

B.E. / B.Text/ B.Tech.

Prospectus No. 141712

Semester VII & VIII

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

Semester VII & VIII

(CREDIT GRADE SYSTEM)

BRANCHES

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



2013

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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 (relevant 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 deficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001.
Ordinance No. 9	: Conduct of Examinations (relevant 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 IN BACHELOR OF ENGINEERING
BRANCH - PRODUCTION ENGINEERING - SEMESTER PATTERN(CREDIT GRADE SYSTEM)

SEMESTER- SEVENTH

Appendix - A

			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code	Subject	HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			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	7PE01	PRODUCTION PLANNING & CONTROL	3	1	0	4	4	3	80	20	100	40	—	—	—	—
02	7PE02	COMPUTER AIDED DESIGN & MANUFACTURING	3	1	0	4	4	3	80	20	100	40	—	—	—	—
03	7PE03	INDUSTRIAL MANAGEMENT AND COSTING	3	1	0	4	4	3	80	20	100	40	—	—	—	—
04	7PE04	PROFESSIONAL ELECTIVE - I	3	0	0	3	3	3	80	20	100	40	—	—	—	—
05	7PE05	PROFESSIONAL ELECTIVE - II	3	0	0	3	3	3	80	20	100	40	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
06	7PE06	COMP. AIDED DESIGN & MANUFAC.- LAB.	0	0	2	2	1						25	25	50	25
07	7PE07	PROFESSIONAL ELECTIVE - I - Lab.	0	0	2	2	1	—	—	—	—	—	25	25	50	25
08	7PE08	PROFESSIONAL ELECTIVE - II - Lab.	0	0	2	2	1	—	—	—	—	—	25	25	50	25
09	7PE09	INDUSTRIAL TRAINING	0	0	0	0	2	—	—	—	—	—	—	50	50	25
10	7PE10	PROJECT & SEMINAR	0	0	2	2	4	—	—	—	—	—	—	50	50	25
		TOTAL	15	3	8	26	27				500				250	
													TOTAL		750	

ELECTIVE - I

- 01 MECHTRONICS
02 INDUSTRIAL ROBOTICS

- 03 FLEXIBLE MANUFACTURING SYSTEM
04 ARTIFICIAL INTELIGENCE AND EXPERT SYSTEM

ELECTIVE - II

- 01 LOW COST AUTOMATION
02 ADVANCE TOOL AND DIE DESIGN
03 ADVANCED WELDING TECHNOLOGY
04 FINITE ELEMENT ANALYSIS

SEMESTER : EIGHTH

THEORY																
01	8PE01	PROFESSIONAL ELECTIVE - III	3	0	0	3	3	3	80	20	100	40	—	—	—	—
02	8PE02	PROCESS ENGINEERING	3	0	0	3	3	3	80	20	100	40	—	—	—	—
03	8PE03	PROFESSIONAL ELECTIVE - IV	3	0	0	3	3	3	80	20	100	40	—	—	—	—
04	8PE04	OPERATION RESEARCH TECHNIQUE	3	1	0	3	3	3	80	20	100	40	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
05	8PE05	PROCESS ENGINEERING - Lab.	0	0	2	2	1	—	—	—	—	—	25	25	50	25
06	8PE06	PROFESSIONAL ELECTIVE- IV LAB	0	0	2	2	1	—	—	—	—	—	25	25	50	25
07	8PE07	OPERATION RESEARCH TECHNIQUE - Lab.	0	0	2	2	1						25	25	50	25
08	8PE08	*PROJECT & SEMINAR	0	0	6	6	12	—	—	—	—	—	75	75	150	75
		TOTAL	12	1	12	24	27				400				300	
													TOTAL		700	

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH- ELECTRONICS & TELICOMMUNICATION ENGINEERING -SEMESTER PATTERN(CREDIT GRADE SYSTEM)

SEMESTER- SEVENTH

Appendix - B

			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code		HOURS / WEEK			Total HOURS/WEE	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	7XT1	Data Communication Network	4	-	-	4	4	3	80	20	100	40	-	-	-	-
02	7X12	Microcontroller and Applications	4	1	-	5	5	3	80	20	100	40	-	-	-	-
03	7XT3	Digital Signal Processing	4	1	-	5	5	3	80	20	100	40	-	-	-	-
04	7XT4	Professional Elective-I	4	-	-	4	4	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
05	7XT5	Microcontroller and Applications Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
06	7XT6	Digital Signal Processing Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
07	7XT7	Simulation Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	7XT8	Project and Seminar	-	-		2	4					-	-	50	50	25
		TOTAL	16	2	6	26	25				400				200	
Professional Elective-I: 1. VLSI Design 2. Computer Organization 3. Artificial Intelligence 4. Satellite & Optical Fibre communication 5. Audio & Video Engineering													TOTAL		600	

Semester : Eighth

THEORY																
01	8XT1	UHF and Microwaves	4	1	-	5	5	3	80	20	100	40	-	-	-	-
02	8XT2	Electronics Circuit Design	4	1	-	5	5	3	80	20	100	40	-	-	-	-
03	8XT3	Wireless Communication	4	-	-	4	4	3	80	20	100	40	-	-	-	-
04	8XT4	Professional Elective-II	4	-	-	4	4	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
05	8XT5	UHF & Microwaves Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
06	8XT6	Electronics Circuit Design Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
07	8XT7	Project and Seminar	-	-	-	6	12	-	-	-	-	-	75	75	150	75
		TOTAL	16	2	4	28	32	-	-	-	400	-	-	-	250	
Professional Elective-II: 1. Biomedical Engineering 2. Digital Image Processing 3.. ARM system development and design 4. Embedded and Real time system 5.Smart sensors													TOTAL		650	

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH- ELECTRONICS ENGINEERING -SEMESTER PATTERN(CREDIT GRADE SYSTEM)

SEMESTER- SEVENTH

Appendix - C

			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code		HOURS / WEEK			Total HOURS/WEE	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMEN	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
													EXNERNAL	INTERNAL		
THEORY																
01	7XN1	Computer Organization	4			4	4	3	80	20	100	40	–	–	–	–
02	7XN2	Microcontroller and Applications	4	1		5	5	3	80	20	100	40	–	–	–	–
03	7XN3	Digital Signal Processing	4	1		5	5	3	80	20	100	40	–	–	–	–
04	7XN4	Professional Elective-I	4			4	4	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
05	7XN5	Microcontroller and Applications Lab			2	2	1	–	–	–	–	–	25	25	50	25
06	7XN6	Digital Signal Processing Lab			2	2	1	–	–	–	–	–	25	25	50	25
07	7XN7	Simulation Lab			2	2	1	–	–	–	–	–	25	25	50	25
08	7XN8	Project and Seminar				2	4					–	–	50	50	25
		TOTAL	16	2	6	26	25				400				200	

Professional Elective-I: 1. Nanoelectronics 2. Mechatronics 3. Digital Instrumentation 4. Integrated Optics & Photonic Systems 5. Wireless Communication 6. Speech Processing

TOTAL

600

Semester : Eighth

THEORY																
01	8XN1	UHF and Microwaves	4	1		5	5	3	80	20	100	40	–	–	–	–
02	8XN2	Electronics Circuit Design	4	1		5	5	3	80	20	100	40	–	–	–	–
03	8XN3	VLSI Design	4			4	4	3	80	20	100	40	–	–	–	–
04	8XN4	Professional Elective-II	4			4	4	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
05	8XN5	UHF & Microwaves Lab			2	2	1	–	–	–	–	–	25	25	50	25
06	8XN6	Electronics Circuit Design and VLSI Design Lab			2	2	1	–	–	–	–	–	25	25	50	25
07	8XN7	Project and Seminar				6	12						75	75	150	75
		TOTAL	16	2	4	28	32				400				250	

Professional Elective-II: 1. System on Chip 2. Digital Signal Processors 3.. Artificial Intelligence & Robotics 4. Digital Image Processing 5. Digital Communication 6. Smart Sensors & Networks

TOTAL

650

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH - INSTRUMENTATION ENGINEERING -SEMESTER PATTERN(CREDIT GRADE SYSTEM)

Appendix - D

SEMESTER- SEVENTH

			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code		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	7IE01	PLC & SCADA Systems	4	–	–	4	4	3	80	20	100	40	–	–	–	–
02	7IE02	Computer Aided Control	4	–	–	4	4	3	80	20	100	40	–	–	–	–
03	7IE03	Instrument & System Design	4	1	–	5	5	3	80	20	100	40	–	–	–	–
04	7IE04	Project Planning Estimation & Assessment	4	–	–	4	4	3	80	20	100	40	–	–	–	–
05	7IE05	Professional Elective-I	4	–	–	4	4	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
06	7IE06	PLC & SCADA Systems-Lab.			2	2	1						25	25	50	25
07	7IE07	Project Planning Estimation & Assessment-Lab.			2	2	1						25	25	50	25
08	7IE08	Project and Seminar	–	–	2	2	4					–	–	50	50	25
		TOTAL	20	1	6	27	27				500				150	
Professional Elective-I: 1)Fuzzy Logic and Neural Network 2) Robotics & Automotion 3) Digital Signal Processing 4) Instrumentation for Agriculture and Food Processing																
TOTAL 650																
Semester : Eighth																
THEORY																
01	8IE01	Process Modeling and Optimization	4	1	–	5	5	3	80	20	100	40	–	–	–	–
02	8IE02	Process Instrumentation	4	–	–	4	4	3	80	20	100	40	–	–	–	–
03	8IE03	Professional Elective-II	4	–	–	4	4	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
04	8IE04	Process Modeling and Optimization-Lab.	–	–	2	2	1		–	–	–	–	25	25	50	25
05	8IE05	Process Instrumentation-Lab.	–	–	2	2	1		–	–	–	–	25	25	50	25
06	8IE06	Project and Seminar	–	–	6	6	12						75	75	150	75
		TOTAL	12	1	10	23	27				300				250	
Professional Elective-II:1)Environmental Instrumentation, 2)Advance Biomedical Instrumentation, 3) Power Plant Instrumentation , 4) Opto Electronics Instrumentation																
TOTAL 550																

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH - COMPUTER SCIENCE & ENGINEERING -SEMESTER PATTERN(CREDIT GRADE SYSTEM)
SEMESTER- SEVENTH

Appendix - E

			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
Sr. No.	Subject Code	Subject	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
THEORY																
01	7KS01	Digital Signal Processing	4	—	—	4	4	3	80	20	100	40	—	—	—	—
02	7KS02	Computer Networks	4	—	—	4	4	3	80	20	100	40	—	—	—	—
03	7KS03	Design & Analysis of Algorithms	4	—	—	4	4	3	80	20	100	40	—	—	—	—
04	7KS04	Object Oriented Analysis & Design	4	—	—	4	4	3	80	20	100	40	—	—	—	—
05	7KS05	Professional Elective I*	4	—	—	4	4	3	80	20	100	40	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
06	7KS06	Digital Signal Processing Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
07	7KS07	Design & Analysis of Algorithms Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
08	7KS08	Object Oriented Analysis & Design Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
09	7KS09	Project & Seminar	—	—	2	2	4	—	—	—	—	—	50	50	25	25
		TOTAL	20	—	8	28	27				500				200	

TOTAL 700

Professional Elective I* (i) Computer Graphics (ii) Multimedia Technologies (iii) Web Engineering (iv) Human Computer Interface

Semester :EIGHTH																
THEORY																
01	8KS01	Artificial Intelligence	3	—	—	3	3	3	80	20	100	40	—	—	—	—
02	8KS02	Embedded Systems	4	—	—	4	4	3	80	20	100	40	—	—	—	—
03	8KS03	Software Engineering	3	—	—	3	3	3	80	20	100	40	—	—	—	—
04	8KS04	Professional Elective II*	3	—	—	3	3	3	80	20	100	40	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
05	8KS05	Artificial Intelligence -Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
06	8KS06	Embedded Systems -Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
07	8KS07	Project & Seminar			6	6	12						75	75	150	75
		TOTAL	13	—	10	23	27				400				250	

TOTAL 650

Professional Elective II* (i) Distributed Computing (ii) Mobile Computing (iii) Soft Computing (iv) Network Security

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH - COMPUTER ENGINEERING -SEMESTER PATTERN(CREDIT GRADE SYSTEM)
SEMESTER- SEVENTH

Appendix - F

			TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
Sr. No.	Subject Code	Subject	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	
THEORY																	
01	7KE01	Signals & Systems	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
02	7KE02	Computer Network	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
03	7KE03	Microprocessors & Interfacing	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
04	7KE04	Mobile Computing	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
05	7KE05	Professional Elective I*	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
PRACTICALS / DRAWING / DESIGN																	
06	7KE06	Computer Network- Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
07	7KE07	Microprocessors & Interfacing Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
08	7KE08	Mobile Computing -Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
09	7KE09	Project & Seminar			2	2	4	–	–	–	–	–	50	50	50	–	
		TOTAL	18	2	8	28	27				500				200		
														TOTAL		700	
Professional Elective I* (i) Artificial Intelligence (ii) Computer Graphics (iii) Design & Analysis of Algorithms (iv) Human Computer Interaction																	
Semester :EIGHTH																	
THEORY																	
01	8KE01	Digital Signal Processing	3	–	–	3	3	3	80	20	100	40	–	–	–	–	
02	8KE02	Embedded Systems	3	–	–	3	3	3	80	20	100	40	–	–	–	–	
03	8KE03	Software Engineering	3	–	–	3	3	3	80	20	100	40	–	–	–	–	
04	8KE04	Professional Elective II*	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
PRACTICALS / DRAWING / DESIGN																	
05	8KE05	Digital Signal Processing Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
06	8KE06	Embedded Systems Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
07	8KE07	Project & Seminar	–	–	6	6	12	–	–	–	–	–	75	75	150	75	
		TOTAL	13	–	10	23	27				400				250		
														TOTAL		650	

Professional Elective II* (i) Network Security (ii) Multimedia Technologies (iii) Expert System Design (iv) Soft Computing

Professional Elective-I (*) : (i) Advanced Nonwoven Technology (ii) Advanced Knitting Technology

Semester : Eighth

Professional Elective-II : (i) Technical Textiles (ii) New Fibre Science

			TEACHING SCHEME			
			HOURS / WEEK			CREDITS
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	
THEORY						
01	7CH01	Chemical Engineering Operations-III (Mass Transfer-II)	3	1	–	4
02	7CH02	Chemical Reaction Engineering-I	3	1	–	4
03	7CH03	Process Dynamics & Control	3	1	–	4
04	7CH04	Professional Elective (*) -I	3	–	–	3
05	7CH05	Plant Design & Project Engineering	3	–	–	3
PRACTICALS / DRAWING / DESIGN						
06	7CH06	Chemical Engineering Operations-III (Mass Transfer-II)-Lab	–	–	2	2
07	7CH07	Chemical Reaction Engineering-I-Lab	–	–	2	2
08	7CH08	Process Dynamics & Control-Lab	–	–	2	2
09	7CH09	Professional Elective I-lab	–	–	2	2
10	7CH10	Industrial Training	–	–	–	1
11	7CH11	Project & Seminar	–	–	2	2
		TOTAL	15	3	10	28

EXAMINATION SCHEME								
THEORY					PRACTICAL			
DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
					EXTERNAL	INTERNAL		
3	80	20	100	40	–	–	–	–
3	80	20	100	40	–	–	–	–
3	80	20	100	40	–	–	–	–
3	80	20	100	40	–	–	–	–
3	80	20	100	40				

–	–	–	–	–	25	25	50	25
–	–	–	–	–	25	25	50	25
–	–	–	–	–	25	25	50	25
					25	25	50	25
					0	50	50	25
					0	50	50	25
			500				300	
					TOTAL			

Professional Elective * -I 1) Industrial Waste Treatment 2) New Separation Techniques 3) Optimisation of Chemical processes4) Polymer Science & Technology										TOTAL										500	
Semester : Elgth																					
THEORY																					
01	8CH01	Transport Phenomena	3	1	_	4	4	3	80	20	100	40	_	_	_	_					
02	8CH02	Chemical Reaction Engineering-II	3	1	_	4	4	3	80	20	100	40	_	_	_	_					
03	8CH03	System Modelling	3	_	_	3	3	3	80	20	100	40	_	_	_	_					
04	8CH04	Professional Elective-II	3	_	_	3	3	3	80	20	100	40	_	_	_	_					
PRACTICALS / DRAWING / DESIGN																					
05	8CH05	Professional Elective-II -Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25					
06	8CH06	Project & Seminar	_	_	6	6	12	_	_	_	_	_	75	75	150	75					
		TOTAL	12	2	8	22	27				400				200						
										TOTAL										600	

Professional Elective-II 1) Petroleum Processing Technology 2) Corrosion Engineering 3) Biochemical Engineering 4) Petroleum Refinery Engineering 5) Bio Fuels 6) Industrial Piping 7) Wine Making 8) Petrochemical Technology 9) Energy Technology & Management 10) Energy & Environment

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH - POLYMER (PLASTIC) TECHNOLOGY - SEMESTER PATTERN(CREDIT GRADE SYSTEM)
SEMESTER- SEVENTH

Appendix - I

			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 Assessment	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks		
													External	Internal				
THEORY																		
01	7PP01	Polymer Processing I	3	1	–	4	4	3	80	20	100	40	–	–	–	–		
02	7PP02	Polymer Reaction Engineering	3	1	–	4	4	3	80	20	100	40	–	–	–	–		
03	7PP03	Structure Property Relationship in Polymers	4	–	–	4	4	3	80	20	100	40	–	–	–	–		
04	7PP04	Professional Elective-I	3	–	–	3	3	3	80	20	100	40	–	–	–	–		
05	7PP05	Plant Design & Project Engineering	3	–	–	3	3	3	80	20	100	40	–	–	–	–		
PRACTICALS / DRAWING / DESIGN																		
06	7PP06	Polymer Processing-I-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25		
07	7PP07	Polymer Reaction Engineering-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25		
08	7PP08	Professional Elective-I-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25		
09	7PP09	Industrial Training	–	–	–	–	2	–	–	–	–	–	–	50	50	25		
10	7PP10	Project & Seminar	–	–	2	2	4	–	–	–	–	–	–	50	50	25		
		TOTAL	16	2	8	26	27				500				250			
															TOTAL		750	

Professional Elective-I 1) Polymer Blends & Composites 2) Packaging Technology

Semester : Eighth																
THEORY																
01	8PP01	Polymer Processing II	3	–	–	3	3	3	80	20	100	40	–	–	–	–
02	8PP02	Polymer Viscoelasticity & Rheology	3	–	–	3	3	3	80	20	100	40	–	–	–	–
03	8PP03	Professional Elective-II	3	–	–	3	3	3	80	20	100	40	–	–	–	–
04	8PP04	Mould Design for Plastics	3	–	–	3	3	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
05	8PP05	Polymer Processing II	–	–	2	2	1	–	–	–	–	–	25	25	50	25
06	8PP06	Professional Elective-II	–	–	2	2	1	–	–	–	–	–	25	25	50	25
07	8PP07	Mould Design for Plastics-Lab	–	–	2	2	1	–	–	–	–	–	–	50	50	25
08	8PP08	Project & Seminar	–	–	6	6	12	–	–	–	–	–	75	75	150	75
		TOTAL	12	–	12	24	27				400				300	
															TOTAL	700

Professional Elective-II 1) Testing & Product Design for Plastics 2) Surface Coating Tech.

