method, Polarized Light Method, Trash content: Measurement. Shirley analyzer, Cotton Colour, cotton grading. High volume instrument. Miscellaneous fibre properties: Friction & Cohesiveness, Cleanability static electricity compressibility & resilience, AFIS Tester.

Unit -VI : Yarn Dimension: Count, Direct & Indirect system of yarn numbering, Count Conversion, folded yarns, Measurement of Count, different methods, Yarn diameter. Twist: Introduction, Twist angle. Effect of twist on yarn & fabric properties, measurement of twist by different methods.

Reference Books :

1. Principles of Textile Testing: J. E. Booth
2. Textile Testing: Grover & Hamby
3. Physical Testing of Textiles: B. P. Saville
4. Textile Statistic: GAV Leaf

5TX04 TEXTILE COSTING AND ECONOMICS

Section- A

Unit- I : Costing: Meaning and various methods of costing, elements of cost, prime cost, over- head, factory cost, selling & distribution overhead, total cost, concept of BEP: Fixed cost, Variable cost.

Unit- II : Raw material purchase procedure, issue of material, bin cards, store ledger, material requisition slip, material transfer and

return slip, different basis of pricing of issued raw material (FIFO, LIFO, HIFO & Average)

Unit- III : Inventory: importance and meaning, consideration for fixing maximum and minimum stock to be maintained. Annual stock taking and perpetual inventory, ABC system of inventory control, Economic order quantity.

Section- B

Unit- IV : Economics: definition & scope, characteristics and classification of wants. Meaning of demand, law of demand. Supply, Law of supply. Price elasticity of demand, factors affecting elasticity of demand, demand supply interaction.

Unit- V : Type of markets: perfect market, imperfect market (monopoly, oligopoly, etc) money function, price level, inflation.

Unit- VI : Banking: commercial bank, function of commercial bank. Central Bank, function of central Bank. National income: definition, measurement of National Income, difficulties in measurement of National Income. International trade. Taxation: Direct and Indirect Taxes.

Assignments :

- 1) Determination of cost of yarn/kg.
- 2) Moisture content in relation to cost.
- 3) Cost calculation for standard fabrics.

Reference Books :

1. Elementary Economic Theory by K. K. Deweet and J D Verma
2. Cost Accounting by B. K. Bhar
3. Industrials Engineering and Management by O. P. Khanna

FREE ELECTIVE

5 FE TX 05 (i) TECHNICAL TEXTILES

Section- A

Unit-I : Introduction: Definition and scope, Classification of technical textiles, Brief idea about technical fibres, Role of yarn and fabric construction, Composite material. Growth of industrial textiles, Engineering textile structures for industrial purposes. Difference with non-industrial textiles.

Unit -II : Filtration textiles: Definition of filtration parameters, Filtration requirements, Role of fiber, Fabric construction and finishing treatments, Dust filtration - general, Protective masks and high temperature filtration- purification and separation of

gases - Cigarette filters - liquid filtration - solid liquid filtration, liquid - liquid separation - Textiles used for the above applications and their features.

Unit -III : Geotextiles: Definition of geo textiles - Basic functions of geo textiles, Brief idea about geosynthetics and their uses, Essential properties of geotextiles, Geotextile requirements for separation, filtration, drainage, reinforcement, protection and waterproofing - geo textiles in temporary and permanent road construction railway stabilisation -Fibre used and fabrics for above application. Geotextile testing and evaluation, application examples of geotextiles.

Section –B

Unit -IV : Medical textiles: Classification of medical textiles, Description of different medical textiles, Material used in bio-textiles; Non-implantations textiles; Textiles for extra-corporeal, Antimicrobial textiles - suture thread natural and synthetic - different types used - PTFE suture, used for cardio vascular textiles - woven, knitted - requirements of artificial blood vessels. Details of textiles used for vascular and hernia surgery - other uses in this surgery.

Unit -V : Protective Clothing: Brief idea about different type of protective clothing, functional requirement of textiles in defence including ballistic protection materials and parachute cloth, temperature and flame retardant clothing, chemical protective clothing, water proof breathable fabrics. Textiles in protective clothing: introduction, protection against heat, impact and others for safety. Fabrics in defence system and weapons; other applications. Automotive Textiles: Application of textiles in automobiles, requirement and design for different tyres, airbags and belts, methods of production and properties of textiles used in these applications.

Unit -VI : Sewing threads, cords and ropes: Types, method of production and applications, functional requirements, structure and properties. Sports and recreation textiles: Functional requirement of different type of product and their construction. Textiles in miscellaneous industrial applications: Introduction, paper makers felt, bearing and sealing materials, sound insulation, battery separators, electrical insulation textiles reinforced products; Transports bags and sheets; Fabrics to control oil spills; Canvas cover and tarpaulins.

Reference Books :

1. “Handbook of Technical Textiles”, Ed. A R Horrocks and S C Anand, Woodhead Publication Ltd., Cambridge, 2000.
2. “Wellington Sears Handbook of Industrial Textiles”, Ed. Sabit Adanaur, Technimic Publishing Company, Inc., Pennsylvania, USA, 1995.
3. “Engineering with Geosynthetics”, Ed. G V Rao and G V S Raju, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.
4. “Industrial Textile”, Ed., J Svedova, Elsevier, New York, 1990.
5. “Modern Textile Characterization Methods”, Ed. M Raheel, Marcel Dekker, Inc., 1996.
6. Mukhopadhyay S K and Partridge J F, “Automotive Textiles”, Vol. 29, No. ½, Textile Institute, 1999.
7. Sewing Threads’ (Textile Progress, Vol. 30, No. 3/4, 2000) J. O. Ukponmwan, A. Mukhopadhyay & K. N. Chatterjee, Textile Institute, Manchester, UK, ISBN 1 870372387.
8. Medical Textiles-International Conference on Medical Textiles,Bolton,Woodhed Publication,Cambridge,1997
9. John,N.W.M”Geotextile”Blackie publication,Glasgow,1987
10. Industrial Textiles – Horrocks

FREE ELECTIVE

5 FE TX 05 (ii) FASHION AND CLOTHING SCIENCE

Section- A

Unit –I : Fashion Concept: Principles of fashion, Fashion cycle, Theories of fashion leadership, Changes in fashion, Fashion terminology for merchandising.Fashion Promotion: Fashion Promotion, factors influencing fashion promotion, Publicity, fashion show, Personal selling and communication process.

Unit –II : Fashion Marketing: Marketing concepts, fashion marketing, role of fashion marketer, market segmentation, Fashion marketing planning, Mass marketing, Marketing management, Franchising and goal of merchandiser and pricing policies.

Unit III : Fashion Buying: Interpreting customer demand, Developing fashion images, Analyzing and selection of resources. Buying in domestic & foreign market.Consumer Behavior: Psychological, Social, Economical, Practical, Family Background and other.

Section- B

Unit IV : Faric Properties: - Fabric Properties for woven and knit clothing: concept, significance importance and evaluation of dimensional stability, serviceability, drape, pilling, abrasion, crease, thickness, surface property and texture, Low stress

mechanical properties, Comfort and Handle properties, Moisture transmission properties. Finishes used to improve these properties.

Unit-V: Properties of Garment:- Comfort properties of garment, Permeability to Air, Moisture, and Light. Water Absorbency, wicking and retention properties. Quality parameters for assessing sew ability, seam strength, seam pucker, seam slippage Needle cutting and seam appearance. Tailor ability, Formability and factors affecting Tailor ability, Formability.

Unit VI : Clothing care Detergents: - Classification and function of soap and detergents. Composition of commercial detergents. Properties and application of various laundry agents like bleaching, optical, whitening agents, stiffeners, softeners, Stain removal: - Nature and classification of stains, principle and classification of stain removals, common stain and their removal.

Reference Books:

1. Concept of Consumer, Stephen Fringes, Fairchild Publication.
2. Fashion Merchandising, Stephen Fringes, Stone & samples publisher.
3. Creative fashion presentation, Polly Guerin, Stone & samples publisher.
4. Fashion Marketing, Easey, Stone & samples publisher.
5. Fashion Advertising and Promotion, Winter & Standlay Goodman, Stone & samples publisher.
6. Physical Testing of Textile, Saville
 - 5 TX 06 Minor Project
 - 5 TX 07 Yarn Manufacturing-III - Lab
 - 10 to 12 Practicals based on syllabus of 5 TX 01
 - 5 TX 08 Fabric Manufacturing -III - Lab
 - 10 to 12 Practicals based on syllabus of 5 TX 02
 - 5 TX 09 Textile Testing -I - Lab
 - 10 to 12 Practicals based on syllabus of 5 TX 03

SIXTH SEMESTER

6 TX 01 FABRIC STRUCTURE

Section-A

Unit-I: Methods of fabric representation; repeat of weave; drafts; lifting plan; construction of weave from a given draft and lifting plan; construction of draft from a given lifting plan and weave. Plain weave; twill weaves; satin and sateen weaves; irregular sateen and satins & their derivatives. Weaves constructed on plain base, Weaves constructed on twill bases; Weaves constructed on satin or sateen bases:

Unit -II : Diamonds (even no & odd no); and diaper designs; honey comb (ordinary & Brighton), huck-a-back; mock leno; Stripe and check weave combination: Welts and piques: Ordinary, wadded, fast back welts; piques; idea of loose back, half fast back and fast back fabrics.

Unit- III: Light & pigment theory of colour, Elements of colour; simple colour and weave effects; construction of line effects; Hound's tooth pattern; Bird's eye & spot effects; Hairline effects; step pattern; idea of compound color and weave effects

Section- B

Unit- IV : Bedford cords- plain face, wadded, crepon, twill face Bedford cords. Backed cloth: Warp backed cloth; weft backed cloth; backed cloth with wadding threads; warp and weft wadded cloths; reversible backed cloths. Classifications of double cloth construction; concept of self stitched; stitched by thread interchange; stitch by cloth interchange; centre stitched.

Unit -V : Leno structure: Principles of leno structures; methods of producing leno and idea of simple constructions, Weft-pile introduction; concept of simple constructions; Jacquard design, Card cutting machine, types of card cutting

Unit-VI: Terry pile introduction; formation of pile; simple terry weaves; idea of a terry pile forming mechanism. Tapestry structures: Introduction; idea of simple weft faced structures; carpet structures Different types of selvages and their applications, Multi-axial fabrics: Introduction; weave.

Reference Books :

1. Grammar of Textile Design: Nisbet
2. Fabric Design: Blinov
3. Textile Design and Colour: Watson
4. Advanced Textile Design & colour: Watson
5. NCUTE- Woven fabric

6 TX 02 ADVANCE YARN MANUFACTURING TECHNOLOGY

Section -A

Unit -I : Blowroom- Modern Mixers – Introduction, Principles, Construction , working, features – multimixer MPM, Aeromixer, unimix. etc. Modern Opener/Blenders/Cleaners - Blendomat BDT, Unifloc., Cleanomat System, ERM Cleaner, Striker Cleaner, Flock Feeder, Tuft Blender, Blender Feeder, Aero feed system. Modern opening, Cleaning, Blending machine

Unit-II: Carding- Aerodynamic Card- Introduction, construction, working and limitation. Suction Cleaning in card, Chute Feed System. Autolevelling- Introduction, Principle, Types of control system-Closed loop, Open Loop, mix loop control system. Card mastertops, maxiclean card. Granular Card, Small Card & other developments of Card.

Unit-III: Carding-Development in L-in Region- Unidirectional Feed, Conventional Feed System, Multiple licker-in Deflector plate. Fibre Retriever. Intrigated grinding System, On-line neps monitoring system. Features of Modern high production Cards-DK803,DK903, C-51.

Section-B

Unit-IV: Rotor Spinning- Introduction, Principle, Stages in yarn production, Advantages and Limitation of Ring spinning & Rotor Spinning Construction & Working of Rotor Spinning machine. Different types Groove & Naval. Process Parameters and its effects on yarn properties. Yarn Structure- core/sheath. Properties of Rotor Spun Yarn, Application. Comparison of Rotor & Ring Spun Yarn. Developments in Rotor Spinning.

Unit-V : Air jet Spinning, Air Vortex, Friction Spinning- Friction Spinning- Introduction, Principle, Stages in yarn production, Advantages and Limitation of Friction Spinning. Construction & Working of Friction Spinning machine- DREF-1, DREF-2, DREF-3, DREF-4, DREF-2000 ,3000. Process Parameters and its effects on yarn properties. Yarn Structure- core/sheath. Properties of Friction Spun Yarn, Application. Recent developments in Friction Spinning. Air jet Spinning - Introduction, Principle, Stages in yarn production,Construction & Working of Air Jet Spinning machine- MJS801H, MJS801, Yarn Structure, Properties of Air jet Yarn, Application. Air Vortex Spinning- Introduction, Principle, Stages in yarn production, Construction & Working of Air vortex Spinning machine, Yarn Structure, Properties of Air vortex Yarn, Application.

Unit-VI : Other Spinning Techniques- Wrap Spinning, Electrostatic Spinning, Ply Fil Spinning, Siro Spinning – Principle, construction, working, Yarn Structure & Properties of yarn. Woollen and Worsted spinning– Principle, construction, working, Yarn Structure & Properties of yarn. 1) Twist less yarns 2) Self Twist yarns 3) Network Yarns 4) Core Spun yarns.

Reference Books :

- 1) New Spinning System–W.Klein
- 2) New Spinning System- R.V.Gowda
- 3) Spun Yarn Technology-Oxtoby
- 4) Spun Yarn Technology, Vol-I-Subramaniam
- 5) Spun Yarn Technology, Vol-II-Subramaniam

6TX03 TEXTILE TESTING-II

Section-A

Unit -I : Hairiness of yarn measurement. Shirley yarn hairiness tester, Zweigle G 565, Uster tester-3 hairiness meter attachment. Yarn bulk. Textured filament yarns: testing of textured yarns. Friction: Coil friction & its measurement.

Unit -II : Types of tensile testing machines: CRL, CRE & CRT principle, pendulum lever principle with CRT, Stelometer, The balance principle, The Pressley fibre strength tester, loading by springs, inclined plane principle. Ballistic Tester, Electronic dynamometer strain gauge transducer, Instron, Tenso-jet.

Unit -III: Tensile Testing : Terminology & definitions load elongation curves, stress strain curve, initial young modulus, yield point, work of rupture, work factor, elastic recovery, instantaneous & time dependent effects, creep, factors affecting tensile properties of textiles. fibre strength testing, yarn strength testing, fabric strength testing

Section-B

Unit -IV : Evenness Testing: Introduction, nature of irregularity. Index of irregularity, variance length curves, methods of measurement & assessment of irregularity of sliver, roving & yarn. Clasimat yarn fault test.

Unit -V : Electronic capacitance tester, photoelectric testers. The cause and effect of irregularity, interpretation of results of irregularity tests, determination of periodic variation. Spectrograph, Uster yarn standards, Location of sources of periodic faults.

Unit VI: Fabric Dimension: Length, Width, Thickness, their measurement, Fabric weight, ends & picks per inch, crimp of yarn in fabric, crimp & fabric properties, measurement of crimp, cloth cover & fabric geometry.

Reference Books :

- 1) Principle of Textile Testing-I.E. Booth
- 2) Physical Testing of Textiles - B. P. Saville
- 3) Textile Testing - Grover & Hamby.

6 TX 04 APPAREL MERCHANDISING**Section-A**

Unit-I: Organization of the Apparel Business- Introduction to Apparel Industry, organization of the apparel industry, types of exporters, Business concepts applied to the Apparel industry- International trade.

Unit-II: Marketing- Functional organization of an apparel firm. Responsibilities of a marketing division- marketing objectives and strategies- marketing research -types of markets: Retailers and wholesale strategies for merchandise Distribution - retailers – sourcing flows and practices. Marketing plan. Labeling and licensing.

Unit-III : Merchandising- Definition of merchandising - functions of merchandising division - Role and responsibilities of merchandiser-different types of buyers- Communications with the buyers- awareness of current market trends- product development- line planning line presentation.

Section-B

Unit IV: Sourcing- Need for sourcing - sourcing materials- manufacturing resources planning principles of MRP- Overseas sourcing- sourcing strategies. Supply chain and demand chain analysis - Materials management for quick response -JIT technology.

Unit-V: Documentation-Order confirmation, various types of export documents, pre-shipment post- shipment documentation. Terms of sale, payment, shipment etc. export incentives: duty drawback. DEPB, I/E incentives duty drawback, DEPB, I/E: license-exchange control regulation - foreign exchange regulation acts - export management risk export finance. WTO / GATT / MFA - Functions and objectives, successes and failures.

Unit-VI: Quality Management System- ISO 9000 Quality Policy, data, records and traceability documenting the Quality System, quality manual, quality audit, ISO 9000 Registration ISO 14000.

Reference Books:

1. D. Sinha.. - Export Planning and Promotion, -II Ms, Calcutta (1989)
2. Tunin K Nandi.,-Import-Eeport Finance “IIMS, Calcutta (1989)

3. Elaine stone. Jean A Samples., - Fashion Merchandising, “McGraw Hill Book company(1985)ISBN: 81-07-O61742-2
4. S. Shivaramu.-’Export Marketing - A practical guide to Exporters”, Wheeler publishing (1996) ISBN: 81-7544-166-6.
5. J,A. Jamow; M , Guerreiro. B. Judelle., - Inside the Fashion Business” Publishing Company (1987) ISBN: 0-02-360000-4.

FREE ELECTIVE - II**6 FE TX 05 (i) COMPUTER AIDED TEXTILE & FASHION DESIGNING****Section- A**

Unit - I: Introduction to textiles: Fibers; Natural and synthetic, Parameters, uses. Yarn: Types of yarns, numbering system, Quality parameter of yarns and uses. Fabric: Types of fabric, fabric design, comforts properties of fabric and uses. Fashion: Introduction to fashion and apparel design.

Unit - II :Origin of fashion, Fashion Theories: Fashion of different eras, French and Greek revolutions, fashion promotion, style-fad-trends. Fashion Design fundamentals, elements of art, Definition of line shape, form, size, space, texture and colour.

Unit - III : Fashion software: Reach Fashion & Reach CAD, Configuration and Installation, commands, library, model E-fashion style, photo, material studio,

Section- B

Unit - VI : Display of fashion materials: definition and importance, source technique and window display, classic fashion shows. Important fashion centers of the world and India.