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING

BRANCH - FOOD, PULP & PAPER, OIL & PAINT AND PETROCHEMICAL TECHNOLOGY - SEMESTER PATTERN (CREDIT GRADE SYSTEM)

SEMESTER - SEVENTH

Appendix - J

			TEACHING SCHEME					EXAMINATION SCHEME									
Sr. No.	Subject Code	Subject	HOURS / WEEK				CREDITS	THEORY					PRACTICAL				
			Lecture	Tutorial	P/D	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	7 CT 01	Mass Transfer	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
02	7 CT 02	Chemical Reaction Engineering -I	3	–	–	3	3	3	80	20	100	40	–	–	–	–	
03	7 FT 03	Food Technology - IV	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	7 PT 03	Pulp & Paper Technology - IV	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	7 OT 03	Oil & Paint Technology - IV	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	7 PC 03	Petrochemical Technology - IV	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
04	7 CT 04	Professional Elective – I (*)	3	–	–	3	3	3	80	20	100	40	–	–	–	–	
05	7 FT 05	Food Technology -V	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	7 PT 05	Pulp & Paper Technology -V	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	7 OT 05	Oil & Paint Technology -V	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	7 PC 05	Petrochemical Technology -V	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
PRACTICALS / DRAWING / DESIGN																	
06	7 CT 06	Mass Transfer -Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
07	7 CT 07	Chemical Reaction Engineering I-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
08	7 FT 08	Food Technology - IV-Lab	–	–	4	4	2	–	–	–	–	–	25	25	50	25	
	7 PT 08	Pulp & Paper Technology - IV-Lab	–	–	4	4	2	–	–	–	–	–	25	25	50	25	
	7 OT 08	Oil & Paint Technology - IV-Lab	–	–	4	4	2	–	–	–	–	–	25	25	50	25	
	7 PC 08	Petrochemical Technology - IV-Lab	–	–	4	4	2	–	–	–	–	–	25	25	50	25	
09	7 CT 09	Professional Elective - I-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
10	7 CT 10	Project & Seminar	–	–	2	2	4	–	–	–	–	–	0	50	50	25	
		TOTAL	16	2	12	30	27				500				250		
														TOTAL		750	
Professional Elective – I (*): 1) Corrosion Engg. 2) Polymer Science & Engg. 3) Manmade Fibre Technology 4) Industrial Waste Treatment																	
Semester : Elgth																	
01	8 FT 01	Food Technology -VI	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	8 PT 01	Pulp & Paper Technology -VI	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	8 OT 01	Oil & Paint Technology -VI	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
	8 PC 01	Petrochemical Technology -VI	3	1	–	4	4	3	80	20	100	40	–	–	–	–	
02	8 CT 02	Chemical Reaction Engineering -II	3	–	–	3	3	3	80	20	100	40	–	–	–	–	
03	8 CT 03	Plant Desgin & Project Engineering	3	–	–	3	3	3	80	20	100	40	–	–	–	–	
04	8 CT 04	Professional Elective – II (*)	3	–	–	3	3	3	80	20	100	40	–	–	–	–	

PRACTICALS / DRAWING / DESIGN																	
05	8 FT 05	Food Technology -VI-Lab	–	–	4	4	2		–	–	–	–	–	25	25	50	25
	8 PT 05	Pulp & Paper Technology -VI-Lab	–	–	4	4	2		–	–	–	–	–	25	25	50	25
	8 OT 05	Oil & Paint Technology -VI-Lab	–	–	4	4	2		–	–	–	–	–	25	25	50	25
	8 PC 05	Petrochemical Technology-VI-Lab	–	–	4	4	2		–	–	–	–	–	25	25	50	25
06	8 CT 06	Project & Seminar	–	–	6	6	12		–	–	–	–	–	75	75	150	75
		TOTAL	12	1	10	23	27					400				200	
																TOTAL	600
Professional Elective – II (*): 1) Biochemical Engg. 2) Petroleum Processing Engg. 3) Fuel Technology																	

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

SEVENTH SEMESTER

7PE01 PRODUCTION PLANNING AND CONTROL

Lecture: 03 Hrs/ w

Internal Assessments: 20

Tutorial: 01 Hrs/ w

University Exam: 80

Credits: 04

Course Objectives:.

- Ç Identify the need to learn about the various functions in production planning and control to better manage manufacturing and/or service systems.
- Ç Providing men, machines, materials etc. of right quality, quantity and also providing them at the right time forms a very important factor.
- Ç Show how qualitative and quantitative forecasting techniques can be used in short, medium, and long range forecasting.
- Ç To Develop material requirements plans (MRP-I) and manufacturing resource plans (MRP-II) as part of resource requirements planning systems.
- Ç Show how various heuristic decision rules can be used to make lot-sizing decisions.
- Ç To Develop quantitative models to manage independent demand inventory systems.

SECTION-A

UNIT-I: Introduction: Objectives and advantages of PPC, production procedure, functions of PPC, production consumption cycle, centralised & decentralised PPC, Prerequisites of PPC, types of PPC systems.

Scheduling: Introduction, inputs of scheduling, loading and scheduling devices, factors influencing scheduling, procedure for scheduling, techniques of Scheduling. (7)

UNIT-II: Production Forecasting : Introduction, definition, importance of forecasts, qualitative model ; Delphi Technique, quantitative models : simple moving average, weighted moving average, simple exponential smoothing. Forecasting error MAD, MSB, BIAS, Tracking signal, Deviation and selection of forecasting model. Types of Forecasts: constant, linear, cyclic forecasts.
Verification and Controlling : The moving range chart, average MR, out of control condition. (7)

UNIT-III: Production Planning : The production order, procedure for formulating order production order, Master Programmer, Basic problems in production planning, quantities in batch production, criteria for batch size determination, minimum cost batch size, production Range, maximum profit batch size, maximum return, maximum rate of return, economic batch size. (7)

SECTION-B

UNIT-IV: Machine Output : Machine output, multimachine supervision by one operator, machine interference, Ashcroft tables, average number of consecutive servicing task, the Ashcroft Number. (7)

UNIT-V: Analytical Structure of Inventory : Definition of inventory, types of inventory and its classification, structure of inventory problems and its analysis, the Relevant cost, objectives of carrying inventories, selective inventory analysis. (ABC analysis)

Deterministic Model: Elementary model [Wilson, Harris model], Shortage Modes of inventory & production models (7)

UNIT-VI: i) Probabilistic inventory Model : Static inventory model .Safety stock determination, estimation of safety stock requirements .Purchase inventory model -basic cost equation, purchase inventory model with price breaks. ÆPösystem and ÆQösystem.
iii) Material Requirement Planning (MRP) : Introduction to MRP, manufacturing resource planning (MRP-II), just in time, Pull system & Push system, Kanban, recent trends in MRP & MRP-II. (7)

TEXT BOOKS :

- 1 Elements of Production Planning and Control by Simuel Eilon Macmillan.
- 2 Production Planning and Control and Management - K.C.Jain & L.N.Agrawal
- 3 Production Systems Planning and Analysis & Control ñ James L.Riggs.

REFERENCE BOOKS

1. Production Control - John E Biegal - Prentice Hall
2. Production Management- Hedge - John Wiley.
3. Inventory Control, Theory & Practice - Starr & Miller.
4. Scientific Inventory Management - Buchan & Kenigshery ñ Prentice Hall.
5. Production and Operations Management - Chunawala & Patel, Himalaya PUblication House.
6. Production and Operations Mgt. - E.E.Adam, Jr.R.J.Ebert ñ Prentice Hall of India.

7. Production Planning and Inventory Control - S.L.Narasimhan, D.W.Mcleavey, P.J.Billingten - PHI
8. Operation Research by Prem Kumar Gupta and D S Hiraô

7PE02 COMPUTERAIDED DESIGN AND MANUFACTURING

Lecture: 03 Hrs/ w

Internal Assessments: 20

Tutorial: 01 Hrs/ w

University Exam: 80

Credits: 04

Course Objectives:

- Ç To become aware of application of computers in development of geometric models using Computer Aided
- Ç Design and use of these models for Design and Analysis, Planning and Organizing Manufacturing Activity and the Control of Machines for manufacturing the product.
- Ç To understand and relate the product design cycle to product manufacturing through experiential learning;
- Ç To introduce concepts in Planning and Organizing Manufacturing Activity and the Control of Machines.
- Ç To use design optimization methods effectively and variety of manufacturing processes, including NC machining, FMS, CIM, PLM and PDM

SECTION-A

UNIT-I: Introduction to CAD/CAM: Definition, applications, types of CAD systems, benefits of CAD, design process, application of computer for design, creating the manufacturing data base, hardware in CAD.

Computer graphics software and data base, graphics system and functions of graphics package, Interactive computer graphics for CAD/CAM applications, configuration of graphic work station, techniques of image generation and types of graphics terminals, colour monitors, input/output devices (07)

UNIT-II: Transformations: Introduction, Formulation, Translation, Rotation, Scaling, Reflections, Homogeneous Representation and Concatenation. Mapping of Geometric Models. Constructing the geometry, database structure and content, wire frame, surface and solid modeling. Computer aided drafting and documentation, principles and concepts of automated drafting, drafting packages, animation concept in graphics, concept of virtual manufacturing and virtual reality. Introduction to PC based and high end packages like AutoCAD / Pro E and their applications. (07)

UNIT-III: Graphics Standards: Introduction, standards for graphics programming GKS, data exchange formats, general file structure, IGES, DXF.

Finite element Modeling and Analysis: Introduction, General steps involved in FEA, Types of analysis, degree of freedom, Elements and structure stiffness equations for Spring, Spar & Beam. Plane stress / Plane strain FEA, Assembly of elements, Introduction to FEA packages, General structure of FEA procedure. Architecture of FE software, Applications of FEA.ô (07)

SECTION-B

UNIT-IV: NC Machines : Introduction, components of NC system, NC procedure, NC co-ordinate system, NC motion control system, MCU & other components of NC system, M/C tool application & other applications, economics of NC. NC part programming : punched tape & tape formats, methods of NC part programming, Computer assisted part programming, language, MACROS. (07)

UNIT-V: Manual data input, DNC, CNC Part programming & adaptive control.

Robot technology : Robot physical configuration, basic robot motions, technical features, elements of robotic system, types of industrial robots, robot application.

Flexible manufacturing system : Types of FMS, components & FMS, production equipment, support system, material handling system, Automated Guided Vehicles, automated storage & retrieval system, FMS application & benefits (07)

UNIT-VI: Computer integrated manufacturing : Introduction, major elements of CIM, development of CIM, design aspects of CIM, CIM planning & implementation process.

Concurrent Engineering: Introduction, concept, principles, traditional versus concurrent approach, schemes and tools of concurrent Engg., application of computers in practice of concurrent Engg., approach in manufacturing systems. (07)

TEXT BOOKS :

- 1) CAD/CAM Principles and Applications by Dr. P. N. Rao, Tata McGraw-Hill.
- 2) MASTERING CAD CAM By Ibrahim Zeid, 2005, TMH, ISBN 0-07-059411-2
- 3) CAD/CAM by Mickel Groover, PHI

REFERENCE BOOKS

- 1) Computer Integrated Design & Manufacturing by David Bedworth, McGraw Hill.

- 2) CAD/CAM/CIM by P.Radhakrishnan, S.Subramanyam, New Age Int. Pub.
- 3) Automation, Production System and Computer Integrated Manufacturing by M.P.Groover, PHI
- 4) Finite Element Methods vs. Classical Methods by New Age Publishers, India.
- 5) Introduction to the Finite Element Method by C. S. Desai & J. F. Abel, CBC Pub.
- 6) Concept And Applications of FEA by Robert D. Cook, John Wiley & Sons.
- 7) CAD/CAM Theory and Practice by Ibrahim Zeid, Tata Mc, Graw-Hill, New Delhi.

7PE03 INDUSTRIAL MANAGEMENT & COSTING

Lecture: 03 Hrs/ w

Internal Assessments: 20

Tutorial: 01 Hrs/ w

University Exam: 80

Credits: 04

Course Objectives:

- Ç To develop a student's skills in supervision of any activity.
- Ç To equip the student with skills necessary for effective communication.
- Ç To enable a student use the available resources to achieve the desired goal in a more efficient and effective way.
- Ç To study concept of cost accounting terminology, job costing, process costing, activity-based costing, activity-based management, standard costing, variance analysis, and decision making.
- Ç Estimation of machining time, estimation of fabrication cost, forging cost, etc.

SECTION-A

UNIT-I: Business Management: Meaning of business, Business system, Business organization, Forms of Business organization, Concept of management science, Evolution of management thought, Scientific management (Taylorism), Modern management (Fayolism), Principles of management, Administration Vs. Organisation, Functions of management, Planning & Decision making, Organisation structure & relationships, Delegation, Decentralization, Communication, Direction, Coordination, Motivation and Control. (8)

UNIT-II: Marketing and Sales Management: Marketing strategy, Market research, Buying motives, Types of markets, New product development, Product life cycle, Product presentation & its effect on consumer, Sales organisation, Advertising, Method of selling, Sales performance objectives.

International Marketing: Introduction to international marketing, International Marketing decisions, Practices & Problems of international marketing, Import & Export procedure. (7)

UNIT-III: I) Personnel Management: Human resource planning, personnel research, Recruitment, training and development workers participation in management, joint consultation, collective bargaining.

II) Materials Management: Classes of materials, scope of material control, scope and function of purchasing department, purchasing procedure, inventory control, ordering procedure, material identification, store function. (7)

SECTION-B

UNIT-IV: Estimation : Objectives, functions, principle factors, miscellaneous and estimating procedure. Estimation of weights and materials, Estimation of machining time, estimation of fabrication cost, forging cost, foundry cost. (7)

UNIT-V: Introduction to costing and costing Techniques:- Definitions, objectives, elements of costs, components of cost, job costing, simple process costing, normal and abnormal losses in process, waste, scrap. (7)

UNIT-VI: i) Financial Statement: Profit and loss statement, balance sheet.

ii) Financing of business: Basis of business finance, need of finance, Kinds of capital, sources of fixed & Working capital.

iii) Depreciation Analysis: Causes & significance, method of calculation of depreciation. (7)

TEXT BOOKS:

1. Industrial Engineering & Management - O.P.Khanna.
2. Business & Ind. Organisation and Marketing Management - S.A.Sherlekar & V.S.Sherlekar.
3. Estimating & Costing - T.R.Banga & S.C.Sharma.

REFERENCE BOOKS

1. Principles on Marketing Management - Philip Kotler.
2. Personnel Mqs & Ind. Relations - C.B.Mammoria.
3. Business Organisation - N.C.Shukla
4. Principles & Practice of Cost Accounting - N.N.Prasad.
5. Cost Accounting - Bhar.
6. Estimating and Costing - TTTI Madras.

**PROFESSIONAL ELECTIVE – I
(01) MECHATRONICS**

Lecture: 03 Hrs/ w

Tutorial: ____

Internal Assessments: 20

University Exam: 80

Credits: 03

Course Objectives:

- Ç Understand the importance of the integration of modeling and controls in the design of mechatronic systems.
- Ç Understand industrial motion control: types of controllers, tuning of controllers, and position/velocity control loops with encoders/resolvers.
- Ç Understand the characteristics and models of various electromechanical actuators (brushed dc
- Ç Motor, brushless dc motor, and stepper motor) and MEMS.

SECTION-A

UNIT-I: Introduction to Mechatronics Scope of Mechatronics, Basics of sensors and transducers, Selection, Contact and non Contact, Optical types, performance, examples. Actuators and Drives used in Robots. (6)

UNIT-II: Computer Process Control Computer process interface, interface hardware. Direct Digital control, Supervisory Computer Control. (6)

UNIT-III: Design of Mechatronic elements Measuring System, Control Software and user interface, Gauging, Tool Monitoring System, Spindle drives, feed drives, Servo principles, Configuration CNC System, Interfacing, Monitoring, Diagnostics. (6)

SECTION-B

UNIT-IV: Automatic loading & unloading devices, their purpose, Magazines, Bunkers, Orientation, Mechanism Unit Heads, Automatic production lines. (6)

UNIT-V: MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS): Introduction to MEMS, Manufacturing processes of MEMS- Photolithography, Surface Micromachining, and Bulk Micromachining. MEMS Applications- Micro sensors and its applications, accelerati sensors, microscopic actuators, printer head^ micro-Fluidic MEMS, Ine, MEMS, Fluidics MEMS, Optical MEMS, RF MEMS. Advantages of MEMS and Trends and scope in MEMS. (6)

UNIT-VI: Digital Electronics: Introduction, LOGICAL Gates, Arithmetic circuits: Adder, Substractors Encoders and Decoders ,Flip-lops,

Registers, counters Memories ò Magnetic, Optical disc memories and semiconductor Memories. Microcontrollers. (6)

TEXT BOOKS:

- 1) Mechatronics by HMT, Tata McGraw Hill.
- 2) Introduction to Mechatronics & Measurement System by M B. Histan & David G.Aiciatore McGraw Hill.
- 3) Mechatronics by M.D.Singh&J.QJoshi, Prentice-Hall of India.

REFERENCES BOOKS:

- 1) Automation, Production System and CIM by M.P.Groover, PHI
- 2) Automation by Maleev, MIR Publication.
- 3) Industrial Automation by Turgam, MIR Publication.
- 4) Pneumatics & Hydraulics by Steward.
- 5) CMTI Handbook by CMTI.
- 6) MEMS: Advanced materials and fabrication methods - National Research Council (NRC) committee report, 1997
- 7) Nano- and Microelectromechanical Systems: Fundamentals of Nano- and Micro engineering - S. E. Lyshevski
- 8) Principles of micro fabrication-Marc Madou.
- 9) Micro sensors-J.W. Gardner.
- 10) Mechatronics by R.K.Rajput, S.Chad and Co.Ltd.ô

**PROFESSIONAL ELECTIVE – I
(02) INDUSTRIAL ROBOTICS**

Lecture: 03 Hrs/ w

Tutorial: ____

Internal Assessments: 20

University Exam: 80

Credits: 03

COURSE OBJECTIVES:

- Ç Introduction to Robotics & Automation and applications
- Ç Classify industrial robots by kinematic structure, work envelope, control system and actuation
- Ç Understand the difference in construction & application of various sensors used in robotic & automation systems
- Ç Examine common robotic and automated systems components such as actuators, power transmission systems and grippers
- Ç Mathematically analyse planar & simple spatial robotic systems for position control

SECTION - A

Unit 1: Introduction to Robotics: Automation and robotics, robot anatomy, Development of industrial Robots and manipulators, basic structure of robots, resolution, accuracy and repeatability. Classification, Configuration of robots, arm and body motions, wrist motions, mechanical, hydraulic and pneumatic Manipulators. (7)

- Unit II: Kinematics and Dynamics of Robot Arms:** The direct kinematics problem, the inverse kinematic solution, Homogeneous transformation. Denavit - Hartenberg's convention for dynamic analysis of Joints, Global & Local Coordinates for analysis. Advanced synthesis of planar mechanisms for ISP, MSP and FSP, Burmester theories and analytical techniques, Applications, Lagrange-Euler formation, generalized D'Alembert equations of motion, Spatial mechanisms. Axodes, kinematics of open and closed loop mechanisms. (7)
- Unit III: Robot Grippers:** Classification, Design consideration, Materials for hostile operation. cylindrical Cam type; Grippers using pneumatic, hydraulic and electrical motor for transmission; Vacuum Grippers, ultrasonic grippers. (7)

SECTION - B

- Unit IV: Sensors in Robotics:** Sensors - functioning, types, analysis and fields of applications. Tactile sensors, temperature sensors, Variable Pressure Light Converting Sensor, High Resolution Pneumatic tactile Sensor, Slip type Sensors, Piezo electric Contact Sensors. Remote Sensor Compliance, Range & Proximity Sensors, Electro- optical Sensors. **Vision system:** Median filtering, thresholding, discretisation, Smoothing of binary image. Recognition Procedure. CCD Camera. (7)
- Unit V: Robot Drives, Control and Robot Programming:** Hydraulic systems, DC servo motors, basic control systems concepts and models, control system analysis, robot activation and feed back components. Positional and velocity actuators. Power transmission systems, robot joint control design. Methods of Programming the robot, Languages, Robographics, Introduction to Artificial Intelligence (7)
- Unit VI: Advanced Applications of Robots and Robot Interfacing:** Pick and place Robot, Arc Welding Robots, Assembly and mega-assembly Robots, Walking Robots, Climbing Robots, Machine mounted Robots. Interfacing Robots with computers. Obstacle Avoidance: Lee's Algorithm; Counter Path Defining using A* point, blending technique. (7)

TEXT BOOKS:

1. Deb S.R., *Robotics*, Tata McGraw Hill Publications, New Delhi.
2. **ROBOTICS AND CONTROL, By R Mittle, I Nagrath**, 2003, McGraw-Hill Education India Pvt. Ltd. INDIA, ISBN: 9780070482937

3. Groover M.P., Weiss M., Nagel R.N., Odrey N.G., *Industrial Robotics Technology - Programming and Applications*, McGraw Hill Book Co.