Unit - V: Computer aided designing: Fashion sketching, color matching and computer graphics. Autotex software Introduction, Configuration and Installation, Colour Library, Weave library, Checks & stripes, yarn library, Dobby, CAD in Dobby industry

Unit-VI: Computer aided designing, fabric simulation, generation of Peg plan report, generation of report colour combination, Create design in weave library, Electronic jacquard, printing of weave, use of digital pen

Reference Books :

1. E.P.G Gohl, “Textile Science” CBS Publishers & Distributors, New Delhi, (India)
2. Bernard P. Corbman, “ Textiles Fiber to Fabric” McGraw-Hill International Editions, Singapore

3. Tate and Sharon Lee, “*Inside fashion design*”, Harper Publication Inc., UK (1976).
4. Mary Kefgen, “*Individuality in Clothing – Selection and Personal Appearance*”, Mac Millan Publications, New York (1981). Page | 41
5. Mikell P, Grover and E Mory, “*Computer Aided Design and Manufacturing*”, Prentice Hall of India
6. Mehta P V and Bhardwaj S K, “*Managing Quality in apparel industry*”, Om Book Service, New Delhi
7. Cooklin Gerry, “*Garment Technology for Fashion Designers*”, OM Book Service, New Delhi (1997).
8. Auto tex & Reach tech manuals

FREELECTIVE-II

6FETX05 (ii) FASHION TECHNOLOGY

Section-A

Unit –I : Fashion Terms: Fashion, style, change, acceptance, taste. Fashion Evolution – fashion cycle, length of cycle consumer identification with fashion cycle, consumer group, fashion leaders, fashion innovators, fashion motivators or role model, fashion victims, fashion followers.

Unit–II: Adoption of fashion- Trickle-down theory reverses adoption, mass dissemination. Motives for consumer buying, fashion selection, Aesthetic appeal, practical considerations Fashion categories- Womens wear, size range, styling and price range. mens wear ,price range styling, children wear- styling, size range, price range.

Unit-III : Fashion Research and Analysis- fashion forecasting, market research, consumer research, shopping, sales records, evaluating the collections, fashion services, fashion editing, design sources.

Section-B

Unit–IV: Fashion Concept: Principles of fashion, Fashion cycle, Theories of fashion leadership, Changes in fashion, Fashion terminology for merchandising. Fashion Promotion: Fashion Promotion, factors influencing fashion promotion, Publicity, fashion show, Personal selling and communication process.

Unit –V : Fashion Marketing: Marketing concepts, fashion marketing, role of fashion marketer, market segmentation, Fashion marketing planning, Mass marketing, Marketing management, Franchising and goal of merchandiser and pricing policies.

Unit –VI : Fashion Buying: Interpreting customer demand, Developing fashion images, Analyzing and selection of resources. Buying in domestic & foreign market. Consumer Behavior: Psychological, Social, Economical, Practical, Family Background and other.

Reference Books:

- 1) Concept of Consumer, Stephen Fringes, Fairchild Publication.
- 2) Fashion Merchandising, Stephen Fringes, Stone and samples publisher.
- 3) Creative fashion presentation, Polly Guerin, Stone and samples publisher.
- 4) Fashion Marketing, Easey, Stone and samples publisher.
- 5) Fashion Advertising and Promotion, Winter & Standlay Goodman, Stone and samples publisher.
- 6) Fashion from concept to consumer – Gini Stephens Frings.
- 7) Elements of fashion and apparel design.

6 TX 07 Minor Project

6 TX 08 Fabric Structure - II Lab

10 to 12 Practicals based on syllabus of 6 TX 01

6 TX 09 Advance Yarn Manufacturing Technology - Lab

8 to 10 Practicals based on syllabus of 6 TX 02

6 TX 10 Textile Testing II - Lab

10 to 12 Practicals based on syllabus of 6 TX 03

6 TX 11 Communication Skill - Lab

10 to 12 Practicals based on syllabus of 6 TX 06

**FOUR YEAR DEGREE COURSE IN
COMPUTER SCIENCE & ENGINEERING
FIFTH SEMESTER (CREDIT & GRADE SYSTEM)**

5KS01/ 5KE01 DATA COMMUNICATION

- Unit I:** Introduction: Components, Networks, Protocols and standards, Basic Concepts: Line Configuration, Topology Transmission mode, analog and digital signals, periodic and aperiodic signals, analog signals, time and frequency domains, composite signals, digital signals. **08Hrs**
- Unit II:** Encoding and modulating: digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion, digital data transmission, DTE-DCE interface, modems, cable modems. Transmission media: guided media, unguided media, and transmission impairment. Performance, wavelength, Shannon capacity, media comparison. **8Hrs**
- Unit III :** Multiplexing: Many to one/ one to many, frequency division multiplexing, wave division multiplexing, TDM, multiplexing applications: the telephone system, Error detection and correction : types of errors, detection, VRC, Longitudinal redundancy check, cyclic redundancy check, checksum, error correction. **08Hrs**
- Unit IV :** Data link Control: Line Discipline, flow control, error control, Data link Protocols: Asynchronous Protocols, synchronous protocols, character oriented protocols, bit - oriented protocols, link access procedures. **08Hrs**
- Unit V :** Local Area Networks: Ethernet, other Ethernet networks, token bus, token ring, FDDI, Comparison, IEEE802.6 (DQDB) SMDS, Switching: circuit switching, packet switching, message switching, integrated services digital networks (ISDN): services, history, subscriber access to ISDN. **08Hrs**
- Unit VI:** Frame relay: introduction, frame relay operation, frame relay layers, congestion control, leaky bucket algorithm, traffic control, and other features. **08Hrs**

Text Book:

Behrouz A. Forouzan: Data Communication and Networking, (2/e) (TMH)

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education.
2. William L. Schweber : Data Communication, McGraw Hill.
3. J.Freedy : Computer Communication & Networks, AEW Press.
4. D. Corner : Computer Networks & Internet, Pearson Education.

5KS02 /5KE02 FILE STRUCTURES & DATA PROCESSING

- UNIT I:** Introduction: File structure design, File processing operations : open, close, read, write, seek. Unix directory structure. Secondary storage devices: disks, tapes, CD-ROM. Buffer management. I/O in Unix. **08 Hrs**
- UNIT II:** File Structure Concepts: Field & record organization, Using classes to manipulate buffers, Record access, Record structures, file access & file organization, Abstract data models for file access. Metadata. Extensibility, Portability & standardization. **08 Hrs**
- UNIT III:** Data Compression, Reclaiming spaces in files, Introduction to internal sorting and Binary searching. Keysorting. Indexing concepts. Object I/O. Multiple keys indexing. Inverted lists, Selective indexes, Binding. **08 Hrs**
- UNIT IV :** Cosequential processing : Object-Oriented model, its application. Internal sorting: a second look. File Merging : Sorting of large files on disks. Sorting files on tapes. Sort merge packages. Sorting and Cosequential processing in Unix. **08 Hrs**
- UNIT V:** Multilevel indexing : Indexing using Binary Search trees. OOP based B-trees. B-tree methods Search, Insert and others. Deletion, merging & redistribution. B*trees. Virtual B-trees. VL records & keys. Indexed sequential file access and Prefix B+trees. **08 Hrs**
- UNIT VI:** Hashing : Introduction, a simple hashing algorithm. Hashing functions and record distributions. Collision resolution. Buckets. Making deletions. Pattern of record access. External hashing. Implementation. Deletion. Performance. Alternative approaches. **08 Hrs**

Text Book: Michael J.Folk, Bill Zoellick, Greg Riccard :File Structures : An Object-Oriented Approach using C++. (Addison-Wesley) (LPE)

Reference Books:

1. M, Loomis: “Data Management & File Processing” (PHI)
2. O.Hanson: “Design of Computer Data Files” McGraw-Hill (IE)
3. D. E. Knuth: “The Art of Computer Programming”, Volume 3, (Addison Wesley).
4. James Bradly: “Files and Database Techniques”, (Mc Graw Hill).

5KS03 /5KE03 SYSTEM SOFTWARE

- Unit I:** Introduction to Compiling: Phases of a compiler, Lexical Analysis: The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, and language for specifying lexical analysis, lex and yacc tools, state minimization of DFA. **08 Hrs**

Unit II : Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, Non recursive predictive parsing, FIRST and FOLLOW, Construction of predictive parsing tables, LL (1) grammars. Error recovery in predictive parsing. **08 Hrs**

Unit III: Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing, LR parsers: LR parsing algorithm, Construction of SLR parsing table, canonical LR parsing tables and canonical LALR parsing tables. Error recovery in LR parsing. **08 Hrs**

Unit IV: Syntax Directed Translation: Syntax directed definitions, attributes, dependency graphs, construction of syntax trees. Syntax directed definition for constructing syntax trees, directed acyclic graphs for expressions. Bottom up evaluation of s-attributed definitions, L-attributed definition. Top down translation, Design of a predictive translator. **08 Hrs**

Unit V : Run Time Environments: Source language issues: Activation trees, control stacks, storage organization, subdivision of run time memory, activation records, Storage allocation strategies, static allocation, stack allocation, dangling references. Symbol table: Entries, Storage allocation, Hash tables, Scope information. **08 Hrs**

Unit VI: Code Generation: Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage management, Basic blocks and flow graphs. **08 Hrs**

Text Book:

A V Aho, R Sethi, J D Ullman “Compilers Principles, Techniques and Tools”, Pearson Education (LPE).

Reference Books:

1. D. M. Dhamdhare, Compiler Construction—Principles and Practice, (2/e), Macmillan India
2. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press
3. K C. Louden “Compiler Construction—Principles and Practice” India Edition, CENGAGE
4. Bennett J.P., “Introduction to Compiling Techniques”, 2/e (TMH).

5KS04 /5KE04 SWITCHING THEORY AND LOGIC DESIGN

Unit I : VHDL Modeling Concepts, VHDL Fundamentals: Constants, Variables, Scalar types, Type Classification, Expressions, Operators, Sequential Statements, If, Case, Null, Loop, Assertion, Reports statements. **08 Hrs**

Unit II : Array & VHDL, Unconstrained array types, Array operations & referencing, Records Basic Modeling constructs: Entity declarations, Architecture bodies, Behavioral descriptions, Structural descriptions, Design processing, Sub Programs and Procedures. **08 Hrs**

Unit III : Minimization of Switching Function: Review of Karnaugh-map up to four variables, Limitation of K-Maps, Implementation of Logic Functions, Nondegenerate Forms, Quine – McCluskey Method. **08 Hrs**

Unit IV : Combinational Logic Design: Introduction, Design Procedure, Adders, Subtractors, Binary Parellel Adder, 4-bit Parallel Subtractor, Binary Adder-Subtractor, The Look-ahead-carry Adder, 2’s Complement Addition and subtraction Using Parallel Adders. **08 Hrs**

Unit V : Serial Adder, BCD Adder, Excess-3 Adder and Subtractor, Binary Multipliers, Code Converters, Parity Bit Generators/Checkers, Comparators, IC Comparator, Encoders, Keyboard Encoders, Decoders, Multiplexers. **08 Hrs**

Unit VI: Sequential Circuits Design: Conversion of Flip-Flops, Design of Synchronous, Asynchronous Counters and Shift Register Counters. Finite State Machine, Mathematical Representation of Synchronous Sequential machine, Mealy and Moore Model. **08 Hrs**

Text Book:

1. Peter J. Ashenden, “The Designer’s Guide to VHDL”, 2nd Edn, Harcourt Asia
2. Anand Kumar “Switching Theory and Logic Design” (PHI)

Reference Books:

1. J.F. Wakerly, “Digital Logic Design”, PHI.
2. V.P. Nelson Et al, “Digital Logic Circuits, Analysis & Design”, PHI.
3. Moris Mano & Kime.”Logic and Computer Design Fundamentals” Pearson Education.
4. J. Bhaskar, “VHDL Primer”, Person Education

FREE ELECTIVE-I
5FEKS05 (i) DATA STRUCTURES & ALGORITHMS

Unit I: Data structures basics, Mathematical /algorithmic notations & functions, Complexity of algorithms, Sub-algorithms. String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms. **08Hrs.**

Unit-II : Linear arrays and their representation in memory, traversing linear arrays, inserting & deleting operations, Bubble sort, Linear search and Binary search algorithms. Multi-dimensional arrays, Pointer arrays. Record structures and their memory representation. Matrices and sparse matrices. **08Hrs.**

Unit-III: Linked lists and their representation in memory, traversing a linked list, searching a linked list. Memory allocation & garbage collection. Insertion deletion operations on linked lists. Header linked lists, Two- way linked lists. **08Hrs.**

Unit-IV: Stacks and their array representation. Arithmetic expressions: Polish notation. Quick sort, application of stacks. Implementation of recursive procedures by stacks, Queues. Deques. Priority queues. **08Hrs.**

Unit-V : Trees, Binary trees & and their representation in memory, Traversing binary trees. Traversal algorithms using stacks, Header nodes : threads. Heap and heapsort. Path length & Huffman's algorithm. General trees. **08Hrs.**

Unit-VI: Graph theory, sequential representations of graphs, Warshalls' algorithm, Linked representation, operations & traversing the graphs. Posets & Topological sorting. Insertion Sort, Selection Sort. Radix sort. **8Hrs.**

Text Book:

Seymour Lipschutz: "Data Structures with C", Schaum's Outline Series.

Reference Books:

1. Forouzan, Gilberg: Data Structures and Algorithms, CENGAGE Learning.
2. Reema Thareja: Data Structures using C, Oxford University Press, 2011.
3. Arpita Gopal: Magnifying Data structures, PHI (EEE), 2010.
4. Ellis Horowitz, Sartaj Sahni: Fundamentals of Data Structures, CBS Publications.

FREE ELECTIVE-I
5FEKS05 (ii) DATA COMMUNICATION AND NETWORKING

Unit I : Introduction: Components, Networks, Protocols and standards, Basic Concepts: Line Configuration, Topology, Transmission mode, analog and digital signals, periodic and aperiodic signals, analog signals, time and frequency domains, composite signals, digital signals.

Unit II : Encoding and modulating: digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion, digital data transmission, DTE-DCE interface, modems, cable modems, transmission media: guided media, unguided media, transmission impairment.

Unit III : Multiplexing: Many to one/ one to many, frequency division multiplexing, wave division multiplexing, TDM, multiplexing applications: the telephone system , Error detection and correction : types of errors, detection , cyclic redundancy check, checksum, error correction.

Unit IV: Data link Control: Line Discipline, flow control, error control, Data link Protocols: Asynchronous Protocols, synchronous protocols, character oriented protocols, bit - oriented protocols.

Unit V : Local Area Networks: Ethernet, other Ethernet networks, token bus, token ring, FDDI, Comparison, MAN: IEEE802.6 (DQDB) SMDS, Switching: circuit switching, packet switching, message switching.

UNIT VI: Networking and Internetworking Devices: Repeaters, Bridges, Routers, Gateways. Transport Layer: Functions of transport layer, connection, the OSI transport protocol, upper OSI Layer: Session layer, presentation layer, Application Layer.

Text Book:

Behrouz A. Forouzan: Data Communication and Networking, (2/e), TMH.

Reference Books:

1. William Stallings: Data & Computer Communications, (6/e) Pearson Education.
2. William L. Schweber : Data Communication, McGraw Hill.
3. J.Freely : Computer Communication & Networks, AEW Press.
4. D. Comer : Computer Networks & Internet, Pearson Education.

5KS06 / 5KE06 COMMUNICATION SKILLS

Unit I: Introduction to Communication: Introduction- Importance of Communication, Basics of Communication, Purpose and Audience, Cross-cultural Communication, Language As a tool of communication, Communicative Skills-LSRW, Effective Communication, Modes of Communication, Importance of Technical Communication, Barriers to Communication: Introduction, Classification of Barriers, Information Gap Principle-Given and New Information, Filters, Basics of Technical Communication: Introduction, Objective and Characteristics of Technical Communication, Process of Communication, Levels of Communication, Flow of Communication, Communication Networks, Visual Aids in Technical Communication

Unit II : Active Listening: Introduction, Reason for poor Listening, Traits of a Good Listener, Listening Modes, Types of Listening, Barriers to Effective Listening, Listening for General Content and Specific Information, Effective Speaking: Introduction, Achieving Confidence, Clarity, and Fluency, Paralinguistic Features, Barriers to Speaking, Types of Speaking, Persuasive Speaking, Public Speaking, Listening and Speaking: Introduction, Conversations, Telephonic Conversations and Etiquette, Dialogue Writing, Effective Presentation Strategies: Introduction, Planning, Outlining and Structuring, Nuances of Delivery, Controlling Nervousness and Stage Fright, Visual Aids in Presentations, Application of Ms PowerPoint, Interviews: Introduction, Objectives of Interviews, Types of Interviews, Job Interviews, Media Interviews, Press Conferences, Group Communication: Introduction, Forms of Group Communication, Use of Body Language in Group Communication, Discussions.

Unit III : Reading: Introduction, Reading Rates, Reading and Interpretation, Intensive and Extensive Reading, Critical Reading, Reading for different Purposes, Reading Comprehension, Reading Techniques: Introduction, Improving Comprehension Skills, Techniques for Good Comprehension, General Kitchen Layout, Predicting the Content, Understanding the Gist, SQ3R Reading technique, Study Skills, Technical Writing: Introduction, Audience Recognition/Analysis, Language, Elements of Style, Techniques for Good Technical Writing, Reports: Introduction, Characteristics of a Report, Categories of Reports, Formats, Prewriting, Structure of Reports (Manuscripts format), Types of Report, Technical Proposals:

Introduction, Definition and Purpose, Types, Characteristics, Structure of Proposals, Style and Appearance, Evaluation of Proposals, Research Paper, Dissertation, Thesis.

Text Book:

Raman & Sharma: “Technical Communication Principles & Practice” (2/e) Oxford University Press.

Reference Books:

1. M Ashraf Rizvi: “ Effective Technical Communication” Mc Graw Hill.
2. Mohan, Banerjee: “Developing Communication Skills”, MacMillan India Limited.
3. Chrissie Wright(Editor): “Handbook of Practical Communication Skills”, Jaico Publishing House.
4. CDC, TTTI WR, Bhopal: “A Course in Technical English, Somaiya Publication Pvt. Ltd.”
5. F.Frank Candlin: “General English for Technical Students”, University of London Press Ltd.

5KS07 System Software Lab.: Minimum Eight experiments/ programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

5KS08 Switching Theory & Logic Design Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus covering each of the units. Design Practical examples should be based on Unit III to Unit VI using VHDL.

5KS09 Communication Skills Lab.: Minimum Eight experiments/ programming assignments must be completed based on the respective syllabus as follows.

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation. The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building, Phonetics.
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

Reference Book: Norman Lewis: Word Power Made Easy
Website: <http://www.teachingenglish.org.uk>

6KS01/ 6KE01 OPERATING SYSTEMS

Unit-I : Introduction: Operating System(OS) definition, OS Evolution, OS Components, OS Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter-process Communication, Threads: Multithreading Models, Threading Issues, Java Threads.

Unit-II: CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms, Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Monitors. Deadlocks: Definition & Characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock. **08 Hrs**

Unit-III: Memory Management: Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging. Virtual Memory: Background, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing. **08 Hrs**

Unit-IV: File-System Interface: Directory Structure, File-System Mounting, File Sharing, Protection. File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, File Recovery. **08 Hrs**

Unit-V : I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations. Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure. **08 Hrs**

Unit-VI: The Linux System: History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File systems, Input and Output, Inter process Communication, Network Structure & Security in Linux. **08Hrs**

Text Book:

Avi Silberschatz ,P.B.Galvin, G.Gagne: “Operating System Concepts” (6/e)
John-Wiley & Sons.