REFERENCE BOOKS

1. Fu K.S., Gonzalez R.C., Lee C.S.G., *Robotics Control Sensing, Vision and intelligence*, McGraw Hill Book Co.
2. Yoram Koren, *Robotics for Engineers*, McGraw Hill Book Co.
3. Hartenberg and Denavit, *Kinematics and Synthesis of Linkages*, McGraw Hill Book Co.
4. Hirschhorn J., *Kinematics and Dynamics of Machinery*, McGraw Hill Book Co.
5. Paul R., *Robots - Manipulators, Mathematics, Programming and Control*, MIT Press.
6. Janakiraman P.A., *Robotics and Image Processing*, Tata McGraw Hill 1995.

7PE04

PROFESSIONAL ELECTIVE – I

(03) FLEXIBLE MANUFACTURING SYSTEMS

Lecture: 03 Hrs/ w

Internal Assessments: 20

Tutorial: _____

University Exam: 80

Credits: 03

Course Objective

- Ç To study fundamental concepts of Flexible Manufacturing Systems.
- Ç To study Tooling and fixturing system in FMS
- Ç To study different Material handling systems in FMS

SECTION – A

- UNIT-I: Introduction:** Flexible and rigid manufacturing, Concept of F.M. Cell and F.M. System, Functions of a manufacturing cell, Types and components of FMS, Tests of flexibility, Group Technology and FMS, Optimization of FMS, Tasks in selection of FMS
- Control structure of FMS:** Architecture of typical FMS, Automated work piece flow in FMS, Hierarchical control system architecture of FMS ñ Factory level, Cell level and Equipment level; Factory networks, Distributed Numerical Control (DNC), unmanned operation, FMS Diagnostics (7)
- UNIT-II: Production Scheduling in FMS:** Shop Floor Control system, phases in SFC, Variable route part programming system in FMS, dynamic scheduling in FMS, procedure, Performance analysis of FMS ñ measures, Deadlocks in automated manufacturing systems- handling deadlocks (6)

UNIT-III: Tooling in FMS: Tool holders for CNC machines, modular tooling, tool monitoring; preset, offset and wear compensation values, robotized tool assembly, tool database, tool management system, tool flow control in FMS

Fixturing in FMS: Palletizing of parts, pallet pool, flexible fixturing ñ principles and methodologies, standard fixtures, modular fixturing system ñ T-slot based and dowel pin based and their components; Computer aided fixture design ñ approaches, use of GT in fixture design ñ fixture design process, fixturing structure and fixturing information tree, fixture database (8)

SECTION – B

UNIT-IV: Database Management Systems in FMS: Conceptual DBMS, types of data structures and their applications in FMS, Integrated DBMS in FMS and its implementation

Material Handling in FMS: Functions of an integrated material handling system in FMS, Flexibilities in material handling, Layouts in FMS, Industrial robots for load / unload applications, Robotic cell layouts;

Automatically Guided Vehicles (AGVs) ñ types, Control of AGVs- Wire guided, optically guided, dead reckoning, free ranging AGVs, Scheduling of AGV, Storage and retrieval machines in AS/RS, (7)

UNIT-V: Automated Inspection Systems: In-process gauging, Coordinate Measuring Machines ñ applications, Probes ñ various shapes, types and applications, programming of CMMs, Types of CMM software, Inspection routines / cycles on CMM for various measurements ñ manual and programmed, CNC machines as CMM

Designing FMS: Simulation – Need, techniques, inputs, procedure, performance analysis (7)

UNIT-VI: Flexible Assembly Systems: Basic concepts, classification, planning and scheduling in FAS, loading and scheduling in F.A. cells

Reconfigurable Manufacturing Systems: Definition, goals, elements, rationale, characteristics, principles, RMS and FMS (7)

TEXT BOOKS :

1. Ranky, Dr. Paul, (1984), óThe Design & Operation of FMSô,
2. Groover, Mikell P., 3/e, óAutomation, Production Systems & Computer Integrated Manufacturingô, Pearson Education or PHI
3. Shivanand H K , M M Benal. & V Koti., óFlexible Manufacturing Systemsô 2006, NEW AGE INTERNATIONAL (P) Ltd, New Delhi. 978-81-224-2559-8

REFERENCE BOOKS :

1. Pinedo, Michael & Chao, Xiuly (1999), óOperations Scheduling with Applications in Manufacturing & Servicesô, McGraw Hill International Editions (with LEKIN Scheduling Software, also available on INTERNET)
2. CAD/CAM/CIM, 3/e ñ Radhakrishnan, Subramanayam & Raju (New Age International)
3. Computer Aided Manufacturing - Chang, Wysk & Wong (Prentice Hall of India)
4. Computer Integrated Manufacturing- A. Alavudeen & N.Venkateshwaran, 2008, (PHI), ISBN-978-81-203-3345-1
5. Planning and Scheduling in Manufacturing and Services- Pinedo, Michael, (2005), Springer, ISBN 0-387-22198-0
6. CAD/CAM ñ Concepts & Applications, - Channakesava R. Alavala, (2008), (PHI) ISBN-978-81-203-3340-6

7PE04 PROFESSIONAL ELECTIVE – I

(04)ARTIFICIAL INTELIGENCE AND EXPERT SYSTEM

Lecture: 03 Hrs/ w

Internal Assessments: 20

Tutorial: _____

University Exam: 80

Credits: 03

SECTION-A

UNIT-I: Introduction to Artificial Intelligence (AI) - Overview of AI, definition and importance of knowledge, knowledge based systems, representation of knowledge, knowledge organization, knowledge manipulation, acquisition of knowledge. (6)

UNIT-II: Introduction to Expert Systems - Features of expert systems, knowledge engineering, basic expert system terminology, human experts and artificial experts, algorithmic and heuristic methods, difference between conventional programs and expert systems. Architecture of expert systems (8)

UNIT-III: Knowledge Representation - Rule based methods, rule execution, forward chaining and backward chaining, knowledge representation using semantic nets, structure of semantic nets, Frame-based methods (8)

SECTION-B

UNIT-IV: Expert System Tools - Types of tools for expert system building, system building aids, support facilities, debugging aids, I/O facilities, explanation facilities, knowledge base editors, stages in the development of expert system tools, procedure oriented

methods, object-oriented methods, logic-based methods, access-oriented methods (7)

UNIT-V: Building an Expert System - Development phases in expert system building, development constraints, reliability, maintainability, examples of expert systems, difficulties in development of expert systems (7)

UNIT-VI: Fuzzy Engineering - Fuzzy logic, fuzzy expert systems, fuzzy sets, membership functions, fuzzy rules for approximate reasoning, fuzzy inference generation, defuzzification, development of rule matrix, applications of fuzzy expert systems for design of industrial controllers. (8)

TEXT BOOKS:

- 1) A Guide to Expert Systems By Donald A. Waterman, Pearson
- 2) Introduction to Artificial Intelligence & Expert Systems By Dan W. Patterson, PHI
- 3) Fuzzy Logic By John Yen, Reza Langari, Pearson

REFERENCE BOOKS:

- 1) Expert Systems - Theory & Practice, By Ermine, Jean Louis, PHI
- 2) Expert System in Engineering, By D. T. Priam, JFS Pub.
- 3) Expert System Applications By Sumit Vadera, Sigma Press
- 4) Artificial Intelligence By Winston P.H., Pearson

7PE05 PROFESSIONAL ELECTIVE-II (01) LOW COST AUTOMATION

Lecture: 03 Hrs/ w

Tutorial: ____

Internal Assessments: 20

University Exam: 80

Credits: 03

Course Objectives:

On the completion of the course student should be able to:

- Ç Develop a PLC program for an automatic control system of a medium degree of complexity.
- Ç Select the right hardware for a given application.
- Ç Connect the field devices to the PLC to create a complete control system.
- Ç Consider such aspects of the automation system as network communication, human machine interface, safety and protection against interference.

SECTION-A

UNIT-I: Pneumatic and electropneumatic components and symbol compressed air physical properties, generation, preparation and distribution, compressed air drying, areas of application control

element description - directional control valves, flow control valves, OR, AND, quick exhaust, adjustable pressure sequence rotary actuator, linear actuator, two pressure valve, Exhausted valve, NRV, check valve, vaccume cup etc. (7)

UNIT-II: Design method considerations for sequential circuits, pneumatic and electropneumatic sequential logic circuit design with Karnaugh Veich mapping method. Design of circuit by cascade method. Step counter method, and design of compound circuit. (7)

UNIT-III: Pneumatic sensors, electrical sensors, Switenes practical application of switches in industries, proportional and servo valves. Sizing of components of pneumatic and hydraulic system like cylinder, valve, tubing, compressor, air receiver, sump etc. (7)

SECTION-B

UNIT-IV: Hydraulic components and symbols. Description of control elements; hydraulic fluid - their properties and selection criteria. Areas of application. Hydraulic power pack pump, pipings, valves, filters. Hydraulic accomolators etc. (7)

UNIT-V: Design and analysis of fully hydraulic, electro hydraulic, pneumo hydraulic circuits for sequencies, synchronizing, interlocking etc. Design of circuit for pneumatic control for hydraulic sequential power system. (7)

UNIT-VI: Programmable logic controller(PLC): Its role in low cent automation, Types of PLCs, Parts of PLC, Building blocks of typical PLC, Man Machine Interfile, Type of display required for operator, Communication options in PLC, Programming techniques for PLC- programing & programmability, Programming ways, Processing ways, PLC Programming Steps, ladder diagrams, Control system flow chart, Ladder programming, PLC programming through computer, PLC selection criteria & its modules, Selection criteria for type of isolation, basic electrical and electronic components used in automation, Advantages of PLC, Application of PLC. (7)

TEXT BOOKS :-

- 1) Pneumatics and hydraulics by Stewart.
- 2) Pneumatic Control for Industrial Automation by Peter Rohner and Garden Smith, John Wiley and Sons.
- 3) Hydraulic and Pneumatic Power Control by Franklin P. Yeaple.

REFERENCE BOOKS:-

- 1) Fluid Power Logic Circuit by Peter Rohner, The McMillan Press Ltd.

- 2) Hydraulic System Analysis by John Stringer, The McMillan Press Ltd.
- 3) Fluidics by Foster K. Parber, Wiley Eastern.
- 4) Introduction to Fluid Power Circuits and System by Russel W. Henke, Addison Wiley.
- 5) Pneumatic Application by Depper and Stoll, Vogel Verlag,

7PE05 PROFESSIONAL ELECTIVE – II
(02) ADVANCE TOOL AND DIE DESIGN

Lecture: 03 Hrs/ w **Internal Assessments:** 20
Tutorial: _____ **University Exam:** 80
Credits: 03

Course Objective

To study principles of designing fixtures and dies for industrial applications.

SECTION – A

UNIT-I: Introduction: Jigs and Fixtures, Flexible Fixturing, Materials for Tools, Fixture and Dies.

Modular Fixture Systems: Development of modular fixtures, T-slot based and Dowel pin based Modular Fixture systems, Interactive Computer Aided Fixture Design (I-CAFD) Structure, Locating / clamping Model Analysis and classification, Fixture Component Selection, Fixture component Assembly Manipulation. (8)

UNIT-II: Group Technology based Computer Aided Fixture Design: Fixture Design process analysis, Fixture Structure Analysis, Fixture Feature Analysis, Fixture Design Similarity Analysis, Representation of Fixturing Feature information, Automated Fixture configuration Design (6)

UNIT-III: Geometric and Accuracy Analysis: Geometric constraint conditions, Assembly Analysis, 3-D Fixture configurations, Locating Accuracy and Error analysis, clamp planning, Machining accuracy analysis. (7)

SECTION – B

UNIT-IV: Basic Principles of Metal Forming: Flow conditions and flow curve, Deformation and material flow, force and work, Formability. **Die Design for Deep Drawing and Stretch Drawing:** design considerations, die materials, efforts of friction, wear and lubrication, Die handling, Die clamping, dies for hydro mechanical deep drawing. (8)

UNIT-V: Die Design for Hydro Forming: Process Technology, Die design considerations, die layout, die clamping, lubricants. (6)

UNIT-VI: Extrusion Dies: Die Design for metal and plastic extrusion, die materials, die clamping, die handling, Dies for Solid Sections, Dies for hollow section. (7)

TEXT BOOKS:

- 1) Rong, Yeming; "Computer Aided Fixture Design", Marcel Dekker, ISBN 0-8247-9961-5
- 2) Metal Forming Handbook ñ Schuler, Springer- Verlag Berlin.
- 3) Dies for Plastic Extrusion ñ M. V. Joshi ñ Mc Millan.

REFERENCE BOOKS:

- 1) Tool Design ñ C. Donaldson, LeCain & Goold (TMH)
- 2) Tool Design ñ H.W. Pollack (Taraporwalla)
- 3) ASM Handbook ñ Forming ñ ASME
- 4) Handbook of Die Design, 2/e ñ Suchy, I (McGraw Hill), 2006.
- 5) Design of Jigs and Fixtures ñ Hoffman (Pearson)
- 6) An Introduction to Jig & Tool Design, M.H.A. Kempster, (ELBS)
- 7) Jigs and Fixture Design Manual, Henrikson (Industrial Press, NY)
- 8) Die Design Fundamentals, J. R. Paquin, R. E. Crowley, Industrial Press Inc.
- 9) Jigs & Fixtures; Design Manual ñ (2/e), P.H. Joshi, (TMH) (2003).

7PE05 PROFESSIONAL ELECTIVE – II
(03) ADVANCED WELDING TECHNOLOGY

Lecture: 03 Hrs/ w **Internal Assessments:** 20
Tutorial: _____ **University Exam:** 80
Credits: 03

Course Objectives:

- Ç This course introduces students to various welding techniques.
- Ç The course will include instruction in arc, oxy-acetylene, metal inert gas, tungsten inert gas welding and cutting methods.
- Ç This course provides the exploration, study and hands on exploration of metal working and joining.

SECTION – A

UNIT-I: Types of weld joints, edge preparation, cleaning of edge, welding fixtures, track welding, arc welding, welding electrode, types of coverings, welding technique for manual welding (in MAW) Gravity welding, power supply for arc welding, arc cutting submerged arc welding, TIG and MIG arc welding CO2 welding and plasma arc welding. (8)

UNIT-II: Gas welding processes, equipments, filler metals, fuel gases, torches, filler metal, fluxes, Back hand, fore hand welding, welding rods, specification. Atomic hydrogen welding and thermal welding. Thermal cutting of metals : Oxygen cutting flame,

cutability of metals, effect of cutting on structure and property of steel, oxygen lancing, machine cutting.

Welding of carbon steel and a alloy steel, C.I. welding, welding of non ferrous metals and its alloys, Copper, Aluminum, Brass, Magnesium, Nickel and their alloys. (8)

UNIT-III: Soldering and brazing : capillary and wetting action, temprage, filler metals and fluxes, process and applications, design and strength of weld joint.

Resistance welding : spot welding, electrode magnet, size, resistance and force, current and time. Types of equipments : Rocker arm press, multiple welding gun and portable welders, applications, seam welding projection welding, flash welding, applications. (8)

SECTION - B

UNIT-IV: Solid phase welding : cold pressure welding, weld formation, techniques for lop and butt welding, application, diffusion joining, friction welding, process, variables, applications force welding, Ultrasonic welding. Nature of bond, velocity of impact, angle of contact and application. (8)

UNIT-V: Radiation Welding : Laser welding, electron beam welding, types of electron gun, spot size, beam power, operation voltage, pulse techniques, deep penetration and application.

Weldability : Design process and metallurgical considerations, testing and improvement of weldability. Welding defects and remedies. Heat treat of welds, flame hardening procedure and applications. (8)

UNIT-VI: Inspection and testing of welds : destructive and non destructive test for welds tension, bend, hardness, fatigue controlled. Thermal severity test. Liquid penetrant test fluorescent penetrant test, magnetic particle inspection, Eddy current testing. Ultrasonic and radiology. (7)

TEXT BOOKS :

- 1) A Text Book of Welding Tech. : O.P.Khanna.
- 2) Welding and Welding Tech. : Richard L.Little.
- 3) Welding Science & Technology, By Md. Ibrahim Khan, New Age Int. ISBN: 81-224-2073-7

REFERENCE BOOK :

- 1) Welding Hand Book : A.W.S.

7PE05

PROFESSIONAL ELECTIVE – II (04)FINITE ELEMENT ANALYSIS

Lecture: 03 Hrs/ w

Tutorial: _____

Internal Assessments: 20

University Exam: 80

Credits: 03

Course Objective

- Ç Introduce students to basic concepts in FEM, various elements used and steps in FEM
- Ç Make students to understand problem formulation and solution by FEM for Single degree, Double degree of freedom problem and Axi-symmetric field problems
- Ç Make students to understand mathematical computation when using higher order elements
- Ç Introduce the students to few case studies for FEM analysis.

SECTION – A

UNIT I: Introduction : Introduction, One Dimensional Problem, Finite Element modeling, Coordinate and Shape function, Derivation of stiffness matrix and Load Vector using Potential Energy approach , Properties of Stiffness Matrix, Assembly of Global Stiffness Matrix and Load Vector, Elimination and penalty approach, shape function, Quadratic Shape Function. (7)

UNIT II: Trusses : Introduction, Plane trusses, Assembly of global Stiffness Matrix for Banded Skyline solutions. (7)

UNIT III: Two-Dimensional Problem Using Constant Strain Triangles: Introduction, finite element formulation, load considerations and boundary conditions, problem modeling, member end forces, plane frame. (7)

SECTION – B

UNIT IV: Axi-symmetric solids subjected to axi-symmetric loading: Introduction, axi-symmetric formulation, finite element modeling of triangular element

Two dimensional iso-parametric elements : Introduction, four node quadrilateral, introduction to higher order elements. (7)

UNIT V: Finite element analysis of heat transfer : Introduction, steady state heat transfer - 1D and 2D heat conduction and convection, governing differential equation, boundary conditions, formulation of element. (7)

UNIT VI: Softwarebased FEA : Mesh generation, meshing techniques, meshing in critical areas, type and size of element, mapped elements, quality checks-[aspect ratio, warp angle, skew,

Jacobean, distortion, stretch, included angle, taper], boundary conditions, interpretation of results and design modification (7)

TEXT BOOKS:

1. Chandrupatla T.R. and Belegunda A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India.
2. Reddy J.N., Introduction to Finite Element Methods, Mc Graw Hill Publications,

REFERENCE BOOKS:

1. Daryl Logan, First Course in the Finite Element Method, Cengage Learning India Pvt. Ltd.
2. David V. Hutton, Fundamentals of Finite Element Analysis, Tata McGraw-Hill Education Pvt. Ltd.
3. Zienkiewicz. C., Taylor, R. I., The Finite Element Method, Butterworth-Heinemann, 5th Edition, 2000.
4. Akin J.E., Finite Element Analysis with Error Estimators, Elsevier, 2005.
5. Cook R. D., Finite Element Modeling for Stress Analysis, John Wiley & Sons Inc, 1995.
6. Liu G.R. and Quek S.S., The Finite Element Method - A Practical Course, Butterworth-Heinemann, 2003.
7. Kwon Y. W., and Bang H., Finite Element Method using MATLAB, CRC Press, 1997.
8. Asghar Bhatti, Fundamental Finite Element Analysis and Applications, John Wiley & Sons Inc, 2005.

7PE06 COMPUTER AIDED DESIGN AND MANUFACTURING-LAB

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical/ Oral Exam: 25

Credits: 01

Course Objectives:

Upon completing the course, the student will be able to:

- Ç Describe CAD/CAM. List the stages of part design and manufacturing. Identify the types of three dimensional modeling schemes and appropriately select the type for designing a part.
- Ç Describe the documentation resulting from the CAD process. Describe CAD design and engineering analysis activities.
- Ç Produce a solid model drawing and transfer geometry to another software
- Ç Translate geometry into programming code suitable for machining. Produce a CNC machined part from a solid model drawing. Describe manual part programming methods. Describe the CAD/CAM part programming process. Describe post processing.