Reference Books:

1. A.S Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D M Dhamdhere “Operating Systems” Tata McGraw-Hill.
4. P.Balkrishna Prasad: “Operating Systems” Scitech Publications(I) Pvt. Ltd.

6KS02 / 6KE02 DATABASE SYSTEMS

Unit-I: Database System Applications, Database Systems versus File Systems, View of Data, Data Models, Database Languages, Database Users and Administrators, Transaction Management, Database System Structure, Application architectures, History of Database Systems. Entity- Relationship Model, Basic Concepts, Constraints, Keys, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Design of an E-R Database Schema, Reduction of an E-R Schema to Tables. **08Hrs**

Unit-II: Relational Model: Structure of Relational Databases, The Relational Algebra, Extended Relational-Algebra Operations, Modification of the Database, Views, The Tuple Relational Calculus, The Domain Relational Calculus, SQL: Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Subqueries, Views. **08Hrs**

Unit-III: Integrity and Security, Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication, Relational-Database Design:, First Normal Form, Pitfalls in Relational-Database, Design, Functional Dependencies, Decomposition, BCNF, Third, Fourth and more Normal Forms, Overall Database Design Process. **08 Hrs**

Unit-IV: Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Estimating Statistics of Expression Results, Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views. **08Hrs**

Unit-V : Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability, Implementation of Isolation, Transaction Definition in SQL, Testing for Serializability. **08Hrs**

Unit-VI: Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularities, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations Weak Levels of Consistency, Concurrency in Index Structures. Recovery System: issues & solutions. **08Hrs**

Text Book:

Silberschatz, Korth, Sudarshan: "Database System Concepts", (5th Edition) McGraw Hill,

Reference Books:

1. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
2. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
3. G.K. Gupta: Database Management Systems, McGraw Hill.
4. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)

6KS03 / 6KE03 COMPUTING RESOURCES MANAGEMENT

Unit-I : Systems Management: Definition, Building a Business Case for Systems Management, Organizing for Systems Management, Factors to Consider in Designing IT Organizations and Infrastructure. Staffing for Systems Management, IT as Service, and IT Service Management.

Unit-II : Availability, Methods for Measuring Availability, Seven 'Rs' of High Availability. Performance and Tuning, Definition and characteristics. Performance and Tuning Applied to the Five Major Resource Environments. Problem Management: Definition and scope. Key Steps to Developing a Problem Management Process.

Unit-III : Storage Management: Definition, Desired Traits, Capacity, Performance, Reliability, Recoverability. Network Management: Definition, Key Decisions about Network Management, Assessing, Measuring and Streamlining an Infrastructure's Network Management Process.

Unit-IV : Configuration Management, Definition, Practical Tips for Improving Configuration Management. Capacity Planning: Definition, reasons for poor Capacity Planning, Developing an Effective Capacity Planning Process, Benefits and hints for effective capacity planning.

Unit-V : Strategic Security: Definition, Developing a Strategic Security Process, Assessing, Measuring and Streamlining the Security Process. Facilities Management: Definition, Major Elements, Tips, Assessing, Measuring and Streamlining the Facilities Management Process.

Unit-VI: Developing Robust Processes: Features of World-Class Infrastructure. Characteristics of a Robust Process. Integrating Systems Management Processes. Client-Server Environment Issues. Web-Enabled Environment Issues.

Text Book:

Ritch Schiesser "IT Systems Management", 2nd Edition, Prentice Hall.

Reference Books :

1. Bill Holtsnider, Brian Jaffe, Brian D Jaffe "IT Managers Handbook" (2/e) Morgan Kaufmann.
2. Jan Van Bon, et al., "Foundation of IT Service Management Based on ITIL V3" Van Haren.
3. HARRISE KERN, RICH SCHIESSER " IT Systems Management", 1st Edition, Prentice Hall.

6KS04 / 6KE04 COMPUTER ARCHITECTURE

Unit I : Instruction Sets: Machine Instruction Characteristics, Types of Operands, Intel x86 and ARM Data Types, Types of Operations, Intel x86 and ARM Operation Types.

08 Hrs

Unit II: Instruction Sets: Addressing, x86 and ARM Addressing modes, Instruction Formats, x86 and ARM Instruction Formats, Assembly language.

08Hrs

Unit III : Processor Structure and Function: Processor Organization, Register Organization, The Instruction Cycle, Instruction Pipelining, The x86 Processor Family, The ARM Processor.

08 Hrs

Unit IV: Reduced Instruction Set Computers (RISCs): Instruction Execution Characteristics, The Use of Large Register File, Compiler-Based Register Optimization, RISC Architecture, RISC Pipelining. RISC versus CISC.

08 Hrs

Unit V : Control Unit Operation: Micro-operations, Control of the Processor, Hardwired Implementation, Microprogrammed control, Basic Concepts, Microinstruction Sequencing & Execution.

08Hrs

Unit VI: Parallel Processing: The Use of Multiple Processors, Symmetric Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Intel x 86 Multi-Core Organization.

08 Hrs

Text Book:

William Stallings: "Computer Organization and Architecture", (8/e) Pearson Education.

Reference Books:

1. Behrooz Parhami: "Computer Architecture", Oxford University Press.

2. J.P. Hayes: "Computer Architecture and Organization" ,McGraw Hill.
3. D.A. Patterson, J.L. Hennessy: "Computer Architecture" Morgan Kauffmann, 2002.
4. Hwang and Briggs: "Computer Architecture and Parallel Processing" McGraw-Hill.

6FEKS05 FREE ELECTIVE-II

(i) DATABASE MANAGEMENT SYSTEMS

Unit-I: Introduction: Database System Applications, Purpose of Database Systems, and View of Data, Database Languages, Database Architecture, Database Users and Administrators. Relational Model: Structure of Relational Databases, Fundamentals of Relational-Algebra.

Unit-II: SQL: Background, Data Definition, Basic Structure of SQL queries, Set Operations, Aggregate Functions, Null Values, Nested Sub queries, Complex Queries, Views, Modification of Database, Joined relations. SQL Data Types and Schemas, Integrity Constraints, Authorization.

Unit-III: Database Design: Overview of the Design Process, Entity-Relationship Model, Constraints, Entity-Relationship Diagrams, Reduction to Relational Schemas. Relational Database Design: Atomic Domains, Normalization and Normal Forms, Functional Dependencies, Decomposition using Functional Dependencies.

Unit-IV: Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions. Query Optimization: Overview, Transformation of Relational Expressions, Materialized Views.

Unit-V: Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability, Testing for Serializability.

Unit-VI: Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity, Weak Levels of Consistency, Recovery System: Failure Classification, Recovery and Atomicity, Log-Based Recovery.

Text Book :

Silberschatz, Korth, Sudarshan: "Database System Concepts", (5/e) McGraw Hill.

Reference Books:

1. Raghu Ramkrishnan, Johannes Gherke: Database Management Systems, TMH.
2. C.J.Date: Introduction to Database Systems, Pearson Education.
3. Connolly & Begg: Database System, Low Price Ed.
4. El-Maseri, Navathe: Fundamentals of Database Systems, Pearson Education.

6FEKS05 FREE ELECTIVE-II

(ii) SOFTWARE PROJECT MANAGEMENT

Unit I: Evolving role of Software. Software crises & myths. Software engineering. Software process & process models: Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts: People, Product, Process, Project. WSHH principle, critical practice.

Unit II: Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.

Unit III: Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User-interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation.

Unit VI: Software testing fundamentals; test case design, Whitebox testing, Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing, Debugging. Technical metrics for software.

Textbook:

Pressman Roger. S: “Software Engineering, A Practitioner’s Approach”, TMH.

Reference Books :

1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Davis A: Principles of Software Development (McGraw Hill)
3. Jawadekar W.S.: Software Engineering Principles and Practice, Mc Graw Hill.
4. Jalote Pankaj: An Integrated Approach to Software Engineering, Narosa Publications.

6KS06 / 6KE06 PROFESSIONAL ETHICS

Unit I : Introduction: Computers in a Social Context. Moral and Legal Issues. Computer Ethical Issues. Philosophical Ethics: Descriptive and Normative Claims, Ethical Relativism, Utilitarianism, Deontological Theories, Rights, Virtue Ethics, Individual and Social Policy Ethics. Professional Ethics: Characteristics and system of Professions, Computing as Profession, Professional Relationships, Conflicting Responsibilities, Code of Ethics and Professional Conduct, Collective Responsibility. **08 Hrs**

Unit II : Ethics and The Internet: Three Morally Significant Characteristics, Hacking and Hacker Ethics, New Species of Old Crime, Netiquette, And Policy Approaches. Computers and Privacy issues, Legislative Background, Global Perspective, Proposals for Better Privacy Protection. Property Rights in Computer Software: Definitions, Current Legal Protection, Philosophical basis and analysis of Property, Proprietary Software, and Software Copying. **08 Hrs**

Unit III : Accountability, Computer and Information Technology: Different Senses of Responsibility, Buying and Selling Software, Y2K Problem, Diffusion of Accountability, Internet Issues, ISP Liability, and Virtual Action. Technology and Social change, Embedded Values, Enhanced and Impeded Values, Democratic Values in the Internet, Internet as Democratic Technology, Access and the Digital Divide, Free Expression, Overarching and Future Issues. **08Hrs**

Text Book:

Deborah G. Johnson: “Computer Ethics” Pearson Education (Third Edition).

Reference Books:

1. George Reynolds: “Ethics in Information Technology” Cengage Learning.
2. Hester and Ford: “Computers and Ethics in the Cyberage.
3. Duncan Langford: “Internet Ethics”
4. Richard A. Spinello: “Case Studies in Information Technology Ethics” PHI.

6KS07 Operating Systems Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

6KS08 Database Systems Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units along with one mini project.

6KS09 Computer Lab-II (Hardware Lab): This lab is based on PC organization, troubleshooting & maintenance.

Student should perform practical on the following areas of PC:

1. PC models.
2. Inside the PC.
3. Preventive maintenance.
4. PC troubleshooting.
5. Semiconductor memories
6. Power supplies & power protection
7. Hard Disks: installing, configuring & maintenance
8. SCSI drives
9. Printers & their troubleshooting
10. Modems & serial interfaces, USB’s and Devices.
11. Keyboard, Mice, Video adapters & displays
12. Sound boards, Video capture & CD ROMs.
13. Study of PC Ports & Interfacing Cards.

Books :

1. Mark Minasi : Complete PC upgrade & Maintenance Guide (BPB)
2. Scott Muller: Upgrading and Repairing PCs 12/e (Que)

**FOUR YEAR DEGREE COURSE IN
COMPUTER ENGINEERING
FIFTH SEMESTER (CREDIT & GRADE SYSTEM)**

5KE01 DATA COMMUNICATION

- Unit I:** Introduction: Components, Networks, Protocols and standards, Basic Concepts: Line Configuration, Topology Transmission mode, analog and digital signals, periodic and aperiodic signals, analog signals, time and frequency domains, composite signals, digital signals. **08Hrs**
- Unit II:** Encoding and modulating: digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion, digital data transmission, DTE-DCE interface, modems, cable modems. Transmission media: guided media, unguided media, and transmission impairment. Performance, wavelength, Shannon capacity, media comparison. **8Hrs**
- Unit III :** Multiplexing: Many to one/ one to many, frequency division multiplexing, wave division multiplexing, TDM, multiplexing applications: the telephone system, Error detection and correction : types of errors, detection, VRC, Longitudinal redundancy check, cyclic redundancy check, checksum, error correction. **08Hrs**
- Unit IV :** Data link Control: Line Discipline, flow control, error control, Data link Protocols: Asynchronous Protocols, synchronous protocols, character oriented protocols, bit - oriented protocols, link access procedures. **08Hrs**
- Unit V :** Local Area Networks: Ethernet, other Ethernet networks, token bus, token ring, FDDI, Comparison, IEEE802.6 (DQDB) SMDS, Switching: circuit switching, packet switching, message switching, integrated services digital networks (ISDN): services, history, subscriber access to ISDN. **08Hrs**
- Unit VI:** Frame relay: introduction, frame relay operation, frame relay layers, congestion control, leaky bucket algorithm, traffic control, and other features. **08Hrs**

Text Book:

Behrouz A. Forouzan: Data Communication and Networking, (2/e) (TMH)

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education.
2. William L. Schweber : Data Communication, McGraw Hill.

3. J.Freey : Computer Communication & Networks, AEW Press.
4. D. Corner : Computer Networks & Internet, Pearson Education.

5KE02 FILE STRUCTURES & DATA PROCESSING

- UNITI:** Introduction: File structure design, File processing operations : open, close, read, write, seek. Unix directory structure. Secondary storage devices: disks, tapes, CD-ROM. Buffer management. I/O in Unix. **08 Hrs**
- UNITII:** File Structure Concepts: Field & record organization, Using classes to manipulate buffers, Record access, Record structures, file access & file organization, Abstract data models for file access. Metadata. Extensibility, Portability & standardization. **08 Hrs**
- UNITIII:** Data Compression, Reclaiming spaces in files, Introduction to internal sorting and Binary searching. Keysorting. Indexing concepts. Object I/O. Multiple keys indexing. Inverted lists, Selective indexes, Binding. **08 Hrs**
- UNITIV :** Cosequential processing : Object-Oriented model, its application. Internal sorting: a second look. File Merging : Sorting of large files on disks. Sorting files on tapes. Sort merge packages. Sorting and Cosequential processing in Unix. **08 Hrs**
- UNITV:** Multilevel indexing : Indexing using Binary Search trees. OOP based B-trees. B-tree methods Search, Insert and others. Deletion, merging & redistribution. B*trees. Virtual B-trees. VL records & keys. Indexed sequential file access and Prefix B+trees. **08 Hrs**
- UNITVI:** Hashing : Introduction, a simple hashing algorithm. Hashing functions and record distributions. Collision resolution. Buckets. Making deletions. Pattern of record access. External hashing. Implementation. Deletion. Performance. Alternative approaches. **08 Hrs**

Text Book: Michael J.Folk, Bill Zoellick, Greg Riccard :File Structures : An Object-Oriented Approach using C++. (Addison-Wesley) (LPE)

Reference Books:

1. M, Loomis: “Data Management & File Processing” (PHI)
2. O.Hanson: “Design of Computer Data Files” McGraw-Hill (IE)
3. D. E. Knuth: “The Art of Computer Programming”, Volume 3, (Addison Wesley).
4. James Bradly: “ Files and Database Techniques”, (Mc Graw Hill).

5KE03 SYSTEM SOFTWARE

- Unit I:** Introduction to Compiling: Phases of a compiler, Lexical Analysis: The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, and language for specifying lexical analysis, lex and yacc tools, state minimization of DFA. **08 Hrs**
- Unit II:** Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, Non recursive predictive parsing, FIRST and FOLLOW, Construction of predictive parsing tables, LL (1) grammars. Error recovery in predictive parsing. **08 Hrs**
- Unit III:** Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing, LR parsers: LR parsing algorithm, Construction of SLR parsing table, canonical LR parsing tables and canonical LALR parsing tables. Error recovery in LR parsing. **08 Hrs**
- Unit IV:** Syntax Directed Translation: Syntax directed definitions, attributes, dependency graphs, construction of syntax trees. Syntax directed definition for constructing syntax trees, directed acyclic graphs for expressions. Bottom up evaluation of s-attributed definitions, L-attributed definition. Top down translation, Design of a predictive translator. **08 Hrs**
- Unit V:** Run Time Environments: Source language issues: Activation trees, control stacks, storage organization, subdivision of run time memory, activation records, Storage allocation strategies, static allocation, stack allocation, dangling references. Symbol table: Entries, Storage allocation, Hash tables, Scope information. **08 Hrs**
- Unit VI:** Code Generation: Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage management, Basic blocks and flow graphs. **08 Hrs**

Text Book:

A V Aho, R Sethi, J D Ullman “Compilers Principles, Techniques and Tools”, Pearson Education (LPE).

Reference Books:

1. D. M. Dhamdhare, Compiler Construction—Principles and Practice, (2/e), Macmillan India
2. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press

3. K C. Louden “Compiler Construction—Principles and Practice” India Edition, CENGAGE
4. Bennett J.P., “Introduction to Compiling Techniques”, 2/e (TMH).

5KE04 SWITCHING THEORY AND LOGIC DESIGN

- Unit I :** VHDL Modeling Concepts, VHDL Fundamentals: Constants, Variables, Scalar types, Type Classification, Expressions, Operators, Sequential Statements, If, Case, Null, Loop, Assertion, Reports statements. **08 Hrs**
- Unit II :** Array & VHDL, Unconstrained array types, Array operations & referencing, Records Basic Modeling constructs: Entity declarations, Architecture bodies, Behavioral descriptions, Structural descriptions, Design processing, Sub Programs and Procedures. **08 Hrs**
- Unit III :** Minimization of Switching Function: Review of Karnaugh-map up to four variables, Limitation of K-Maps, Implementation of Logic Functions, Nondegenerate Forms, Quine – McCluskey Method. **08 Hrs**
- Unit IV :** Combinational Logic Design: Introduction, Design Procedure, Adders, Subtractors, Binary Parellel Adder, 4-bit Parallel Subtractor, Binary Adder-Subtractor, The Look-ahead-carry Adder, 2’s Complement Addition and subtraction Using Parallel Adders. **08 Hrs**
- Unit V :** Serial Adder, BCD Adder, Excess-3 Adder and Subtractor, Binary Multipliers, Code Converters, Parity Bit Generators/ Checkers, Comparators, IC Comparator, Encoders, Keyboard Encoders, Decoders, Multiplexers. **08 Hrs**
- Unit VI :** Sequential Circuits Design: Conversion of Flip-Flops, Design of Synchronous, Asynchronous Counters and Shift Register Counters. Finite State Machine, Mathematical Representation of Synchronous Sequential machine, Mealy and Moore Model. **08 Hrs**

Text Books:

1. Peter J. Ashenden, “The Designer’s Guide to VHDL”, 2nd Edn, Harcourt Asia
2. Anand Kumar “Switching Theory and Logic Design” (PHI)

Reference Books:

1. J.F. Wakerly, “Digital Logic Design”, PHI.
2. V.P. Nelson Et al, “Digital Logic Circuits, Analysis & Design”, PHI.
3. Moris Mano & Kime.”Logic and Computer Design Fundamentals” Pearson Education.
4. J. Bhaskar, “VHDL Primer”, Person Education

FREE ELECTIVE-I
SFEKE05 (i) WEB TECHNOLOGIES

UNIT I: Introduction to the Web: History, Creating Websites, web applications, writing web projects, identification of objects, target users, web team. Web architecture: web servers, web browsers, TCP/IP protocol suite, IP Address, MIME. Hypertext Transfer Protocol (HTTP): Introduction, Resources, URL anatomy, Message Format, Examples, Web caching, Proxy.