List of Practical:- Minimum 04 Practical on Section A and 04 on Section B should be performed from the following:

1. Modeling of 3D Machine Element Assembly like Coupling, Joint, etc.
2. Study of finite element analysis package to solve ID problem.
3. Preparing and executing all phases of the design of a mechanical assembly using a major commercial CAD/CAM software system.
4. Generation of Gear or Cam Profile in a graphics package.
5. Volumetric Analysis of Solid Model and assembly
6. Mass property and CG of Part and Assembly
7. Study Practical on latest 2 / 3 Axes NC/CNC machines.
8. Study Practical on latest Multi Axes, Multi spindle or SPM CNC machines.
9. Study Practical on CNC Tooling and Cutting Process Parameter Selection.
10. Preparing and executing NC part programming for any two component on CNC Turning m/c.
11. Preparing and executing NC part programming on CNC milling.
12. Preparing and executing APT part programming on CNC Turning / Milling operation.
13. Preparing and executing Robot programming for simple operation
14. Study practical of FMS.

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

7PE07

PROFESSIONAL ELECTIVE –I– LAB

(01) MECHATRONICS –LAB

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical/ Oral Exam: 25

Credits: 01

PRACTICALS:

At least five practicals should be performed from the following:-

- i) Practical based on MEMS.
- ii) Ruining of automation system through PLC.
- iii) Experiments based on PLC controlled ROBOT,
- iv) Study of Disc pocket type orientation mechanism,
- v) Experimentation on control system for DC servomotor,
- vi) Experimentation on control system for Non Servo AC motor (Synchronous).
- vii) Experiments on linear conveyor system with Sensor Kit.
- viii) Experiments on rotary table motion and position control with sensor Kit
- ix) Experiments on X-Y motion and position control

A journal should be

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

**7PE07 PROFESSIONAL ELECTIVE – I – LAB.
(02) INDUSTRIAL ROBOTICS – LAB.**

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical / Oral Exam: 25

Credits: 01

Objective:

- Ç The student will be introduced to the concepts of robotics as it applies to production plants and assembly processes.
- Ç Sensors, controllers, actuators, materials, power-transmission systems,
- Ç Basic principles of robotics in Industrial Automation.

Term Work

The term work shall be based on the following assignments:

1. Study of configuration of robots and motion of robot manipulator
2. Study of direct kinematics and inverse kinematic solutions (Numerical Problems)
3. Study of robot grippers (includes the problems based on gripper force)
4. Study of machine vision system
5. Study of robot drives and control
6. Study of robot interfacing with PC
7. Study on advanced industrial applications of robots
8. Programming the robot for pick and place operation
9. Robot structure and types of Robot.
10. Solution to direct kinematics problems on computer.
11. Solution to inverse kinematics problems on computer.
12. Establishing accuracy & repeatability of Robot
13. Robot programming for simple task such as pick-n-place using languages like VAL, WALLI etc.
14. Demonstration of Robot application.

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

**7PE07 PROFESSIONAL ELECTIVE – I – LAB.
(03) FLEXIBLE MANUFACTURING SYSTEMS – LAB.**

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical / Oral Exam: 25

Credits: 01

TERMWORK

Minimum eight assignments based on the following.

1. Exercise on scheduling using various dispatching rules, heuristics or

local search techniques for the following cases, using scheduling software package (like LEKIN Scheduling System / MS Project), involving schedule generation, preparation of Gantt Chart and comparison of alternative schedules on the basis of various parameters with the output printouts.

- a) Single machine / parallel machines
 - b) Flow shop
 - c) Job shop
 - d) Flexible Job shop
 - e) Flexible Flow shop
2. Simulation of FMS shop, using Simulation software package (like ARENA or FLEXSIM) including various modules like Arrive, Server, Depart, Simulate modules, Creating models of FMS shops and simulating the performance to obtain output results
 3. Exercises on assessment of performance of batch production systems for the following measures
 - a) Manufacturing lead time,
 - b) Work - in ñ process
 - c) Machine utilization
 4. Development of a simple manufacturing or tool or fixture database using a suitable software like MS Access or similar.
 5. Industrial visit to study components of FMS and submission of visit report (At least one visit is compulsory.)

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

**7PE07 PROFESSIONAL ELECTIVE – I – LAB.
(04) ARTIFICIAL INTELLIGENCE AND EXPERT
SYSTEM – LAB.**

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical / Oral Exam: 25

Credits: 01

TERMWORK

- Ç Practical: The students are expected to perform five practical based on the above syllabus.
- Ç A journal should be prepared and submitted on above term work. The practical examination shall be based upon the term work and viva examination.

**7PE08 PROFESSIONAL ELECTIVE-II
(01) LOW COST AUTOMATION - LAB**

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical / Oral Exam: 25

Credits: 01

PRACTICALS:

1. Design, analysis and performance of any one circuit for particular application of fully pneumatic system by using Karnaugh Veich mapping method. (Atleast for two cylinder sequencing.)
2. Design and analysis of circuit for particular specific material handling application of Electropneumatic system by using Karnaugh Veich map method.
3. Design and analysis of pneumatic and electropneumatic circuit for any particular application by using :
 - i) Cascade method
 - ii) Step Counter method
 - iii) Combination circuit.
4. Laboratory performance of pneumatics, electropneumatics, hydraulic sequential circuit for One, Two and Three cylinder problem.
5. Design of pneumatic and hydraulic circuit for plastic molding machineries.
6. Design and computer simulation of pneumatic and electropneumatic circuit for automating m/c operator. e.g. automating drilling m/c operation, automatic key way milling m/c etc.
7. Experiment on Automation of Electro Pneumatic / Electro Hydraulic Circuit through PLC
Practical examination consists of performance of any circuit by the batch of five students and viva-voce on the circuit and above term work.

**7PE08 PROFESSIONAL ELECTIVE – II – LAB.
(02) ADVANCE TOOL AND DIE DESIGN – LAB.**

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical / Oral Exam: 25

Credits: 01

PRACTICAL TERM WORK :

- 1) Case Study of T- Slot based Modular Fixturing system.
- 2) Case Study of Dowel pin based Modular Fixturing system.
- 3) Computer Aided Fixture Design for Simple Component.
- 4) Die Design for stretch drawing operation for a component.
- 5) Extrusion die design for solid section in plastic.
- 6) Study of die clamping systems for various processes.
A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

**7PE08 PROFESSIONAL ELECTIVE – II – LAB.
(03) ADVANCED WELDING TECHNOLOGY – LAB.**

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical / Oral Exam: 25

Credits: 01

Course Objectives:

- Ç This course introduces students to various welding techniques. The course is especially designed for students who have a career interest in the welding field. The course will include classroom and practical instruction in arc, oxy-acetylene, metal inert gas, tungsten inert gas welding and cutting methods.
- Ç This course provides the exploration, study and hands on exploration of metal working and joining.

PRACTICAL TERM WORK :

- 1) Design and Drawing of welding fixtures - 03 Job.
- 2) Seminar on any one of the topics from syllabus.

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

**7PE08 PROFESSIONAL ELECTIVE – II – LAB.
(04) FINITE ELEMENT ANALYSIS – LAB.**

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical / Oral Exam: 25

Credits: 01

Term Work:

The term work shall consist of record of any three from 1 to 4 (C/ MATLAB programs) and any three from 5 to 8 assignments of the problems based on following topics:

1. Computer program for axial bar subjected to axial forces.
2. Computer program for truss subjected to plane forces.
3. Computer program for beams subjected to transverse forces and moments.
4. Computer program for frames subjected to transverse forces and moments.
5. Stress and deflection analysis of two dimensional truss using FEA software.
6. Stress and deflection analysis of any machine component consisting of 2-D elements using FEA software.
7. Stress and deflection analysis of any machine component consisting of 3-D elements using FEA software.
8. Modal analysis of any machine components.

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

7PE09**INDUSTRIAL TRAINING****Max Marks:** 50**Credits:** 02**INDUSTRIAL VISIT / TRAINING:**

During the course of study from III to VII semester each student is expected to undertake a minimum of two weeks of industrial training. In addition student should visit at least one industrial exhibition.

The students are expected to submit a report and diary, which will be evaluated by an internal assessment committee at the end of seventh semester for **50 marks**.

The industrial training shall be taken by students strictly during vacation and on their own risk and cost. An undertaking in this regards signed by student and Parents shall be submitted before proceeding for training to the concerned Head of Department/ Head of Institution. Institutes shall help students to organise industrial exhibition.

7PE10**PROJECT & SEMINAR****Project :** 02Hrs/ w**Tutorial:** ____**Project Term Work:** 50**Project / Oral Exam:** ____**Credits:** 04**SEMINAR:**

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for **50 marks**. The Seminar Report will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of **VIII Semester**.

PROJECT:

The objective of the project is to enable the students to work in groups of not more than five members in each group on a project involving analytical, experimental, design or combination of these in the area of **Production Engineering**. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for **75 marks** by way of oral

presentations. The university examination, which carries a total of **75 marks**, will be a Viva Voce examination at the end of **VIII Semester**, conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

EIGHTH SEMESTER**8PE01****PROFESSIONAL ELECTIVE - III****(01) ADVANCED PRODUCTIVITY TECHNIQUES****Lecture:** 03 Hrs/ w**Tutorial:** ____**Internal Assessments:** 20**University Exam:** 80**Credits:** 03**Course Objective**

Based on the course description, at the conclusion of the semester the student should be able to:

- Ç Understand the role of design and lead-in time production of quality products and services
- Ç Understand the functions and techniques of successful project management
- Ç Understand the role of the TQM, VE & GT in performance of an organization

SECTION-A

- UNIT-I:** Production and Production systems, production functions, system performance, system synthesis, importance of productivity, productivity ratio, total productivity index, productivity measurement. (7)
- UNIT-II: Production System Models :** Development, types, basic approach to model development, models of machine breakdown, models of task time variability. Codification - 7- digit coding, 9-digit coding. (7)
- UNIT-III: Product development & Design :** Company policy, effect of competition on design, long range planning, selecting the right product analysis, make & buy decision, standardisation, simplification, modification, line balancing models, diversification. (7)

SECTION-B

- UNIT-IV: TQM, ISO 9000 & Product patenting:** Historical perspective of quality concepts.

TQM : Introduction, definition, implementation and benefits, concepts of TQM by Deming, Cross by & Juran.

ISO 9000 : Objectives, models, major steps to get ISO 9000 Patenting of Products. (7)

UNIT-V: Value Engineering : Concept, advantages, role of creativity in value engineering, application, types of values, types of phases, function analysis system technique. (7)

UNIT-VI: Group Technology : Introduction, definition, benefits, fields of application, forming part families & group, group scheduling, desirable characteristics of group cellular manufacturing-concept. (7)

TEXT BOOKS :-

1. Production System - James L.Riggs
2. Production Hand Book - John A.White
3. Production Engineering Science - R.C.Pandey & C.K.Singh

REFERENCE BOOKS:

1. Production Planning & Control - Samuel Eilon
2. Production Planning & Control - Jain and Agrawal
3. Techniques of Value Analysis and Engg.:-Miles(McGraw Hill)
4. Value Engineering in Manufacturing :-ASTEM (Prentice Hall)
5. Value Engineering for Management - Glauson, Auerbach
6. Total Quality Management - Sundara Raju (Tata McGraw Hill)
7. Getting More at Less Cost - Jagannathan (Tata McGraw Hill)
8. Automation, Production Systems and Computer Integrated Manufacturing - Mickell Groover (PHI)

8PE01 PROFESSIONAL ELECTIVE - III (02) FINANCIAL MANAGEMENT AND COST CONTROL

Lecture: 03 Hrs/ w

Tutorial: _____

Internal Assessments: 20

University Exam: 80

Credits: 03

SECTION – A

UNIT-I: Financial Management: Financial Function, Scope, goals and tools. Sources of finance, corporate planning and financial management. Ratio Analysis: Classification, Ratio Analysis and its limitations. Operating and Financial Leverage. (7)

UNIT-II: Capital Budgeting: Control of Capital Expenditure, Evaluation Process-Payback approach, Accounting of Rate of Return, Present Value Method Vs Internal Rate of Return. Replacement cost and discounted cash flow. (7)

UNIT-III: A) Working Capital Management : Concept and design of Working Capital, types of working capital, sources of working capital, time value of money, cost and capital, cost of capital.

B) Funds Flow Analysis: Concepts, Objectives, and Techniques of Funds Flow Statement. (8)

SECTION-B

UNIT-IV: A) Costing: Methods of costing and elements of cost. Material Cost: Different methods of pricing of issue of materials. Material losses - Wastage and its consideration.

B) Labour Cost: Different methods wages and incentive plans. Principles of good remunerating system, labour turnover and its methods.

C) Overheads: Classification, collection of overheads, Primary and Secondary apportionment of overheads, absorption of overheads. Machine hour and labour hour rate. Under and over absorption of overheads. Estimation of overheads. (8)

UNIT-IV: A) Budgetary control and variance Analysis: Material, Labour, Overhead, Sales. Profit, Productmix and Yield Variance.

B) Cost control: Capital cost control-the nature of control, elements of cost control programme, project planning and scheduling, cost reporting and corrective action. Capital cost control repetitive operating cost, standard costs, cost reporting and corrective action. (7)

UNIT-VI: Types of Costing Methods : Concept, development & use of standard costing, Marginal Costing: Use of Marginal Costing in decision-making Activity based costing: Concept, cost drives, applications.

Process costing: Concept, transfer cost, concept of by products, joint costing, scrap, waste, losses, cost of quality. (7)

TEXT BOOKS:

1. N. K. Prasad, *Principles and Practice of Cost Accounting*, Syndicate Pvt. Ltd., Calcutta
2. I. M. Pandey, *Financial Management*, New Delhi Vikas Publication House Pvt. Ltd., ISBN : 81- 259-0638-X
3. M. Y. Khan, P. K. Jain, *Financial Management*, Tata McGraw Hill Publishing Ltd.
4. B. K. Bhar, *Cost Accounting Methods and Problems*, Academic Publishers, Calcutta

REFERENCE BOOKS:

1. Henry M. Steiner, "*Engineering Economics Principles*", McGraw Hill Publication.
2. C.B. Gupta, "*Fundamentals of Business*", Sultan Chand & Co.,
3. P. A. Samuelson, "*Economics*", McGraw Hill International.
4. K. K. Dewett, "*Modern Economic Theory*", Sultan Chand & Co., ISBN 81-219-0331-1
5. Colin Drury, *Management and Cost Accounting*, English Language Book Society, Chapman & Hall London.

8PE01 PROFESSIONAL ELECTIVE -III
(03) MATERIALS AND LOGISTIC MANAGEMENT

Lecture: 03 Hrs/ w

Tutorial: ____

Internal Assessments: 20

University Exam: 80

Credits: 03

SECTION - A

Unit I: Materials Management : Introduction to Material Management functions, scope, objectives, tools and techniques. Make or buy decision, Material Requirement Planning (MRP1).

Value analysis: Value analysis / Value analysis engineering, concepts, advantages, applications, problem recognition, role of creativity, analysis of functions, use, esteem and exchange values elimination of unnecessary costs, value engineering techniques. (7)

Unit II: Purchase Management : Objectives, functions, purchase cycle, documents in purchasing, purchasing with 5 R's (Quality, Quantity, Time, Supplier, Price), vendor rating and vendor development.

Import and Import Substitution: Factors affecting National and International markets, Import procedure and documents (Bill of lading, letter of credit etc.) (7)

Unit III: Stores Management Functions of stores, types of stores, stores identification, receipt-issue, recording system, stock taking system.

Waste Management: Importance of waste management and techniques. waste management system, Disposal of surplus and obsolete items. Mechanical and thermal disposal system. (7)

SECTION - B

Unit IV: Logistic Management Operating Responsibility, Logistical performance Cycle, Work of Logistics, Functional areas of logistics

Warehouse Management: Nature and importance of warehousing, warehouse location, warehousing operations and Facility development. Economic and service benefits of warehouse.

Transportation Management: Transport planning parameters, Basic Economics & pricing factors affecting transportation cost. (7)

Unit V: Supply Chain Management : Introduction, Types of supply chain, Components, Drivers, Role of supply chain in manufacturing, Supply chain performance and its measurement, Planning, Demand and supply in supply chain, Risk in supply chain and managing the risk, Coordination in supply chain (7)

Unit VI: Inventory control of finished goods Economic manufacturing quantity (EMQ), Fixed order quantity and fixed order interval system, Probabilistic models, Safety stocks, service levels, inventory control of finished goods, single order inventory policies. Inventory models under risk and under uncertainty. (7)

TEXT BOOKS:

1. Dobler and Lee, *Purchasing and Material Management*, Tata McGraw Hill, New Delhi
2. Jhamb, L.C., *Inventory Management*, Everest Publications,
3. Menon, K.S., *Purchasing and Inventory Control*, Wheeler Publication, New Delhi
4. Chopra Sunil and Peter Meindl., *Supply Chain Management: Strategy, Planning and Operation*, 3rd Edition, Prentice Hall, 2006.

REFERENCE BOOKS:

1. Miles L.D., *Techniques of Value Analysis and Engineering*, McGraw Hill Book Company.
2. Simchi-Levi, Kaminsky, *Designing and Managing the Supply Chain, Concepts Strategies and*

8PE01 PROFESSIONAL ELECTIVE -III
(04) MARKETING AND SALES MANAGEMENT

Lecture: 03 Hrs/ w

Tutorial: ____

Internal Assessments: 20

University Exam: 80

Credits: 03

SECTION – A

UNIT-I: Market Management : marketing concept, market segmentation, characteristics, affecting consumer behavior, marketing decision related to product, pricing policies. Marketing control Ratio analysis, Profit-volume relationship. (8)

UNIT-II: Marketing Research: importance and scope, the marketing research process, sources of information, Techniques of marketing.

Motivation Research: the nature & importance of motivation research, techniques of motivation research. (7)

UNIT-III: Export Marketing: composition of Indian exports, exports promotion agencies in India, exports procedure, export strategy for the future.

Rural Marketing: the profile of rural market of India, channel management, sales force management and marketing communication in rural markets. (8)

SECTION-B

UNIT-IV: Sales Management and Sales Personnel : sales organisation, setting salesforce objectives, selection, training and motivation of sales personnel. methods of salesforce control. (8)

UNIT-V: Advertising and Sales Promotion : advertising message creation, media selection, advertising budget, advertising evaluation, Importance of sales promotion, sales promotion techniques. (8)

UNIT-VI: Sales Forecast : importance, methods of sales forecasting, types of forecast, factors affecting sales forecast, relation between national income and sales forecast. channels of distribution : channel design decisions, factors affecting selection of channel, Relatiling and wholesaling. (8)

TEXT BOOKS :

1. Marketing Management - An analysis, Planning and Control By Philip Kotler.
2. Principles of Marketing - By Philip Kotler.
3. Modern Marketing Management - By R.S. Dawar.

REFERENCE BOOKS :

1. Fundamentals of Marketing - By W.J.Stamtion.
2. Marketing Management - By S. Namakumari.
3. Marketing & Higher Management - By Esmond Pearce.

8PE02 PROCESS ENGINEERING

Lecture: 03 Hrs/ w

Tutorial: _____

Internal Assessments: 20

University Exam: 80

Credits: 03

Course Objective

The students will learn to:

- Ç Explain basic concepts of process engineering and process planning, part print analysis.

- Ç Understand and implement use of dimensional analysis , tolerance chars.

- Ç Classify operations, process sequence and process pictures.

SECTION-A

UNIT-I: Process Engineering / Process Planning : Introduction, importance, scope, product engineering, functions, process engineering functions, role, processes approaches to process planning, preliminary partprint analysis, partprint interpretation, problems & remedies, establishment of general characteristics of workpiece from part print, identification of critical areas, specifications relating w/p characteristics, with nature of work to be performed. Finishing & identifying operations. (7)

UNIT-II: Dimensional Analysis : Angular & rectangular dimensioning systems. Geometry of form, limit stacks & tolerance stacks, cost of arbitrary tolerance selection.