08Hrs

Unit II: Hypertext Markup language (HTML): History of HTML, HTML & its flavors, HTML basics, Elements, attributes and tags of HTML, Basic Tags, Advanced Tags, Frames, Images, Meta Tag, Planning of web page, Model and Structure of web site, Designing web pages, Multimedia content.

08Hrs

Unit III: Cascading Style Sheet (CSS): Introduction, advantages, Adding CSS, Browser compatibility, CSS and page layout, Selectors, Grouping, and Type Selectors. Extensible Markup Language (XML): Common Usage, Role of XML, Prolog, Body, Elements, Attributes, Validation, Displaying XML, Namespaces.

08 Hrs

Unit IV: XML DTD: Introduction to DTD, Purpose of DTD, DTD in XML document, Element type declaration, Attribute declaration, Entity declaration, DTD validation. XML Schema: Introduction, comparison with DTD, schema structure, schema element, element declaration, schema validation, built in data types, declaring simple elements.

08Hrs

Unit V: Java Script: Introduction, variables, literals, operators, control structure, conditional statements, Arrays, Functions, Parameter Passing, Function Pointer, Inner/Nested Functions, and Objects. Client side programming.

08Hrs

Unit VI: Common Gateway Interface (CGI): Internet programming paradigm, Server side programming with JavaScript, Language for CGI, Applications, Server environment, Environment variables, CGI building blocks, CGI scripting using JavaScript, Shell script, writing CGI program, CGI security, alternatives and enhancement in CGI.

08 Hrs

Text Book:

Roy Uttam K: Web Technologies, Oxford University Press, 2010.

Reference Books:

1. Dr. Raja Subramanian: Creating Web Sites in Engineering, University Science Press.
2. Mohler J.L. & Duff J.M.: Designing Interactive Web Sites, CENGAGE Learning.
3. Joel Sklar: Text Book of Web Design, CENGAGE Learning.
4. Meenakshi G.M.: Web Graphics, Scitech Publications(India) Pvt. Ltd.

FREE ELECTIVE-I

SFEKE05 (ii) OBJECT ORIENTED PROGRAMMING

Unit I: Objects & Classes in C++: Declaring & using classes, Constructors, Objects as function arguments, Copy Constructors, Static class data, Arrays of Objects, C++ String class.

Unit II: Operator Overloading: Overloading Unary & Binary Operators, Data Conversion, Pitfalls of Operator Overloading, Pointers & Arrays, Pointers & Functions, New & Delete Operators, Pointers for Objects.

Unit III: Inheritance in C++: Derived Class & Base Class, Derived class Constructors, Function overloading, Class hierarchies, Public & Private Inheritance, Multiple Inheritance, Containership: Classes within Classes.

Unit IV: Virtual Function Concepts: Abstract Classes & Pure Virtual Functions, Virtual Base classes, Friend functions, Static Functions, Assignment & copy initialization, the this pointer, Dynamic type information.

Unit V: Streams & Files in C++: Stream Classes, stream errors, disk file I/O with streams, File Pointers, Error handling in file I/O, File I/O with member functions, overloading the extractions & Insertions operator, Command Line Arguments, Multi-file programs.

Unit VI: Function Template, Class template, Exception Syntax, Multiple exceptions, Exception with Arguments, Introduction to Standard Template Library, Algorithms, Sequential Containers. Function objects.

Text Book:

Robert Lafore: Object Oriented Programming in C++, Galgotia Publication.

Reference Books:

1. Herbert Schildt: C++: Complete Reference, TMH.
2. Bjarne Stroustrup: C++ Programming Language, Addison Wesley.

3. Venugopal: Mastering C++, TMH.
4. Lipmann: C++ Primer, Addison Wesley.

5KE06 COMMUNICATION SKILLS

Unit I: Introduction to Communication: Introduction- Importance of Communication, Basics of Communication, Purpose and Audience, Cross-cultural Communication, Language As a tool of communication, Communicative Skills-LSRW, Effective Communication, Modes of Communication, Importance of Technical Communication, Barriers to Communication: Introduction, Classification of Barriers, Information Gap Principle-Given and New Information, Filters, Basics of Technical Communication: Introduction, Objective and Characteristics of Technical Communication, Process of Communication, Levels of Communication, Flow of Communication, Communication Networks, Visual Aids in Technical Communication

Unit II : Active Listening: Introduction, Reason for poor Listening, Traits of a Good Listener, Listening Modes, Types of Listening, Barriers to Effective Listening, Listening for General Content and Specific Information, Effective Speaking: Introduction, Achieving Confidence, Clarity, and Fluency, Paralinguistic Features, Barriers to Speaking, Types of Speaking, Persuasive Speaking, Public Speaking, Listening and Speaking: Introduction, Conversations, Telephonic Conversations and Etiquette, Dialogue Writing, Effective Presentation Strategies: Introduction, Planning, Outlining and Structuring, Nuances of Delivery, Controlling Nervousness and Stage Fright, Visual Aids in Presentations, Application of Ms PowerPoint, Interviews: Introduction, Objectives of Interviews, Types of Interviews, Job Interviews, Media Interviews, Press Conferences, Group Communication: Introduction, Forms of Group Communication, Use of Body Language in Group Communication, Discussions.

Unit III : Reading: Introduction, Reading Rates, Reading and Interpretation, Intensive and Extensive Reading, Critical Reading, Reading for different Purposes, Reading Comprehension, Reading Techniques: Introduction, Improving Comprehension Skills, Techniques for Good Comprehension, General Kitchen Layout, Predicting the Content, Understanding the Gist, SQ3R Reading technique, Study Skills, Technical Writing: Introduction, Audience Recognition/Analysis, Language, Elements of Style, Techniques for Good Technical

Writing, Reports: Introduction, Characteristics of a Report, Categories of Reports, Formats, Prewriting, Structure of Reports (Manuscripts format), Types of Report, Technical Proposals: Introduction, Definition and Purpose, Types, Characteristics, Structure of Proposals, Style and Appearance, Evaluation of Proposals, Research Paper, Dissertation, Thesis.

Text Book:

Raman & Sharma: "Technical Communication Principles & Practice" (2/e) Oxford University Press.

Reference Books:

1. M Ashraf Rizvi: "Effective Technical Communication" Mc Graw Hill.
2. Mohan, Banerjee: "Developing Communication Skills", MacMillan India Limited.
3. Chrissie Wright(Editor): "Handbook of Practical Communication Skills", Jaico Publishing House.
4. CDC, TTTI WR, Bhopal: "A Course in Technical English, Somaiya Publication Pvt. Ltd."
5. F.Frank Candlin: "General English for Technical Students", University of London Press Ltd.

5KE07 System Software Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

5KE08 Switching Theory & Logic Design Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus covering each of the units. Design Practical examples should be based on Unit III to Unit VI using VHDL.

5KE09 Communication Skills Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus as follows.

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation. The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building, Phonetics.
2. Technical report writing
3. Group discussions

4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

Reference Book: Norman Lewis: Word Power Made Easy
Website: <http://www.teachingenglish.org.uk>

6KE01 OPERATING SYSTEMS

- Unit-I:** Introduction: Operating System(OS) definition, OS Evolution, OS Components, OS Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter-process Communication, Threads: Multithreading Models, Threading Issues, Java Threads. **08 Hrs**
- Unit-II:** CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms, Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Monitors. Deadlocks: Definition & Characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock. **08 Hrs**
- Unit-III:** Memory Management: Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging. Virtual Memory: Background, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing. **08 Hrs**
- Unit-IV:** File-System Interface: Directory Structure, File-System Mounting, File Sharing, Protection. File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, File Recovery. **08 Hrs**
- Unit-V :** I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations. Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure. **08 Hrs**
- Unit-VI:** The Linux System: History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File systems, Input and Output, Inter process Communication, Network Structure & Security in Linux. **08Hrs**

Text Book:

Avi Silberschatz ,P.B.Galvin, G.Gagne: “Operating System Concepts” (6/e) John-Wiley & Sons.

Reference Books:

1. A.S Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D M Dhamdhare “Operating Systems” Tata McGraw-Hill.
4. P.Balkrishna Prasad: “Operating Systems” Scitech Publications(I) Pvt. Ltd.

6KE02 DATABASE SYSTEMS

- Unit-I:** Database System Applications, Database Systems versus File Systems, View of Data, Data Models, Database Languages, Database Users and Administrators, Transaction Management, Database System Structure, Application architectures, History of Database Systems. Entity- Relationship Model, Basic Concepts, Constraints, Keys, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Design of an E-R Database Schema, Reduction of an E-R Schema to Tables. **08Hrs**
- Unit-II:** Relational Model: Structure of Relational Databases, The Relational Algebra, Extended Relational-Algebra Operations, Modification of the Database, Views, The Tuple Relational Calculus, The Domain Relational Calculus, SQL: Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Subqueries, Views. **08Hrs**
- Unit-III:** Integrity and Security, Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication, Relational-Database Design:, First Normal Form, Pitfalls in Relational-Database, Design, Functional Dependencies, Decomposition, BCNF, Third, Fourth and more Normal Forms, Overall Database Design Process. **08 Hrs**
- Unit-IV:** Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Estimating Statistics of Expression Results, Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views. **08Hrs**
- Unit-V :** Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability, Implementation of Isolation, Transaction Definition in SQL, Testing for Serializability. **08Hrs**

Unit-VI: Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularities, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations Weak Levels of Consistency, Concurrency in Index Structures. Recovery System: issues & solutions. **08Hrs**

Text Book:

Silberschatz, Korth, Sudarshan: "Database System Concepts", (5th Edition) McGraw Hill,

Reference Books:

1. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
2. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
3. G.K. Gupta: Database Management Systems, McGraw Hill.
4. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)

6KE03 COMPUTING RESOURCES MANAGEMENT

Unit-I : Systems Management: Definition, Building a Business Case for Systems Management, Organizing for Systems Management, Factors to Consider in Designing IT Organizations and Infrastructure. Staffing for Systems Management, IT as Service, and IT Service Management.