Tolerance Chart : functions, terms, & symbols, procedure of tolerance chart. W/p control, equilibrium theories, & concept of location, geometric control, dimensional control, mechanical control, alternate location theory, gauging. (7)

UNIT-III: Classifying operations, selection & planning of manufacturing processes, function, economy, aesthetics, rules & approach of process planning, influence of product design and processing, eliminating, operations tooling selection, terminating process. (7)

SECTION-B

UNIT-IV: Manufacturing sequence, major process sequence, factors affecting operation sequence, case studies on operation sequences planning. Selection of equipment, special purpose machines, general purpose machines, factors in machine selection, leasing, review of standard special equipments, tooling classification. (7)

UNIT-V&VI: Process picture & operation routing process picture symbols, sheet, processing dimension. Operation routing uses, sheet. Tool layout of turret or capstan lathe. (14)

REFERENCE BOOK :-

- 1] Process Engineering for Manufacturing, Donald F.Eary & Gerald E.Johnson, Prentice Hall, Inc. Englewoodd Cliffs, N.J.

8PE03 PROFESSIONAL ELECTIVE -IV
(01)COMPUTER INTEGRATED MANUFACTURING

Lecture: 03 Hrs/ w

Internal Assessments: 20

Tutorial: _____

University Exam: 80

Credits: 03

Course Objective

The students will learn to:

- Ç Explain basic concepts of CIM systems. Develop control systems for manufacturing cells, Design CIM systems to fulfill certain requirements . Identify and solve problems in the operations of CIM systems, Enhance performance of manufacturing systems by applying different CIM concepts and tools

SECTION –A

UNIT I: INTRODUCTION TO CIM : The meaning and origin of CIM- the changing manufacturing and management scene External communication, islands of automation and software-dedicated and open systems-manufacturing automation protocol, product related activities of a company, marketing engineering, production planning ,plant operations, physical distribution, business and financial management. (7)

UNIT II: GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING: History of group technology, role of G.T. in CAD/ CAM integration, part families, classification and coding, DCLASS and MICLASS and OPITZ coding systems-facility design using G.T. - benefits of G.T. , cellular manufacturing.
Process planning: Role of process planning in CAD/CAM integration - approaches to computer aided process planning - variant approach and generative approaches - CAPP and CMPP process planning systems. (7)

UNIT III: SHOP FLOOR CONTROL AND INTRODUCTION OF FMS: Shop floor control, phases, factory data collection system, automatic identification methods, Bar code technology, automated data collection system.
FMS: Components of FMS, Types of FMS, FMS workstation, material handling and storage systems, FMS layout ,computer control systems ,application and benefits. Conceptual understanding of Lean manufacturing , Agile manufacturing (8)

SECTION – B

Unit IV : COMPUTER COMMUNICATIONS : Principles of networking, Techniques, components of networking and wiring methods , Network interface cards , Network standards, examples

,Operating system , Security, Managing remote systems , Design activity in a networked environment. Case Study on Networking in manufacturing company. (7)

UNIT V: CIM and company strategy, system modeling tools, IDEF models, activity cycle diagram CIM open system architecture (CIMOSA), manufacturing enterprise wheel-CIM architecture.
COMPUTER AIDED QUALITY CONTROL: The computer in Q.C, automated inspection principles and methods, Contact inspection methods, non-contact inspection methods, machine vision system, optical inspection method, sensors, coordinate, measuring machine, Computer-Aided testing, Integration of CAQL with CAD/CAM. (8)

UNIT VI: DETROIT TYPE OF AUTOMATION: Flow lines, Transfer Mechanisms, work pattern transfer, Different methods, & Problems.

ANALYSIS OF AUTOMATED FLOW LINES: Analysis of transfer lines without storage with storage buffer single stage, Double stage, Multistage with problems, Automated assembly systems, Design for automated assembly, parts feeding devices, analysis of Multi station assembly machine, Analysis of Single stage assembly machine, (7)

TEXT BOOKS:

1. Mikell.P.Groover óAutomation, Production Systems and computer integrated manufacturingô, Pearson Education 2001.
2. Radhakrishnan P, Subramanyan S.and Raju V., óCAD/CAM/CIMô, 2nd Edition New Age International (P) Ltd., New Delhi, 2000.
3. Kant Vajpayee S, óPrinciples of Computer Integrated Manufacturingô, Prentice Hall India, 2003

REFERENCES BOOKS:

1. Yorem koren, óComputer Integrated Manufacturing Systemô, McGraw-Hill, 1983.
2. Ranky, Paul G., óComputer Integrated Manufacturingô, Prentice Hall International, 1986.
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe óComputer Integrated Design and Manufacturingô, McGraw-Hill Inc.
4. Roger Hanman óComputer Intergrated Manufacturingô, Addison ñ Wesley.
5. Mikell.P.Groover and Emory Zimmers Jr., óCAD/CAMô, Prentice Hall of India Pvt. Ltd., New Delhi-1.

**8PE03 PROFESSIONAL ELECTIVE -IV
(02) PRODUCT DESIGN FOR MANUFACTURING
& ASSEMBLY**

Lecture: 03 Hrs/ w

Tutorial: _____

Internal Assessments: 20

University Exam: 80

Credits: 03

Course Objective

As a result of this course student will:

- Ç Understand the basic principles of design for manufacturing design for assembly
- Ç Develop a deep understanding of major manufacturing processes Describe the types, principles, and uses of various production techniques
- Ç Obtain competitive experience in real world work through class projects Demonstrate the ability to apply mathematic and scientific principles in design for manufacturing and assembly technique.

SECTION - A

UNIT-I: Introduction to product design : definition of product design, Asimo's model for product design, design by evolution and innovation, essential factor of PD, its chronological structure, product analysis, product parameters, product life cycle & its characteristics, Decay curve of new product ideas, production consumption cycle & its value addition, primary design phases product development process. (7)

UNIT-II: Role of allowance, process capability & tolerance in design & assembly. Design practice in industry product strategies, analysis of product, product characteristics, designer & role of designer, industrial design organisation, procedures, & models used by industrial designers, three S's interchangeability of product modular design of products, functional design practices, designing for comfort & aesthetics. (7)

UNIT-III: **Design Optimisation:** introduction Siddal's classification, value engineering. Product design, design for reliability. (7)

SECTION - B

UNIT-IV: Strength consideration & material selection for products, design for stiffness & rigidity, introduction to FEA method. (7)

UNIT-V: **Design for manufacturability:** design of product to suit for various manufacturing processes such as casting forging, press working, rolling, machining etc., design of plastic & other non-metal products. (7)

UNIT-VI: Use of Computer in product design & development, new approaches to product design & development - concurrent engineering, Quality Function Development, (QFD), 3D modeling, manufacturing during design & Rapid Prototyping Techniques, product designs compatible to JIT manufacturing. (7)

TEXT BOOK:

1. "Product Design for Manufacturing & Assembly", by Geoffrey Boothroyd et al., publisher: CRC, 2nd ed., 2001, ISBN-10: 082470584X or ISBN-13: 978-0824705848

RECOMMENDED REFERENCES:

1. "Design for Manufacturing Handbook", by James G. Bralla, publisher: McGraw Hill Professional, 2nd Ed., 1998, ISBN-10: 007007139X or ISBN-13: 978-0070071391
2. "Product Design and Development", by Karl Ulrich and Steven Eppinger, publisher: McGraw-Hill/Irwin, 4th ed., 2007, ISBN-10: 0073101427 or ISBN-13: 978-0073101422

**8PE03 PROFESSIONAL ELECTIVE -IV
(03) PRODUCT LIFECYCLE MANAGEMENT**

Lecture: 03 Hrs/ w

Tutorial: _____

Internal Assessments: 20

University Exam: 80

Credits: 03

SECTION – A

UNIT-I: Introduction to PLM: Need for PLM, opportunities and benefits of PLM, different views of PLM, components of PLM, phases of PLM, PLM feasibility study, PLM visioning. (7)

UNIT-II: PLM Strategies : Industrial strategies, strategy elements, its identification, selection and implementation, change management for PLM. (7)

UNIT-III: Product Design: Engineering design, organization and decomposition in product design, product design process, methodical evolution in product design, concurrent engineering, design for DfM and design central development model. Strategies for recovery at end of life, recycling, human factors in product design. Modeling and simulation in product design. (7)

SECTION – B

UNIT-IV: Product Data Management (PDM): PDM systems and importance, reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation. (7)

UNIT-V: New Product Development: Structuring new product development, building decision support system, Estimating market opportunities for new product, new product financial control, implementing new product development, market entry decision, launching and tracking new product program. Concept of redesign of product. (7)

UNIT-VI: Technology Forecasting: Future mapping, invoking rates of technological change, methods of technology forecasting such as relevance trees, morphological methods and mission flow diagram, combining forecast of different technologies, uses in manufacture alternative. (7)

TEXT BOOK:

1. Kevin Otto & Kristin Woob, 6 PRODUCT DESIGN 2004, Pearson India New Delhi, ISBN 81-297-0271-1

REFERENCE BOOKS:

1. Fabio Giudice, Guido La Rosa, Product Design for the environment-A life cycle approach, Taylor & Francis 2006.
2. Robert J. Thomas, NPD: Managing & forecasting for strategic processes.
3. Martins Joseph, Technological Forecasting for decision Making, 2nd edition, North Holland.

8PE03 PROFESSIONAL ELECTIVE -IV (04) ERGONOMICS IN PRODUCT DESIGN & MANUFACTURING

Lecture: 03 Hrs/ w
Tutorial: _____

Internal Assessments: 20
University Exam: 80
Credits: 03

SECTION - A

Unit I: Introduction to Human Factors : Human criteria, human physical activities, features of the human body, Measures of physiological functions such as: energy expenditure, gross body activity, local muscular activity, work load, work efficiency, work and rest. Type of movements of body members. Performance criteria for physical activity such as: Strength & endurance speed of movements, accuracy of movements, manual material handling (MMH). (7)

Unit II: Applied Anthropometry and Work Space Introduction to anthropometry, use & principles of anthropometry data, work spaces, work space envelopes for seated persons, design of work spaces such as: work surface height, seated & standing, principles of seat design, workplace design. Physical space &

arrangement, principles of arrangement of component, (7)
Unit III: Design of Displays and Controls Information input & processing, visual displays of static & dynamic information. Auditory, textual & olfactory displays, general location of controls & displays within workspace, concept of visibility. Functions of controls, types of controls, factors in control design, design of specific hand operated controls, foot controls and special control devices. (7)

SECTION - B

Unit IV: Working Conditions Illumination: Color systems, energy consideration, effect of lighting on performance. Atmospheric conditions: Measurement of thermal variables, wet-bulb globe temperature, Botsball, heat stress index, heat index, wind chill index, physiological effect of heat & cold on performance. Noise: Physiological effect of noise on performance, noise exposure limits, noise controls. (7)

Unit V: Energy Expenditure Muscle mechanism, BMR, Heart Rate variations, Oxygen consumption, Rest allowances, Rate of energy expenditure, Manual Material Handling Capacity determination, Effect of environmental conditions and work design on Energy Expenditure. (7)

Unit VI: Ergonomics and Work Organization Human factors and ergonomics standards, Human factors applications in system design, characteristics of system design, human factors data for interface design, ergonomic safety and health management, case studies of ergonomically designed product. (7)

TEXT BOOKS:

1. Sanders M. S. and McCormick E. J., 6 Human Factors in Engineering and Design, McGraw- Hill International Editions,
2. Bridger R. S., 6 Introduction to Ergonomics, McGraw-Hill International Editions

REFERENCES:

1. Gavriel Salvendy (Ed.), 'Handbook of human factors and ergonomics', 3rd Edition, John- Wiley and Sons

8PE04 OPERATIONS RESEARCH TECHNIQUES

Lecture: 03 Hrs/ w
Tutorial: 01 Hrs/ w

Internal Assessments: 20
University Exam: 80
Credits: 04

Course Objective

This course is intended to provide students with a knowledge that can make them appreciate the use of various research operations tools

in decision making in organizations. At the end of the Course participants are expected to demonstrate a working knowledge of the various OR tools in making decisions as well as being able to formulate organizational problems into OR models for seeking optimal solutions.

SECTION-A

UNIT-I: Operations Research - introduction, characteristics, phases, limitations; model building and classification of O.R.Models.
Linear Programming: formulation, simplex methods, primal dual relationship. (7)

UNIT-II: **Transportation problems :** introduction, methods, LP formulation of transportation problems, methods for finding initial solution, MODI method.

Assignment Problems : introduction, mathematical statement and solution methods of assignment problems, variations of assignment problems. (7)

UNIT-III: **Network Models :** Network models ñ Network construction, PERT analysis, CPM analysis, cost analysis, updating, resource smoothening and leveling. (7)

SECTION-B

UNIT-IV: **Waiting line models :** introduction classification of waiting line models, analysis of M/M/1 and M/M/S models, application of simulation to waiting line model and Monte- Carlo technique. Sequencing-Processing of n jobs through 2 machines, n jobs through 3 machines, 3 jobs through n machines, n jobs through n machines. (7)

UNIT-V: **Replacement Models** -individual and group replacement policies.
Simulation: Introduction, basic nature of simulation, when to simulate, advantages and limitations, role of random numbers in simulations, generation of random numbers. (7)

UNIT-VI: **Dynamic Programming** -introduction, characteristics, development of an optimum decision policy, dynamic programming under certainty, application of dynamic programming to linear programming. (7)

TEXT BOOKS:

1. Operations Research - Hira & Gupta
2. Operations Research - J.C.Pant
3. Operations Research - Kanti Swarup
4. Operations Research - S.D.Sharma

REFERENCE BOOKS:

1. Operations Research - C.R.Kothari
2. Operations Research - A.S.Phillipose
3. Operations Research - R.C.Patel
4. O.R. and Mathematical Models - A.S.Sharma, Tata McGraw Hill
5. Operations Research - H.Taha
6. Operations Research - Kapoor
7. Operations Research - Askhedkar-Kulkarni

8PE05

PROCESS ENGINEERING – LAB.

Practical: 02 Hrs/ w

Tutorial: ____

Practical Term Work: 25

Practical/ Oral Exam: 25

Credits: 01

Term Work: Students are expected to do at least six practical out of the following :

1. Preliminary part print analysis for components.
2. Preparation of tolerance chart for two components.
3. Drawing of arrangement of locators, for standard shaped components like rectangular prism, pyramids, cylinder, tube, cones and any one non standard component for good geometric control.
4. Drawing of arrangement of locators for good mechanical control of any two components.
5. Illustration of centre line control in circular components for 30, 90, 120.
6. Sketching of two practical arrangements of alternate locators in tool Design.
7. Listing & classification of operations, for any two given engine parts
8. Study of considerations in the Operation sequence with respect to any one part.
9. Preparation of process picture sheet for any two parts.
10. Preparation of operation routing sheet for any two parts.
11. Study considerations of tool layout for turret & or capstan lathe for any two component.

PRACTICAL :- Shall consists of oral based on above term work.

REFERENCE BOOK :-

- 1] Process Engineering for Manufacturing, Donald F.Eary & Gerald E.Johnson, Prentice Hall, Inc. Englewoodd Cliffs, N.J.

**8PE06 PROFESSIONAL ELECTIVE –IV –LAB.
(01)COMPUTER INTEGRETED MANUFACTURING–LAB.**

Practical: 02 Hrs/ w
Tutorial: ____

Practical Term Work: 25
Practical / Oral Exam: 25
Credits: 01

TERMWORK

Practical: The students are expected to perform Six practical based on the above syllabus.

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

**8PE06 PROFESSIONAL ELECTIVE –IV –LAB.
(02) PRODUCT DESIGN FOR MANUFACTURING
& ASSEMBLY –LAB.**

Practical: 02 Hrs/ w
Tutorial: ____

Practical Term Work: 25
Practical / Oral Exam: 25
Credits: 01

TERMWORK:

Practical: The students are expected to perform Six practical based on the above syllabus.

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

**8PE06 PROFESSIONAL ELECTIVE –IV –LAB.
(03)PRODUCT LIFECYCLE MANAGEMENT–LAB.**

Practical: 02 Hrs/ w
Tutorial: ____

Practical Term Work: 25
Practical / Oral Exam: 25
Credits: 01

TERMWORK:

Practical: The students are expected to perform Six practical based on the above syllabus.

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

**8PE06 PROFESSIONAL ELECTIVE –IV –LAB.
(04)ERGONOMICS IN PRODUCT DESIGN
& MANUFACTURING–LAB.**

Practical: 02 Hrs/ w
Tutorial: ____

Practical Term Work: 25
Practical / Oral Exam: 25
Credits: 01

TERMWORK:

Practical: The students are expected to perform Six practical based on the above syllabus.

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

8PE07 OPERATIONS RESEARCH TECHNIQUES–LAB.

Practical: 02 Hrs/ w
Tutorial: ____

Practical Term Work: 25
Practical / Oral Exam: 25
Credits: 01

Course Objectives:

Upon completion of this course, student will be able to:

- Ç Formulate a real-world problem as a mathematical programming model
- Ç Understand the theoretical workings of the simplex method for linear programming
- Ç Understand the relationship between a linear program and its dual, including strong duality .
- Ç Solve specialized linear programming problems like the transportation and assignment problems
- Ç Solve network models like the shortest path problems

List of Practicals :- Atleast 6 practicals from following. :-

1. Computer programme for PERT CPM analysis.
2. Computer programme for LPP.
3. Case study on PERT/CPM network
4. Formulation of LPP from real life situation.
5. Study of dynamic programming problems.
6. Case Study on transportation problems.
7. Case study on assignment problems.
8. Case study on sequencing problems.

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

8PE08 PROJECT & SEMINAR

Project : 06 Hrs/ w
Tutorial: ____

Project Term Work: 75
Project / Oral Exam: 75
Credits: 12

SEMINAR:

The Seminar Report submitted by the student at the end of **VII Semester** will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of **VIII Semester**.

PROJECT:

The objective of the project is to enable the students to work in

groups of not more than five members in each group on a project involving analytical, experimental, design or combination of these in the area of **Production Engineering**.

Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for **75 marks** by way of oral presentations. The university examination, which carries a total of **75 marks**, will be a Viva Voce examination at the end of **VIII Semester**, conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

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

7XT1 DATA COMMUNICATION NETWORK

SECTION-A

- Unit I: -** Introduction to Communication Network
Network Functions; Network Topology; Types of network: LAN, MAN, WAN, Basics of Circuit switching, packet switching, message switching and cell switching, Layered Architecture: Need for Protocol; Protocol & Protocol architecture model; OSI Reference model; Overview of TCP/IP architecture (6)
- Unit II: -** Peer to Peer Protocols and Data Link control, Point to Point Protocol and service models; End to End requirements and Adaptation Function; End to End versus Hop by Hop
Flow Control: Need for flow control; Stop and Wait Flow Control; Sliding Window Flow Control; Stop and wait ARQ; Go-Back-N ARQ; Selective Repeat ARQ; Transmission efficiency of ARQ protocols; HDLC Protocol (8)
- Unit III: -** Local Area Networks and Access Control Protocols, LAN Architecture; Medium Access Control (MAC) and Logical Link Control (LLC) for LAN; Contention Techniques: CSMA, CSMA/CD (IEEE 802.3)
Control Access Techniques: Token Bus (IEEE 802.4); Token Ring (IEEE 802.5); Polling; FDDI, Random Access Techniques: ALOHA; Slotted ALOHA; (10)

SECTION-B

- Unit IV: -** Networking Devices, Routing Techniques and Traffic Control Protocols: Hubs; Switches; Bridges; Routers; Gateways; Routing Switches **Routing Algorithms:** Alternate routing in circuit switched network; Fixed Routing, Flooding, and Random Routing in Packet Switched networks **Least Cost Algorithms:** Dijkstra's Algorithm (Problems expected); Bellman Ford Algorithm (Problems expected) Traffic Control: Leaky Bucket algorithm; Token Bucket Algorithm (8)
- Unit V: -** Asynchronous Transfer Mode (ATM), Frame Relay and ISDN
ATM: - ATM Protocol Architecture; Concept of Virtual channel and Virtual path; ATM Cell; ATM Services
Frame Relay: - Protocol architecture

ISDN: -Principles of ISDN; ISDN Architecture; ISDN Channels;
Broadband ISDN Functional Architecture (7)

Unit VI:- TCP/IP Protocol

Overview of TCP/IP; IP Services; Internet Protocol (IPv4); Classfull and Classless IP Addressing; Internet Control Message Protocol (ICMP); IP Address Resolution protocol; Reverse Address Resolution Protocol; IPv4 versus IPv6; IP Datagram; Datagram Forwarding; TCP (Frame Format); UDP (Frame Format) (7)

TEXT BOOKS :

1. W. Stallings : óData and Computer Communicationsô, (Maxwell Macmillan)
2. Behrouz A Forouzan : óData Communication and Networkingô, (TMH)

REFERENCE BOOKS :

1. D Bertsekas and R.G. Gallager: óData Networksô, (2 e) , Pearson Ed., (PHI)
2. A. S. Tanenbaum : óComputer Networksô, PHI
3. Uyless Black : óComputer Networksô, (PHI)
4. Douglas E. Comer : óComputer Networks and Internetsô, (Pearson Education)
5. Gerd Kaiser, óLocal area networkô, (TMH) 2nd Edition
6. Leon Garcia, óCommunication Network.

**7XT2 MICROCONTROLLER & APPLICATIONS
SECTION-A**

- UNIT-I:** An Introduction to uC 8051:Architecture of 8051, Signal description of 8051, Register set of 8051, Timer structure and their mode and I/O port structure.
Bus standards : Serial RS 232, Parallel IEE-488 (8 Lectures)
- UNIT-II:** Instruction set of 8051, Addressing modes of 8051, Memory and I/O addressing by 8051, Assembly Language Programming using 8051. (8 Lectures)
- UNIT-III:** Study of ADC 0809, DAC 0808 and its interfacing with 8051, Interfacing of Sensors, Measurement of Temperature, Speed and Resistance. (8 Lectures)

SECTION-B

- UNIT-IV:** Interfacing LCD & Keyboard with 8051., Relays and Optoisolators, Stepper Motor interfacing, DC motor interfacing and PWM with 8051.

- UNIT-V:** Serial port programming in assembly: Basics of serial communication, 8051 connection to RS232C, 8051 Serial port programming in assembly. RTC interfacing and Programming : DS 12887 RTC interfacing, Programming, Alarm, SQW, and IRQ features of DS 12887 Chip. (10)

- UNIT-VI :** 8051 programming in C : Data types and time delay in 8051 C, IO programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C.

TEXT BOOKS :

1. M. A. Mazidi, J. G. Mazidi and R. D. McKinley : óThe 8051 Microcontroller and Embedded Systems using Assembly and Cô, Pearson Education (2nd Ed.)
2. K. J. Ayala : óThe 8051 Microcontrollerô, Penram Int. Pubs., 1996

REFERENCE BOOKS :

1. Using the MCS-51 Microcontroller by Han- Way Huang, Oxford University Press
2. National Semiconductor : Data Acquisition Linear Devices Data Book.
3. Embedded Microcontrollers and Processors:-Volume-I-Intel
4. Intel Peripheral Devices Data Book.

**7XT3 DIGITAL SIGNAL PROCESSING
SECTION-A**

- UNIT-I:** Introduction to DSP, Frequency domain description of signals & systems, Discrete time sequences systems: Linearity, causal, Time invariant system, Stability criteria, Convolution unit sample response. (10)
- UNIT-II:** Z- transform: complex Z-plane, ROC determination of filter coefficients and its properties, Solution of difference equations using Z-transform, inverse Z-transform. (12)
- UNIT-III:** Introduction to Fourier transform of discrete time signal and its properties. Inverse Fourier transforms DFT and its properties, Circular convolution, linear convolution from DFT, FFT: Decimation in time and frequency radix 2 algorithm. (10)

SECTION-B

- UNIT-IV:** Filter Structures: Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Frequency sampling structures

for F.I.R. filter. FIR filter design: Design by Pole Zero Placements and Windowing method: Rectangular, Triangular, Blackman window and Kaiser window. (8)

UNIT-V: Methods to convert analog filter into IIR digital: Mapping of differential equation, Impulse invariant, bilinear transformation, and Matched Z transformation. Design of Analog filter: Specification and formulae to decide to filter order cut of frequency and transfer function of Butterworth filter and Chebyshev filter. (8)

UNIT-VI: Multi rate DSP, Introductory concept of multi rate signal processing, Design of Practical sampler, Rate converters, Decimators and Interpolator, Filter Bank application and examples. Overview and architecture of DSP processor TMS320C54XX. (8)

TEXT BOOKS :

1. Oppenheim & Schafer: Discrete time Processing (PHI)
2. Proakis & Manolakis D.G. : Digital Signal Processing (PHI)
3. Mitra S.K. : Digital Signal Processing (TMH)

REFERENCE BOOKS:

1. Roman Kuc : Digital Signal Processing (MGH)
2. Ifeather E.C., Jervis B. W. : Digital Signal Processing (Addison Wesley)
3. P. P. Vaidyanathan : DSP and Multirate Systems (PHI)
4. Rabiner and Chrocherie : Multirate DSP (PHI)
5. Avtar Singh, S Shrinivasan : DSP implementation using DSP microprocessor with example From TMS320C54XX. Brooks cole publisher 2003.

PROFESSIONAL ELECTIVE-I

7XT4 (1)

VLSI DESIGN

SECTION-A

Unit I: Digital Design Fundamentals: Review of techniques of using a truth table, canonical forms to develop the AND/OR or OR/AND combinational circuit models, minimization techniques, Hazards and Hazard free circuits. Difference between combinational and sequential circuits. General model of sequential machine, timing and triggering considerations.

Unit II: Basic HDL Constructs: VLSI Design flow, Overview of different modeling styles in VHDL, Data types and data objects in VHDL, Dataflow Modeling, Behavioral Modeling, using VHDL for combinational Circuits and sequential Circuits.

Unit III: Hardware Description Language: Structural Modeling, Subprograms, Packages and Libraries, Generics, Configurations, attributes. Comparison of various Hardware Description Languages.

SECTION-B

Unit IV : Programmable Logic Devices: Introduction to CPLDs: Function block architecture, input/output block, switch matrix, Study of architecture of CPLDs of Altera /Xilinx. Introduction to FPGAs: Configurable logic block, input/output block and interconnect, Study of architecture of FPGAs of Xilinx /Altera.

Unit V: CMOS Circuits: Different logic families, MOS Transistor, CMOS as an inverter, propagation delay, power consumption/dissipation issues, simple circuits using CMOS.

Unit VI: CMOS Processing & Digital Circuit Verification: CMOS Fabrication: Different steps of fabrication, CMOS p-well, n-Well and twin tub processes, CMOS Layout and Design rules. Simple Test Bench, Simulation and Synthesis issues, case study of ALU/ Sequence Detector.

TEXT BOOKS:

- 1) Neil H.Weste and Kamran Eshraghian, Principles of CMOS VLSI design. Pearson
- 2) J Bhasker, VHDL Primer. Addison Wesley
- 3) Douglas Perry, VHDL Tata McGraw HILL
- 4) William I. Fletcher An Engineering approach to Digital Design, Prentice Hall India.

REFERENCE BOOKS:

- 1) Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with VHDL Design. Tata McGrawHILL
- 2) Wayne Wolf: VLSI Technology
- 3) VLSI Test Principles and Architectures by Laung Terng Wang, Elsevier

PROFESSIONAL ELECTIVE-I

7XT4 (2)

COMPUTER ORGANIZATION

SECTION-A

UNIT I: Organization and architecture, structure and function, Computer evolution and performance: Brief history of computer, designing for performance, computer components, computer function, bus interconnection, PCI

UNIT II : External devices, I/O modules, I/O Channels and IOPs, SCSI and firewire interfaces, operating system overview, memory management, swapping, partitioning , paging , virtual memory.

UNIT III : ALU: Machine instruction characteristics , operand types, operation types, Addressing modes, instruction formats, CPU structure, processor organization register organization, instruction cycle, instruction pipelining.

SECTION-B

UNIT IV : RISC machine, instruction execution characteristics, register file concept, compiler based register optimization , RISC architecture, RISC pipelining, RISC vs CISC, case study of power PC 620.

UNIT V : Control unit operation: Micro operation, control of processor Hardwired implementation, micro program control : Concepts, microinstructions sequencing and execution, application of microprogramming.

UNIT VI : Multiple processor organizations, symmetric multiprocessors, Mainframe SMP, Cache coherence and MESI protocol, clusters. Non uniform memory access. Vector computation

TEXT BOOKS:

- 1) William Stallings óComputer organization and architectureô. 6/e (Pearson education)
- 2) A.S. Tanenbaum óStructured computer organizationô 4/e McGraw Hill (ISE)

REFERENCE BOOKS:

- 1) C. Hamacher, R. Zaky Computer Organization. 5/e McGraw Hill (ISE)
- 2) J.P. Hayes Computer architecture and organization. 4/e McGraw Hill (ISE)
- 3) M. Mano & Kime Logic & Computer design fundamentals, 2/e (Pearson education)

PROFESSIONAL ELECTIVE-I ARTIFICIAL INTELLIGENCE

7XT4 (3)

SECTION-A

Unit I: Artificial Intelligence: History and Applications, definitions, fundamental issues, challenges, growth of AI, current trends in applied AI

Unit II: Knowledge Representation: Reasoning, Issues, and Acquisition, propositional calculus, predicate calculus, rule-based knowledge representation, basic knowledge representation issues

Unit III: Heuristic Search, search as a problem-solving technique, techniques for heuristic search, hill climbing heuristic, best-first search, evaluation of heuristic functions, State space search, strategies, implementation of graph search, depth-first search, breadth first search, representation of reasoning with predicate calculus using state space, application of search technique in game playing and planning

SECTION-B

Unit IV: Expert Systems, features, characteristics, development of ES technology, architecture, goals, basic activities, advantages, difference between ES and conventional methods, stages in the development of ES, ES tools, difficulties in developing ES, applications of expert systems

Unit V: Artificial Neural Networks, introduction, supervised learning, feed-forward neural networks, recurrent neural networks, Elman backpropagation neural network, Hopfield neural network, features of artificial neural networks, functional link neural network, Fuzzy systems, foundations, crisp set to fuzzy set, representing fuzzy elements, basic terms and operations, properties of fuzzy sets, fuzzy measures, measures of fuzziness, fuzzification, fuzziness and probability theory, membership function shape analysis, defuzzification methods, fuzzy logic in control and decision making applications, hardware realization of the analog fuzzy controller

Unit VI: Genetic Algorithms, procedures of GA, representations, initialization and selection, genetic operators, mutation, natural inheritance operators, logic behind GA, GA applications, applicability of Gas, evolutionary programming, working of evolutionary programming, swarm intelligent systems, background of ant intelligent systems, ant colony paradigm, applications of ant colony intelligence in static and dynamic combinatorial optimization problems, particle swarm intelligent systems, engineering applications of particle swarm intelligent systems

TEXT BOOK:

Artificial Intelligence and Intelligent Systems, Padhy, Oxford Univ Press

REFERENCE BOOK:

Artificial Intelligence by Rich and Knight, McGraw-Hill

PROFESSIONAL ELECTIVE -I**7XT4(4) SATELLITE AND OPTICAL FIBER COMMUNICATION****SECTION-A****UNIT I:- INTRODUCTION**

Satellite frequency bands, Satellite types-LEO, MEO, GEO, HEO, Kepler's laws, Satellite orbits, Geo-stationary Satellite. Orbital Aspects of Satellite Communication: Orbital period and velocity, Effect of orbital inclination, Azimuth and Elevation, Converge angle and Slant range, Orbit determination, Orbital effect in communication system performance.

UNIT II:- SATELLITE CHANNELS

Electromagnetic field Propagation, Antennas, Atmospheric losses, Receiver noise, Carrier to noise ratio, Satellite system link model: Uplink, Downlink, Cross link, Transponder, Satellite system parameters, Satellite link analysis, Frequency reuse and depolarization.

UNIT III:- SATELLITE SERVICES

Very Small Aperture Satellite (VSAT): Overview of VSAT system, Network architecture, Access control protocols, Signal format, Modulation coding and interference issues, VSAT antennas, Transmitter and Receiver, Link analysis for VSAT network.

Satellite Navigation and Global Positioning System (GPS): Radio and Satellite navigation, Position, Location in GPS, GPS receivers and codes, GPS navigation message and signal levels, Timing accuracy, GPS receiver operation, Differential GPS.

SECTION-B**UNIT IV: OPTICAL FIBER WAVEGUIDE AND TRANSMISSION CHARACTERISTICS**

Ray Theory of Optical Fiber, Total internal reflection, Snell's law, Acceptance Angles, Numerical Aperture (NA), Theory of Circular Waveguide, Modes in Optical Fiber, Single mode and Multimode Optical Fiber, Power flow.

Transmission Characteristics of Optical Fiber: Attenuation, Absorption losses, Scattering losses, Bending losses, Dispersion, Intermodal and Intramodal Dispersion.

UNIT V:- OPTICAL SOURCES AND DETECTORS

Optical Sources: Optical Emission from Semiconductor, LED, Power, Efficiency, Double heterojunction LED, Basic concept of LASER, Semiconductor injection LASER, Optical Detectors: Optical detection principle, Absorption quantum efficiency, Responsivity, PIN Photodiode, Avalanche Photodiode, Phototransistor and Photoconductive Detector.

UNIT VI:- OPTICAL ELECTRONIC SYSTEM

Optical Transmitter, Receiver, Digital system planning consideration, Power budgeting, Coherent and Non-coherent system, Modulation and Demodulation schemes, Wavelength multiplexing, Optical switches,

TEXT BOOKS:-

- 1) Gagliardi Robert M.: "Satellite Communication", CBS Publication and Distributors, New Delhi
- 2) Senior J.M.: "Optical Fiber communication and Application", Prentice Hall of India Pvt. Ltd, New Delhi.

REFERENCE BOOKS:-

- 1) Gowar: "Optical Communication System", Prentice Hall.
- 2) R. P. Khare: "Fiber Optics and Opto Electronics", Oxford University Press, First Edition.
- 3) G. Keiser: "Optical Fiber Communication", McGraw Hill International Book Co. New York.
- 4) Pratt Timothy and Bostian W. Charles: "Satellite Communication", Wiley International Publication, New York.

PROFESSIONAL ELECTIVE –I**7XT4(5) AUDIO & VIDEO ENGINEERING****SECTION-A**

Unit I: Principle of disc recording, principle of disc reproduction, Block diagram of disc reproduction system, Coarse-grooves and micro grooves, construction of cutter stylus, Play back needles, cartridges of pick up units, principle of magnetic recording and reproduction, Recorded wavelength, Gap-width and tape speed, need for biasing DC And & AC biasing, Parts of tape recorder, tape transport mechanism advantages and disadvantages of tape recording, Block diagram tape recording and reproducing system Wow and flutter distortions, Rumble, Hissing noise, Types of optical recording of sound, methods of optical recording of sound on films

Unit II: Multimedia Definition, Elements of multimedia system, need of multimedia audio application, audio capture, compression, standards Video applications, video capture Television, compression, standards, proprietary compression, Introduction to video system, sound and picture transmission, scanning process, camera pickup devices, camcorder, video signal, aspect

ratio, horizontal and vertical resolution, video bandwidth and interlaced scanning composite video signal for monochrome TV video signal standards, sound and video modulation, VSB transmission and reception (CCIR ñ B standards), composite color signals, compatibility TV transmitter block diagrams.

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 ñ delta gun.

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

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

TEXT BOOKS:

1. Herve Benoit, Digital Television Satellite, Cable, Terrestrial, IPTV, Mobile TV in the DVB Framework, 3/e, Focal Press, Elsevier, 2008
2. Shlomo Ovadia: Broadband Cable TV Access Networks, PH-PTR, 2001
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

REFERENCE BOOKS:

1. Multimedia in Practice Technology and Applications By Judith Jeffcoate (PHI)

2. Audio-Video Engineering By Gupta
3. Television and Video Engineering By A.M.Dhake
4. R.R. Gulati: Monochrome and Colour Television. New Age international, 2008.
5. Basic Television and Video Systems By Bernord Grob
6. Communication Electronics By Frenzel
7. Electronic Communication Systems By George Kennedy

7XT5: MICROCONTROLLER AND APPLICATIONS- LAB

Minimum 8 experiments uniformly distributed based on the syllabus of 7XT2 (Microcontroller and Applications)

7XT6: DIGITAL SIGNAL PROCESSING- LAB

Minimum 8 experiments uniformly distributed based on the syllabus of 7XT3 (Digital Signal Processing)

7XT7: SIMULATION - LAB

Minimum 8 experiments based on MATLAB /P-SPICE

7XT8: PROJECT AND SEMINAR

SEMESTER EIGHT

8XT1

UHF & MICROWAVES

SECTION-A

Unit I: MICROWAVE TUBES

Limitation of Conventional devices at high frequency, Microwave Tubes: Two cavity, Multicavity klystron, and reflex klystron, Cylindrical Cavity Magnetron, TWT & Backward Wave Oscillator (8)

Unit II: Semiconductor microwave Devices:

Gunn diode: RWH theory, Gunn domain, modes of Gunn oscillation, Negative resistance amplifier, Parametric amplifiers: operation & types, Principle of operation of IMPATT, TRAPATT diodes, & MASER. (8)

Unit III: Transmission of Microwaves:

Waveguides: Rectangular Wave guide, Circular Waveguide, Introduction to Parallel Microstriplines: Microstrip line characteristics impedance & losses (10)

SECTION-B**Unit IV: Microwave Resonator:**

Basic Resonant circuits RLC, transmission line resonators, Cavity resonators: rectangular and circular cavities, resonant frequency, and quality factor of resonators. (8)

Unit V: Microwave Components:

Microwave passive components, terminator, Attenuator, phase shifter, Scattering matrix formulation, Two hole directional coupler, E-plane tee, H-plane tee, Magic tee. Microwave propagation in ferrites, devices employing Faraday rotation: Isolator, Gyrator & Circulator. (8)

Unit VI: Microwave Measurements:

Frequency Measurements, Power Measurements, Attenuation Measurements, VSWR Measurements, Impedance Measurements, insertion Loss Measurements, Dielectric constant Measurements. (8)

TEXT BOOKS :

1. Liao, Samuel Y. : óMicrowave devices & circuitsô, Tata Mc-Graw Hill Co. Ltd., New Delhi
2. Collin, Robert E. : óFoundations for Microwave Engineeringô, Mc-Graw Hill, New York.

REFERENCE BOOKS :-

1. Kennedy G. :ôElectronics Communication Systemsô, Tata Mc-Graw Hill Book Co., New Delhi..
2. K.C. Gupta : óMicrowave Engineeringô, (New Age)
3. Reich, Scolnik, Ordnung, Krangs : óMicrowave Principlesô, PHI
5. M.L. Sisodiya and G.S. Raghuwanshi : óMicrowave Circuits and Passive devicesô, (WEL)
6. Mathew M. Radmanesh : RF and Microwave Electronics ñ Illustrated.

8XT2**ELECTRONIC CIRCUIT DESIGN****SECTION-A**

UNIT-I: Design of regulated power supply using transistor, design of DC amplifier, comparator, window detectors, scaling and summing amplifier using IC 741 / IC 324 or equivalent.

UNIT-II: Design of waveform generator using IC 741, IC 8038, IC 566. Design of sweep generator, voltage controlled oscillator. Design of first and second order filters, design of notch filter.

UNIT-III: Design of instrumentation amplifier, Temperature controller / indicator using thermocouple, resistance thermal detector , thermo sensors AD590, LM35

SECTION-B

UNIT-IV: Introduction to CMOS / VLSI circuits, MOS Transistor switch, Realization of universal gates and compound gates using MOS transistors, basic physical design of simple logic gates.