Unit-II : Availability, Methods for Measuring Availability, Seven 'Rs' of High Availability. Performance and Tuning, Definition and characteristics. Performance and Tuning Applied to the Five Major Resource Environments. Problem Management: Definition and scope. Key Steps to Developing a Problem Management Process.

Unit-III : Storage Management: Definition, Desired Traits, Capacity, Performance, Reliability, Recoverability. Network Management: Definition, Key Decisions about Network Management, Assessing, Measuring and Streamlining an Infrastructure's Network Management Process.

Unit-IV : Configuration Management, Definition, Practical Tips for Improving Configuration Management. Capacity Planning: Definition, reasons for poor Capacity Planning, Developing an Effective Capacity Planning Process, Benefits and hints for effective capacity planning.

Unit-V : Strategic Security: Definition, Developing a Strategic Security Process, Assessing, Measuring and Streamlining the Security Process. Facilities Management: Definition, Major Elements, Tips, Assessing, Measuring and Streamlining the Facilities Management Process.

Unit-VI: Developing Robust Processes: Features of World-Class Infrastructure. Characteristics of a Robust Process. Integrating Systems Management Processes. Client-Server Environment Issues. Web-Enabled Environment Issues.

Text Book:

Ritch Schiesser "IT Systems Management", 2nd Edition, Prentice Hall.

Reference Books :

1. Bill Holtsnider, Brian Jaffe, Brian D Jaffe "IT Managers Handbook" (2/e) Morgan Kaufmann.
2. Jan Van Bon, et al., "Foundation of IT Service Management Based on ITIL V3" Van Haren.
3. Harrise Kern, Rich Schiesser "IT Systems Management", 1st Edition, Prentice Hall.

6KE04 COMPUTER ARCHITECTURE

Unit I: Instruction Sets: Machine Instruction Characteristics, Types of Operands, Intel x86 and ARM Data Types, Types of Operations, Intel x86 and ARM Operation Types. **08 Hrs**

Unit II: Instruction Sets: Addressing, x86 and ARM Addressing modes, Instruction Formats, x86 and ARM Instruction Formats, Assembly language. **08Hrs**

Unit III : Processor Structure and Function: Processor Organization, Register Organization, The Instruction Cycle, Instruction Pipelining, The x86 Processor Family, The ARM Processor. **08 Hrs**

Unit IV: Reduced Instruction Set Computers (RISCs): Instruction Execution Characteristics, The Use of Large Register File, Compiler-Based Register Optimization, RISC Architecture, RISC Pipelining. RISC versus CISC. **08 Hrs**

Unit V : Control Unit Operation: Micro-operations, Control of the Processor, Hardwired Implementation, Microprogrammed control, Basic Concepts, Microinstruction Sequencing & Execution. **08Hrs**

Unit VI: Parallel Processing: The Use of Multiple Processors, Symmetric Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Intel x 86 Multi-Core Organization. **08 Hrs**

Text Book:

William Stallings: “Computer Organization and Architecture”, (8/e) Pearson Education.

Reference Books:

1. Behrooz Parhami: “Computer Architecture”, Oxford University Press.
2. J.P. Hayes: “Computer Architecture and Organization” ,McGraw Hill.
3. D.A. Patterson, J.L. Hennessy: “Computer Architecture” Morgan Kauffmann, 2002.
4. Hwang and Briggs: “Computer Architecture and Parallel Processing” McGraw-Hill.

FREEELECTIVE-II**6FEKE05 (i) JAVA PROGRAMMING**

Unit I: Java features, Program Structures. Fundamentals of Java Programming, Primitive data types and operations, Selection statements, loops, Methods and Arrays in Java.

Unit II: Classes & Objects in Java, Creating Objects, Methods, Constructors, Class Variable and Methods, this keyword, Arrays of objects, String class, Character class, StringBuffer class, Command Line Arguments. File class, Text I/O.

Unit III: Inheritance: Inheritance vs. Aggregation, super keyword, final keyword, Method Overriding & overloading. Object class, ArrayList class. Protected data & methods, Final classes, methods & variables. Abstract classes and Interfaces.

Unit IV: CUI programming: GUI components, Java GUI API, frames, layout managers, Color class, Font class, Panels, Swing GUI components, Image icons. Graphics class, Polygon class.

Unit V: Event-Driven programming: Event & Event sources, Event delegation Model, Event listeners, registration and handling. Adapter classes, Inner Classes. Mouse events, Key events. Creating user interfaces: Buttons, Checkboxes, Radio buttons, Labels, Text Fields, Combo Boxes, Lists, Scroll Bars, Sliders.

Unit VI: Applets: Applet class and JApplet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint(), update() and repaint(), More about applet tag, getDocumentBase() and getCodeBase() methods.

Text Book:

Liang Y Daniel: Introduction to Java Programming, (Pearson-PHI)

Reference Books:

1. Herbert Schildt: Java Complete References (McGraw Hill)
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Khalid Mughal: A Programmer’s Guide to Java Certification, 3rd Edition (Pearson)
4. Sachin Malhotra & Saurabh Choudhary: Programming in Java, (OUP).

FREE ELECTIVE-II**6FEKE05 (ii) EXPERT SYSTEMS**

Unit I: Introduction: Definitions & importance. DP, MIS & DSS. Artificial Intelligence: overview. Evolution of expert Systems. Early expert systems: their characteristics, features& applications. Recent Expert systems: future Expert systems.

Unit II: Components of knowledge is ES. Knowledge representation methods. Representation via Rule-based systems. Knowledge acquisition & domain expert. Example, Knowledge acquisition via Rule Introduction. Software rule introduction.

Unit III: Inference engine: Role, Search strategies, Forward chaining algorithm. Backward chaining algorithm. Max modes. ES Modularity. Enhancements: Uncertainty concepts& approaches to uncertainty. Bridges in ES Explanation.

Unit IV: Validation: ES justification, rule-based validation. Performance verification. Case study. Hybrid ES: Defination. Importance. Examples of Hybrid ES, an overview of permutation search.

Unit V: ES departments: overview, development Languages’. ES shells. ES environments.ES hardware. Implementations: Overview milestone chart, software & hardware considerations monitoring, Maintenance & documentation.

Unit VI: Staffing & training: Overview, essential & supplemental tools. Justifications, organizational considerations. Oversight & evolution. ES & Heuristic programming. Future trends in expert systems. ES development flow diagram.

TextBook:

Igniazio James P.” Introduction to Expert Systems”, (McGraw Hill)

Reference Books:

1. Rolston “Expert System Design”, (Mc Grew Hill)
2. Hayes Roth “Expert System Design” , (Addison-Wesley)
3. Patterson “Artificial Intelligence & Expert Systems”, (PHI)

6KE06 PROFESSIONAL ETHICS

Unit I: Introduction: Computers in a Social Context. Moral and Legal Issues. Computer Ethical Issues. Philosophical Ethics: Descriptive and Normative Claims, Ethical Relativism, Utilitarianism, Deontological Theories, Rights, Virtue Ethics, Individual and Social Policy Ethics. Professional Ethics: Characteristics and system of Professions, Computing as Profession, Professional Relationships, Conflicting Responsibilities, Code of Ethics and Professional Conduct, Collective Responsibility. **08 Hrs**

Unit II : Ethics and The Internet: Three Morally Significant Characteristics, Hacking and Hacker Ethics, New Species of Old Crime, Netiquette, And Policy Approaches. Computers and Privacy issues, Legislative Background, Global Perspective, Proposals for Better Privacy Protection. Property Rights in Computer Software: Definitions, Current Legal Protection, Philosophical basis and analysis of Property, Proprietary Software, and Software Copying. **08 Hrs**

Unit III: Accountability, Computer and Information Technology: Different Senses of Responsibility, Buying and Selling Software, Y2K Problem, Diffusion of Accountability, Internet Issues, ISP Liability, and Virtual Action. Technology and Social change, Embedded Values, Enhanced and Impeded Values, Democratic Values in the Internet, Internet as Democratic Technology, Access and the Digital Divide, Free Expression, Overarching and Future Issues. **08Hrs**

Text Book:

Deborah G. Johnson: "Computer Ethics" Pearson Education (Third Edition).

Reference Books:

1. George Reynolds: "Ethics in Information Technology" Cengage Learning.
2. Hester and Ford: "Computers and Ethics in the Cyberge.".
3. Duncan Langford: "Internet Ethics"
4. Richard A. Spinello: "Case Studies in Information Technology Ethics" PHI.

6KE07 Operating Systems Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

6KE08 Database Systems Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units along with one mini project.

6KE09 Computer Lab-II (Hardware Lab): This lab is based on PC organization, troubleshooting & maintenance.

Student should perform practical on the following areas of PC:

1. PC models.
2. Inside the PC.
3. Preventive maintenance.
4. PC troubleshooting.
5. Semiconductor memories
6. Power supplies & power protection
7. Hard Disks: installing, configuring & maintenance
8. SCSI drives
9. Printers & their troubleshooting
10. Modems & serial interfaces, USB's and Devices.
11. Keyboard, Mice, Video adapters & displays
12. Sound boards, Video capture & CD ROMs.
13. Study of PC Ports & Interfacing Cards.

Books :

1. Mark Minasi : Complete PC upgrade & Maintenance Guide (BPB)
2. Scott Muller: Upgrading and Repairing PCs 12/e (Que)