UNIT-V: VHDL : Design flow, EDA tools, code structures, data types, operators and attributes. Signals & Variables, concurrent code, sequential code, packages and components, configuration, Introduction to VERILOG

UNIT-VI: Design of combinational blocks such as multi-bit adders, ALU, MUX, DEMUX , encoders, decoders, Design of sequential circuits, asynchronous and synchronous design issues, state machine modeling (Moore and Mealy machines).

TEXT BOOKS :

1. R.A. Gayakwad : óOP-AMP and Linear Integrated Circuitsô
2. Volnei Pedroni, óCircuit Design with VHDLô, PHI , 2005 edition

REFERENCE BOOKS:

1. Sergio Franco : Design with Linear Integrated Circuits & Opamps.
2. Douglas L. Perry : VHDL (3rd Ed.), McGraw Hill.
3. Brown & Vranesic : óDigital Logic Design using VHDLô, TMH
4. Paul Horowitz-W.Hill:ôThe art of Electronicsô (Cambridge publications)
5. Neil Weste- K. Eshraghian :Principles of CMOS/VLSI design (Pearson Education)
6. J. Bhaskar óVHDL Primerô (Pearson Education)

8XT3**WIRELESS COMMUNICATION****SECTION-A****Unit-I: CELLULAR FUNDAMENTALS**

Evolution of cellular mobile system (1G, 2G, 3G) A basic cellular system, cell shape, concept of frequency reuse, cellular system architecture, , operation of cellular systems, Mobility Management: Hand off techniques , Types of hand off, Radio link transfer ,roaming management. (8)

Unit II : CELLULAR RADIO SYSTEM DESIGN FUNDAMENTALS

Frequency managements: Cellular system spectrum, frequency assignment, channel assignment strategies, co-channel and non-co-channel interference, cellular system capacity, improving coverage and capacity in cellular system. (9)

Unit III : MOBILE RADIO PROPAGATION MECHANISM

Radio propagation mechanism, multipath propagation, fading, doppler shift, fast and slow fading, control of fading in mobile systems. (8)

SECTION-B**Unit IV : GSM SYSTEM**

GSM system architecture, radio subsystem, channel types, frame structure, GSM Signaling Protocols, call processing in GSM, handovers in GSM, signal processing in GSM, data oriented CDPD network, Specification of HCS, GPRS, EDGE. (9)

Unit V : CDMA SYSTEM

Frequency and channel specification, physical and logical channels of IS-95, call processing in IS-95, soft hand off and power control in CDMA. Cell loading, cell radius, Reverse & Forward link cell size. (9)

Unit VI : MOBILE ADHOC NETWORKS, WLAN & WMAN

Bluetooth: Bluetooth enable devices network, Bluetooth protocol, layers, Zigbee Architecture. Specifications Wireless LAN: Wi-Fi architecture and protocol, Wireless MAN: Wi-MAX architecture and protocol. (9)

TEXT BOOKS:

- 1) Theodore S. Rappaport : Wireless Communications : Principles & Practice, Second edition, Pearson Education (2002)
- 2) Vijay K. Garg : Wireless network Evolution 2G to 3G, Pearson Education.
- 3) K. Pahlavan and P. Krishnamurthy : Principles of Wireless Networks, Pearson Education Asia Publication (2002)

REFERENCE BOOKS:

- 1) William Stallings : Wireless Communications and Networks, Pearson Education Asia Publication (2002)
- 2) Jochen Schiller : Mobile Communications, Pearson Education Asia Publication (2002)
- 3) Andy Dornam : The Essential Guide to Wireless Communication Applications, Pearson Education Asia Publication.
- 4) Upena Dalal : Wireless communication, Oxford University Press
- 5) William CY Lee : Mobile Cellular Telecommunications (second edition) McGraw Hill Inc.

**PROFESSIONAL ELECTIVE -II
BIOMEDICAL ENGINEERING**

8XT4(1)

SECTION-A**UNIT-I: INTRODUCTION TO BIOMEDICAL ENGINEERING**

Physiological system of heart, Man instrument system, Sources of bioelectric potentials, Different bioelectric signals like ECG, EMG and EEG, Biopotential Electrode theory, Basic electrode, Electrodes for EEG, ECG, EMG, Biochemical electrodes. Skin contact Theory : skin contact impedance measurement of skin contact impedance, motion artifacts, nearest equation Nernst Equation. (9)

UNIT-II: BIOMEDICAL RECORDER AND MEASUREMENT

Biomedical recorders for EEG, ECG, EMG, Blood pressure variation as a function of time, relationship of heart sounds to a function of the cardio vascular system, Measurement of Blood Pressure (Direct & Indirect), Blood flow, Heart sound. (8)

UNIT-III: MEDICAL IMAGING SYSTEM

Instrumentation for diagnostics X-ray, X-ray basics properties, X-ray machine, Special imaging technique.

Ultrasonic imaging system: Physics of Ultrasound, Biological effect of ultrasound. Ultrasonic A-scan, M-scan, B-scan, Real-time ultrasonic imaging systems. (8)

SECTION-B**UNIT-IV: THERAPEUTIC EQUIPMENTS**

Need of Physiological and electrotherapy equipments. Cardiac pacemaker machine, Cardiac Defibrillators, Nerve and Muscle stimulators. Diathermy : short wave, microwave, ultrasonic. (8)

UNIT-V: PATIENT CARE AND MONITORING AND SAFETY

System concepts, Bedside patient monitors, central monitors, Average reading heart monitor, Intensive care monitoring, Ambulatory monitoring. **Biotelemetry:** Single channel and Multichannel bio-telemetry, telephonic data transmission.

PATIENT SAFETY: Electric shock hazards, leakage current. Types of Leakage current, measurement of leakage current, methods of reducing leakage current, precautions to minimize electric shock hazards. Telemedicine. (9)

UNIT-VI: COMPUTERS IN BIOMEDICAL ENGINEERING

Computerized Axial Tomography (CAT) Computerized Aided ECG analysis Computerized patient monitoring system. Computerized Catheterization. (8)

TEXT BOOKS:

1. Khandpur R.S. : óHandbook of Biomedical Instrumentationô, Tata Mc-Graw Hill, New Delhi.
2. Cromwell L. & Weibell F.J. : óBiomedical Instrumentation and Measurementô, Prentice Hall of India.

REFERENCE BOOKS:

1. Dr. Lele R.D. : óComputer Applications of Medicineô, Tata Mc- Graw Hill, New Delhi.
2. Webster J.G. : óMedical Instrumentationô, IIed., John Wiley & Sons.
3. Carr and Brown : Biomedical Equipment Technology.

PROFESSIONAL ELECTIVE -II
8XT4(2) DIGITAL IMAGE PROCESSING

SECTION-A

- UNIT-I:** Introduction to digital image processing, Digital Image Fundamental, Elements of Visual Perception, Simple Image Model, Sampling and Quantization, Basic Relationships between Pixel Imaging Geometry, Gray scale image representation. (8)
- UNIT-II:** Image Transforms: Introduction to the Fourier Transform, DFT, Properties of Two Dimensional Fourier Transform, FFT, Hadamard, Harr, DCT, Slant Transform. (8)
- UNIT-III:** Image Enhancement : Basic Techniques, Enhancement by point processing, Spatial Filtering, Enhancement in Frequency domain, histogram based processing, homomorphic filtering. (8)

SECTION-B

- UNIT-IV :** Image Restoration: Degradation model, Diagonalisation concept, Algebraic approach to Restoration. Inverse filtering, Weiner (CNS) filtering Restoration in Spatial domain, Basic morphological concept, morphological principles, binary morphology, Basic concepts of erosion and dilation. (9)
- UNIT-V :** Image Compression: Fundamentals, Image compression models, Elements of Information theory, Lossy and predictive methods, vector quantization, runlength coding, Hauff coding, and lossless compression, compression standards. (9)
- UNIT-VI:** Image Segmentation : Detection of discontinuities, Edge Linking and boundary detection, Thresholding, Regional oriented Segmentation. (8)

TEXT BOOKS :

- 1) Gonzalez and Woods: óDigital Image Processingô, Addison / Wesley.
- 2) Milan Sonka, Vaclav Hlavac, Roger Boyle : Image processing Analysis and Machine Visionô , Book / Cole 2nd Edition.

REFERENCE BOOKS:

- 1) A. K. Jain : óDigital Image Processingô, PHI
- 2) William K. Pratt : óDigital Image Processingô, 3rd ed. , John Wiley and Sons Publications.

PROFESSIONAL ELECTIVE -II
8XT4 (3) ARM SYSTEM DEVELOPMENT AND DESIGN

SECTION-A

- Unit I:** Introduction to Processor Design: Processor architecture and organization Abstraction in hardware design MUO, a simple processor Instruction set design, Processor design trade-offs, The Reduced Instruction Set, Computer Design for low power consumption.
- Unit II:** The ARM Architecture: The Acorn RISC Machine Architectural inheritance The ARM programmer's model ARM development tools.
- Unit III:** ARM Assembly Language Programming: Data processing instructions, Data transfer instructions, Control flow instructions, writing simple assembly language programs.

SECTION-B

- Unit IV:** ARM Organization and Implementation: 3-stage pipeline ARM organization, 5-stage pipeline ARM organization , ARM instruction execution, ARM implementation ,The ARM coprocessor interface.
- Unit V :** The ARM Instruction Set -1: Introduction, Exceptions, Conditional execution Branch and Branch with Link (B, BL) Branch, Branch with Link and exchange (BX, BLX) Software Interrupt (SWI) Data processing instructions, multiply instructions, Count leading zeros (CLZ - architecture v5T only) Single word and unsigned byte data transfer instructions ,Half-word and signed byte data transfer instructions.
- Unit VI:** The ARM Instruction Set -2: Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General

register to status register transfer instructions, Coprocessor instructions, Coprocessor data operations, Coprocessor data transfers, Coprocessor register transfers, Breakpoint instruction (BRK - architecture V5T only) ,Unused instruction, space Memory faults ,ARM architecture variants.

TEXT BOOK:

ARM SYSTEM ON-CHIP ARCHITECTURE, Steve Furber, Second Edition, Pearson

REFERENCE BOOKS:

1. ARM System Developer's Guide, Elsevier
2. Co-Verification of Hardware and Software for ARM SoC Design by Jason Andrews. Elsevier

PROFESSIONAL ELECTIVE-II 8XT4 (4) EMBEDDED AND REAL TIME SYSTEM

SECTION-A

Unit I: Introduction to an embedded systems design: Introduction to Embedded system, Embedded System Project Management, ESD and Co-design issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.

Unit II: RTOS & its overview 1: Real Time Operating System: Task and Task States, tasks and data, semaphores and shared Data Operating system Unit III : RTOS & its overview 2: Services-Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS

SECTION-B

Unit IV: Microcontroller: Role of processor selection in Embedded System (Microprocessor V/s Micro-controller), ARM Microcontroller, Instruction set architecture, THUMB instructions, Exceptions in ARM, Programming examples, PIC Microcontroller: Architecture, basic assembly language programming concepts, Instruction set

Unit V: Embedded system development: Embedded system evolution trends Round - Robin, robin with Interrupts, function-One Scheduling Architecture, Algorithms Introduction to assembler,

compiler-cross compilers, Integrated Development Environment (IDE), Object Oriented Interfacing, Recursion, Debugging strategies, Simulators

Unit VI: Networks for Embedded Systems: The I2C Bus, The CAN bus, SHARC link Ports, Ethernet, Myrinet, Internet, and Introduction to Bluetooth: Specification, Core Protocol, and Cable replacement protocol, IEEE 11491 (JTAG) Testability: Boundary Scan Architecture

TEXT BOOKS:

1. Embedded System Design by Santanu Chattopadhyay, PHI
2. Embedded Systems by Raj Kamal, TMH
3. J B Peatman, Design with PIC Microcontrollers, Prentice Hall

REFERENCE BOOKS:

1. Embedded Systems Architecture by Tammy Noergaard, Elsevier
2. Embedded System Design by Frank Vahid, Tony Givargis, John Wiley & Sons, Inc
3. Real-time systems & software by Alan C Shaw, John Wiley & sons, Inc
4. Embedded System Design by Peter Marwedel, Kluwer Academic Pub

PROFESSIONAL ELECTIVE -II 8XT4(5) SMART SENSORS

SECTION-A

Unit I: Smart Sensor and the Nature of Semiconductor Sensor Output: Mechanical-Electronic Transitions in Sensing, Nature of Sensors, Integration of Micromachining and Microelectronics, Sensor Output Characteristics, Wheatstone bridge, Piezoresistivity in Silicon, Semiconductor Sensor Definitions, Static versus Dynamic Operation, Noise/Interference Aspects.

Unit II: Sensing Technologies: Capacitive Sensing, Piezoelectric Sensing, Hall Effect, Chemical sensors, Improving Sensor Characteristics, Digital Output Sensors, Incremental Optical Encoders, Digital Techniques, Low-Power, Low-Voltage Sensors, combined Solution: Micromachining and Microelectronics.

Unit III: Getting Sensor Information into the MCU : Amplification and Signal Conditioning, Instrumentation Amplifiers, Switched-Capacitor Amplifier , Barometer Application Circuit , 4- to 20-mA Signal Transmitter , Inherent Power-Supply Rejection, Separate Versus Integrated Signal Conditioning , Integrated Passive

Elements , Integrated Active Elements , Digital Conversion , A/D Converters , Performance of A/D Converters , Implications of A/D Accuracy and Errors.

SECTION-B

Unit IV: MCUs/DSPs to Increase Sensor IQ : MCU Control , MCUs for Sensor Interface Peripherals ,Memory, Input/Output , Onboard A/D Conversion , Power-Saving Capability , Local Voltage or Current Regulation , Modular MCU Design , DSP Control , Algorithms Versus Lookup Tables , Techniques and Systems Considerations , Linearization , PWM Control , Autozero and Autorange, Diagnostics , Reducing Electromagnetic Compatibility and Radio Frequency Interference , Indirect (Computed, Not Sensed) Versus Direct Sensing , Software, Tools, and Support , Sensor Integration .

Unit V: Control Techniques : Programmable Logic Controllers , Open Versus Closed-Loop Systems, PID Control , State Machines, Fuzzy Logic , Neural Networks , Combined Fuzzy Logic and Neural Networks ,Adaptive Control ,Observers for Sensing, Other Control Areas , RISC Versus CISC , Combined CISC, RISC, and DSP , The Impact of Artificial Intelligence .

Unit VI: Transceivers, Transponders, and Telemetry : The RF Spectrum, Spread Spectrum, Wireless Data and Communications, Wireless Local Area Networks, FAX/ Modems, Wireless Zone Sensing, Optical Signal Transmission, RF Sensing Surface Acoustical Wave Devices, Radar, Global Positioning System, Remote Emissions Sensing, Remote Keyless Entry, Intelligent Transportation System, RF-ID , Other Remote Sensing Measuring RF Signal Strength, Telemetry, RF MEMS.

TEXTBOOK:

Understanding Smart Sensors, Randy Frank, 2e, Artech House

8XT5: UHF & MICROWAVES - LAB

Minimum 8 experiments uniformly distributed based on the syllabus of **8XT1 (UHF and Microwaves)**

8XT6: ELECTRONIC CIRCUIT DESIGN - LAB

Minimum 8 experiments uniformly distributed based on the syllabus of **8XT2 (Electronic Circuit Design)**

8XT7: PROJECT AND SEMINAR

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

SEVENTH SEMESTER

7XN1 COMPUTER ORGANIZATION

SECTION-A

UNIT I: Organization and architecture, structure and function, Computer evolution and performance: Brief history of computer, designing for performance , computer components, computer function , bus interconnection, PCI

UNIT II: External devices, I/O modules, I/O Channels and IOPs, SCSI and firewire interfaces, operating system overview, memory management, swapping, partitioning , paging , virtual memory.

UNIT III: ALU: Machine instruction characteristics , operand types, operation types, Addressing modes, instruction formats, CPU structure, processor organization register organization, instruction cycle, instruction pipelining.

SECTION-B

UNIT IV : RISC machine, instruction execution characteristics, register file concept, compiler based register optimization , RISC architecture, RISC pipelining, RISC vs CISC, case study of power PC 620.

UNIT V : Control unit operation: Micro operation, control of processor Hardwired implementation, micro program control : Concepts, microinstructions sequencing and execution, application of microprogramming.

UNIT VI : Multiple processor organizations, symmetric multiprocessors, Mainframe SMP, Cache coherence and MESI protocol, clusters. Non uniform memory access. Vector computation.

TEXT BOOKS:

- 1) William Stallings ó Computer organization and architecture. 6/e (Pearson education)
- 2) A.S. Tanenbaumô Structured computer organizationô 4/e McGraw Hill (ISE)

REFERENCE BOOKS:

- 1) C. Hamacher, R. Zaky Computer Organization. 5/e McGraw Hill (ISE)
- 2) J.P. Hayes Computer architecture and organization. 4/e McGraw Hill (ISE)
- 3) M. Mano & Kime Logic & Computer design fundamentals, 2/e (Pearson education)

7XN2 MICROCONTROLLER & APPLICATIONS**SECTION-A**

- UNIT-I:** An Introduction to uC 8051:Architecture of 8051, Signal description of 8051, Register set of 8051, Timer structure and their mode and I/O port structure.
Bus standards : Serial RS 232, Parallel IEEE-488
- UNIT-II:** Instruction set of 8051, Addressing modes of 8051, Memory and I/O addressing by 8051, Assembly Language Programming using 8051
- UNIT-III:** Study of ADC 0809, DAC 0808 and its interfacing with 8051, Interfacing of Sensors, Measurement of Temperature, Speed and Resistance.

SECTION-B

- UNIT-IV:** Interfacing LCD & Keyboard with 8051., Relays and Opto-isolators, Stepper Motor interfacing, DC motor interfacing and PWM with 8051.
- UNIT-V:** Serial port programming in assembly: Basics of serial communication, 8051 connection to RS232C, 8051 Serial port programming in assembly. RTC interfacing and Programming : DS 12887 RTC interfacing, Programming, Alarm, SQW, and IRQ features of DS 12887 Chip.
- UNIT-VI:** 8051 programming in C : Data types and time delay in 8051 C, IO programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C.

TEXT BOOKS :

1. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay : The 8051 Microcontroller and Embedded Systems using Assembly and C, Pearson Education (2nd Ed.)
2. K.J.Ayala : The 8051 Microcontroller, Penram Int. Pubs., 1996

REFERENCE BOOKS :

1. Using the MCS-51 Microcontroller by Han- Way Huang, Oxford University Press
2. National Semiconductor : Data Acquisition Linear Devices Data Book.
3. Embedded Microcontrollers and Processors:-Volume-I-Intel
4. Intel Peripheral Devices Data Book.

7XN3 DIGITAL SIGNAL PROCESSING**SECTION-A**

- UNIT-I:** Introduction to DSP, Frequency domain description of signals & systems, Discrete time sequences systems: Linearity, causal, Time invariant system, Stability criteria, Convolution unit sample response. (10)
- UNIT-II:** Z- transform: complex Z-plane, ROC determination of filter coefficients and its properties, Solution of difference equations using Z-transform, inverse Z-transform. (12)
- UNIT-III:** Introduction to Fourier transform of discrete time signal and its properties. Inverse Fourier transforms DFT and its properties, Circular convolution, linear convolution from DFT, FFT: Decimation in time and frequency radix 2 algorithm. (10)

SECTION-B

- UNIT-IV:** Filter Structures: Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Frequency sampling structures for F.I.R. filter. FIR filter design: Design by Pole Zero Placements and Windowing method: Rectangular, Triangular, Blackman window and Kaiser window. (8)
- UNIT-V:** Methods to convert analog filter into IIR digital: Mapping of differential equation, Impulse invariant, bilinear transformation, and Matched Z transformation. Design of Analog filter: Specification and formulae to decide filter order cut off frequency and transfer function of Butterworth filter and Chebyshev filter. (8)
- UNIT-VI:** Multi rate DSP, Introductory concept of multi rate signal processing, Design of Practical sampler, Rate converters, Decimators and Interpolator, Filter Bank application and examples. Overview and architecture of DSP processor TMS320C54XX. (8)

TEXT BOOKS :

1. Oppenheim & Schaffer: Discrete time Processing (PHI)
2. Proakis & Manolakis D.G. : Digital Signal Processing (PHI)
3. Mitra S.K. : Digital Signal Processing (TMH)

REFERENCE BOOKS :

1. Roman Kuc : Digital Signal Processing (MGH)
2. Ifeather E.C., Jervis B. W. : Digital Signal Processing (Addison Wesley)
3. P. P. Vaidyanathan : DSP and Multirate Systems (PHI)

4. Rabiner and Chrocherie : Multirate DSP (PHI)
5. Avtar Singh, S Shrinivasan : DSP implementation using DSP microprocessor with example From TMS320C54XX. Brooks cole publisher 2003.

PROFESSIONAL ELECTIVE-I NANOELECTRONICS

7XN4 (1)

SECTION A

- Unit I:** Introduction to nanotechnology and nanoelectronics, Impacts, Limitations of conventional microelectronics. Introduction to methods of fabrication of nanomaterials-different approaches. fabrication of nano-layers -Physical Vapor Deposition, Chemical Vapor Deposition, Epitaxy, Molecular Beam Epitaxy
- Unit II:** Ion Implantation, Formation of Silicon Dioxide. Fabrication of nanoparticle- grinding with iron balls, laser ablation, reduction methods, sol gel, self assembly, precipitation of quantum dots. Introduction to characterization tools of nano materials- - principle of operation of STM, AFM, SEM, TEM, XRD, PL & UV instruments.
- Unit III:** Mesoscopic Physics and Nanotechnologies - trends in Microelectronics and Optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence, Quantum wells, wires and dots, Density of states and dimensionality The physics of low dimensional structures - basic properties of two dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, quantum wires and quantum dots Semiconductor quantum nanostructures and super lattices ñ MOSFET structures, Heterojunctions.

SECTION B

- Unit IV:** Quantum wells, modulation doped quantum wells, multiple quantum wells The concept of super lattices Kronig - Penney model of super lattice. Transport of charge in Nanostructures under Electric field - parallel transport, perpendicular transport, quantum transport in nanostructures Transport of charge in magnetic field and quantum Hall effect - Effect of magnetic field on a crystal, the Aharonov-Bohm effect, the Shubnikov-de Hass effect, the quantum Hall effect.
- Unit V:** Nanoelectronic devices and systems - MODFETS, heterojunction bipolar transistors, resonant tunnel effect, RTD, RTT, hot

electron transistors, Coulomb blockade effect and single electron transistor, CNT transistors, heterostructure semiconductor laser,

Unit VI: quantum well laser, quantum dot LED, quantum dot laser, vertical cavity surface emitting laser, quantum well optical modulator, quantum well sub band photo detectors, Infrared detector, nanoswitches, principle of NEMS.

TEXT BOOKS:

1. J.M. Martinez-Duart, R. J. Martin Palma, F. Agulle Rueda Nanotechnology for Microelectronics and optoelectronics , Elsevier,2006.
2. W.R. Fahrner, Nanotechnology and Nanoelectronics, Springer, 2005

REFERENCES

1. K. Goser, P. Glosekotter, J. Dienstuhl, Nanoelectronics and nanosystems, Springer 2004.
2. Supriyo Dutta, Quantum Transport- Atom to transistor, Cambridge University Press, 2005.
3. T. Pradeep, Nano the Essentials, TMH, 2007.
4. Poole, Introduction to Nanotechnology ,John Wiley 2006
5. Chattopadhyay, Banerjee, Introduction to Nanoscience & Technology, PHI 2009
6. Diwanand and Bharadwaj, Nanoelectronics, Pentagon Press Delhi 2006

PROFESSIONAL ELECTIVE-I MECHATRONICS

7XN4(2)

SECTION-A

UNIT I: INTRODUCTION

Definition, Trends, Control Systems, Microprocessor/Micro controller based controllers, PC based controllers, proportional/ Integral/Differential controllers, PID Controllers, Digital Controllers, Adaptive Controller.

UNIT II: ELECTROMECHANICAL DRIVES

DC Servo motors, 4-quadrant servo drives, braking methods, Bipolar drives, MOSFET Drivers, SCR Drives, variable frequency drives.

UNIT III: PLC CONTRILLERS

Ladder diagram, FSD structured programming, Interfacing of Sensors and Actuators to PLC. Programmable Motion

Controllers: Interpolation: point-to-point, Linear Circular, B-S plane, Home, Record position.

SECTION-B

UNIT IV : PRECISION MECHANICAL ACTUATION

Pneumatic Actuators, Electro-pneumatic Actuators, hydraulic Actuators, Electrohydraulic Actuators, Types of motions, Kinematics, Inverse Kinematics, Timing Belts, Ball Screw and Nut, Linear motion Guides, Linear Bearings, Harmonic Transmission, motor/ Drive selection.

UNIT V : MEMS

Overview of MEMS & Microsystems, Typical MEMS & Micro system, products and applications. Micro sensors and micro actuators: Phototransistors, pressure sensors, thermal sensors, micro grippers, micro motors, micro valves, Micro pumps. Micro Manufacturing: Bulk Manufacturing, Surface Manufacturing, LIGA Process.

UNIT VI : DESIGN OF MECHATRONIC SYSTEMS

The design process, traditional and Mechatronic designs. A few case studies like piece counting system pick and place manipulator, simple assembly involving a few parts, part loading. Unloading system, automatic tool and pallet changers etc.

TEXT BOOKS / REFERENCE BOOKS :

1. W.Bolton “**Mechatronics** “,Addison Wesley , IInd Edition
2. N.P. Mahalik,” **Mechatronics Principles, Concepts and Applications**”, Tata Mc-Graw Hill, New Delhi.
3. Dan Neculescu, “ **Mechatronics**”, Pearson Education.
4. Yoram Koren , “**Computer Control of Manufacturing systems**”, Mc-Graw Hill ,New Delhi
5. Tai Ran Hsu,” **MEMS and Microsystems Design and Manufacture**” Tata Mc-Graw Hill, New Delhi.
6. Grover, Weiss, Nagel, and Ordey, “ **Industrial Robotics : Technology, Programming and Applications**”, Mc-Graw Hill publication
7. Fu, Gonzalez and Lee, “**Robotics : Controls, Sensing, Vision and Intelligence**”, Mc-Graw Hill publication
8. S. R. Deb, “**Robotics Technology and Flexible Automation**”, Tata Mc-Graw Hill, Publication.

PROFESSIONAL ELECTIVE-I DIGITAL INSTRUMENTATION

SECTION - A

- Unit I:** Digital instruments - the basics of digital instruments, digital measurement of time interval, phase, frequency, Digital LCR meter, voltmeter and multimeter. Working principle and applications of Wave form analyzer, harmonic distortion meter, harmonic analyser and Spectrum analyzer. Logic state analyser and its application.
- Unit II:** IEEE - 488 General Purpose Interface Bus (GPIB) Instruments with application. Telemetry- Basic scheme of telemetry, Sources of error, line or transmission error, DC voltage and current telemetry schemes, Radio telemetry, PWM and digital telemetry schemes.
- Unit III:** Virtual Instrumentation - Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems.

SECTION - B

- Unit IV:** Embedded Controller, OPC, HMI / SCADA software, Active X programming. VI programming techniques - VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.
- Unit V:** Data acquisition basics - Introduction to data acquisition on PC, Sampling fundamentals, Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution,
- Unit VI:** Data acquisition interface requirements. VI Chassis requirements. Common Instrument Interfaces - Current loop, RS 232C/ RS485, GPIB. Bus Interfaces - USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI.

TEXT BOOKS:

1. D.A.Bell, *Electronic Instrumentation and Measurements*, PHI, 2003.
2. Helfrick & Cooper, *Modern Electronic Instrumentation and Measurement Techniques*, PHI, 2008.
3. Gary Johnson, *LabVIEW Graphical Programming*, 2/e, McGraw Hill.
4. Kevin James, *PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control*, Newnes, 2000.

REFERENCE BOOKS:

1. S.Gupta and J.P.Gupta, *PC Interfacing for data acquisition and Process control*, Instrument Society of America.
2. National Instruments Inc.& Bishop, *Lab View 8 Student Edition*, Prentice all, 2007.
3. Rangan C.S., Sarma G.R. and Mani V.S.V., *Instrumentation Devices and Systems*, 2/e, TMH, 2008.
4. Sanjay Gupta Joseph John, *Virtual Instrumentation Using LabVIEW*, TMH, 2006.
5. *LabVIEW Basics-I Manual*, National Instruments, 2005.

PROFESSIONAL ELECTIVE-I**7XN4(4) INTEGRATED OPTICS AND PHOTONIC SYSTEMS****SECTION -A**

- Unit I:** Introduction , advantages, comparison of optical IC with electrical IC, applications of integrated optics, substrate materials for optical IC. Optical wave guide mode, modes in a planar wave guide, ray optic approach to optical mode theory
- Unit II:** basic three layer waveguide, symmetric and asymmetric wave guide, rectangular channel and strip loaded wave guides. Wave guide fabrication technique, deposited thin film, substitution dopant atoms, carrier concentration reduction wave guide, epitaxial growth, electro optic wave guide.
- Unit III:** Polymer and fiber integrated optics, polymer processing, applications, polymer wave guide devices, optical fiber wave guide devices, fiber sensor, types, applications. Losses in optical wave guide, measurement of losses. Wave guide input and output couplers, types of couplers, coupling between wave guides, coupled mode theory

SECTION - B

- Unit IV:** wave guide modulator, electro optic modulator, single and dual channel electro optic modulator acousto optic modulator. Integrated semiconductor laser, integrated semiconductor optical amplifier, monolithical integrated direct modulator, direct modulation of QD laser, integrated optical detectors, structures, factors affecting the performance, principle of micro optical devices.
- Unit V:** Optical amplifiers, semiconductor laser amplifier, doped fiber amplifiers, Fiber Raman amplifier, fiber Brillouin amplifier, noise

characteristics , crosstalk, system applications. Direct detection light wave system,

- Unit VI:** Digital optical receiver, direct detection with optical amplifiers, performance. Coherent detection light wave system, system configurations, performance. Soliton light wave system, soliton wave propagation, soliton amplification, system design.

TEXTBOOKS/REFERENCES:

- 1 Robert Hunsperger, *Integrated optics :Theory and technology* 6/e Springer, 2009
- 2 Keico Iizuka, *Elements of photonics*, John Wiley, 2002
- 3 Pappannareddy, *Introduction to light wave systems*, Artech House, 1995
4. Lifante, *Integrated Photonics: Fundamentals* , John Wiley 2003

PROFESSIONAL ELECTIVE-I**7XN4 (5) WIRELESS COMMUNICATION****SECTION-A**

- Unit-I: CELLULAR FUNDAMENTALS**
Evolution of cellular mobile system (1G, 2G, 3G) A basic cellular system, cell shape, concept of frequency reuse, cellular system architecture, operation of cellular systems, Mobility Management: Hand off techniques , Types of hand off, Radio link transfer ,roaming management. (8)
- Unit II: CELLULAR RADIO SYSTEM DESIGN FUNDAMENTALS**
Frequency managements: Cellular system spectrum, frequency assignment, channel assignment strategies, co-channel and non-co-channel interference, cellular system capacity, improving coverage and capacity in cellular system. (9)
- Unit III: MOBILE RADIO PROPAGATION MECHANISM**
Radio propagation mechanism, multipath propagation, fading, Doppler shift, fast and slow fading, control of fading in mobile systems. (8)

SECTION-B

- Unit IV: GSM SYSTEM**
GSM system architecture, radio subsystem, channel types, frame structure, GSM Signaling Protocols, call processing in GSM, handovers in GSM, signal processing in GSM, data oriented CDPD network, Specification of HCS, GPRS, EDGE. (9)

Unit V: CDMA SYSTEM

Frequency and channel specification, physical and logical channels of IS-95, call processing in IS-95, soft hand off and power control in CDMA. Cell loading, cell radius, Reverse & Forward link cell size. (9)

Unit VI: MOBILE ADHOC NETWORKS, WLAN & WMAN

Bluetooth: Bluetooth enable devices network, Bluetooth protocol, layers, Zigbee Architecture. Specifications Wireless LAN: Wi-Fi architecture and protocol, Wireless MAN: Wi-MAX architecture and protocol. (9)

TEXT BOOKS:

- 1) Theodore S. Rappaport : Wireless Communications : Principles & Practice, Second edition, Pearson Education (2002)
- 2) Vijay K. Garg : Wireless network Evolution 2G to 3G, Pearson Education.
- 3) K. Pahlavan and P. Krishnamurthy : Principles of Wireless Networks, Pearson Education Asia Publication (2002)

REFERENCE BOOKS:

- 1) William Stallings : Wireless Communications and Networks, Pearson Education Asia Publication (2002)
- 2) Jochen Schiller : Mobile Communications, Pearson Education Asia Publication (2002)
- 3) Andy Dornam : The Essential Guide to Wireless Communication Applications, Pearson Education Asia Publication.
- 4) Upena Dalal : Wireless communication, Oxford University Press
- 5) William C. Y. Lee : Mobile Cellular Telecommunications (second edition) McGraw Hill Inc.

PROFESSIONAL ELECTIVE -I

7XN4 (6)

SPEECH PROCESSING**SECTION-A**

Unit I: Process of speech production, Acoustic theory of speech production, Lossless tube models, and Digital models for speech signals, Time dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using energy & zero crossings, Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function, Median smoothing.

Unit II: Sampling speech signals, Instantaneous quantization, Adaptive quantization, Differential quantization, Delta Modulation, Differential PCM, Comparison of systems, direct digital code conversion.

Unit III: Linear Filtering interpretation, Filter bank summation method, Overlap addition method, Design of digital filter banks, Implementation using FFT, Spectrographic displays, Pitch detection, Analysis by synthesis, Analysis synthesis systems. Homomorphic systems for convolution, complex cepstrum, Pitch detection, Formant estimation, Homomorphic vocoder.

SECTION-B

Unit IV: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications.

Unit V: Spectral subtraction & filtering, Harmonic filtering, parametric re-synthesis, Adaptive noise cancellation. Principles of speech synthesis, Synthesizer methods, Synthesis of intonation, Speech synthesis for different speakers, Speech synthesis in other languages, Evaluation, Practical speech synthesis.

Unit VI: Speech Recognition - Speech recognition model, Distortion Measures for speech recognition : Log spectral Distance, Cepstral Distance and likelihood distance. Time alignment Normalization : Dynamic Time Warping. HMM based speech recognizer - Definition of HMM, Formulation of speech recognition process using HMM.

TEXT BOOKS:

1. L. R. Rabiner and R. W. Schafer, Digital Processing of Speech Signals, Pearson Education (Asia) Pte. Ltd., 2004.
2. D. O'Shaughnessy, Speech Communications: Human and Machine, Universities Press, 2001.
3. L. R. Rabiner and B. Juang, Fundamentals of Speech Recognition, Pearson Education (Asia) Pte. Ltd., 2004.
4. Z. Li and M.S. Drew, Fundamentals of Multimedia, Pearson Education (Asia) Pvt. Ltd., 2004.

REFERENCE BOOKS:

1. C. Becchetti & L. P. Ricotti, Speech Recognition Theory & C++ Implementation, John Wiley & Sons

2. D. O'Shaughnessy, óSpeech Communication Human & Machineô, Universities Press.
3. B. Gold & N. Morgan óSpeech & Audio Signal Processingô, John Wiley & Sons.
4. Thomas F. Quatieri: Discrete Time Speech Signal Processing: Principles and Practice, Pearson Education Asia.
5. J R Deller Jr, et al: Discrete-Time Processing of Speech Signals, IEEE Press, 2000.

7XN5: MICROCONTROLLER AND APPLICATIONS-LAB

Minimum 8 experiments uniformly distributed based on the syllabus of 7XN2 (Microcontroller and Applications)

7XN6: DIGITAL SIGNAL PROCESSING-LAB

Minimum 8 experiments uniformly distributed based on the syllabus of 7XN3 (Digital Signal Processing)

7XN7: SIMULATION - LAB

Minimum 8 experiments based on MATLAB /P-SPICE

7XN8: PROJECT AND SEMINAR

SEMESTER : EIGHT

8XN1 UHF & MICROWAVES

SECTION-A

Unit I: MICROWAVE TUBES

Limitation of Conventional devices at high frequency, Microwave Tubes: Two cavity, Multicavity klystron, and reflex klystron, Cylindrical Cavity Magnetron, TWT & Backward Wave Oscillator (8)

Unit II: Semiconductor microwave Devices:

Gunn diode: RWH theory, Gunn domain, modes of Gunn oscillation, Negative resistance amplifier, Parametric amplifiers: operation & types, Principle of operation of IMPATT, TRAPATT diodes, & MASER. (8)

Unit III: Transmission of Microwaves:

Waveguides: Rectangular Wave guide, Circular Waveguide, Introduction to Parallel Microstriplines: Microstrip line characteristics impedance & losses (10)

SECTION-B

Unit IV: Microwave Resonator:

Basic Resonant circuits RLC, transmission line resonators, Cavity resonators: rectangular and circular cavities, resonant frequency, and quality factor of resonators. (8)

Unit V: Microwave Components:

Microwave passive components, terminator, Attenuator, phase shifter, Scattering matrix formulation, Two hole directional coupler, E-plane tee, H-plane tee, Magic tee. Microwave propagation in ferrites, devices employing Faraday rotation: Isolator, Gyrator & Circulator. (8)

Unit VI: Microwave Measurements:

Frequency Measurements, Power Measurements, Attenuation Measurements, VSWR Measurements, Impedance Measurements, insertion Loss Measurements, Dielectric constant Measurements. (8)

TEXT BOOKS :

1. Liao, Samuel Y. : óMicrowave devices & circuitsô, Tata Mc_Graw Hill Co. Ltd., New Delhi
2. Collin, Robert E. : óFoundations for Microwave Engineeringô, Mc-Graw Hill, New York.

REFERENCE BOOKS :-

1. Kennedy G. : óElectronics Communication Systemsô, Tata Mc-Graw Hill Book Co., New Delhi..
2. K.C. Gupta : óMicrowave Engg.ô, (New Age)
3. Reich, Scolnik, Ordung, Krangs : óMicrowave Principlesô, PHI
5. M.L. Sisodiya and G.S. Raghuvanshi : óMicrowave Circuits and Passive devicesô, (WEL)
6. Mathew M. Radmanesh : RF and Microwave Electronics ñ Illustrated.

8XN2 ELECTRONIC CIRCUIT DESIGN

SECTION-A

UNIT-I: Design of regulated power supply using transistor, design of DC amplifier, comparator, window detectors, scaling and summing amplifier using IC 741 / IC 324 or equivalent.

UNIT-II: Design of waveform generator using IC 741, IC 8038, IC 566. Design of sweep generator, voltage controlled oscillator. Design of first and second order filters, design of notch filter.

UNIT-III: Design of instrumentation amplifier, Temperature controller / indicator using thermocouple, resistance thermal detector , thermo sensors AD590, LM35

SECTION-B

UNIT-IV: Introduction to CMOS / VLSI circuits, MOS Transistor switch, Realization of universal gates and compound gates using MOS transistors, basic physical design of simple logic gates.

UNIT-V: VHDL : Design flow, EDA tools, code structures, data types, operators and attributes. Signals & Variables, concurrent code, sequential code, packages and components, configuration, Introduction to VERILOG.

UNIT-VI: Design of combinational blocks such as multi-bit adders, ALU, MUX, DEMUX , encoders, decoders, Design of sequential circuits, asynchronous and synchronous design issues, state machine modeling (Moore and Mealy machines).

TEXT BOOKS :

1. R.A. Gayakwad : OP-AMP and Linear Integrated Circuits
2. Volnei Pedroni, Circuit Design with VHDL, PHI , 2005 edition

REFERENCE BOOKS:

1. Sergio Franco : Design with Linear Integrated Circuits & Opamps.
2. Douglas L. Perry : VHDL (3rd Ed.) , McGraw Hill.
3. Brown & Vranesic : Digital Logic Design using VHDL, TMH
4. Paul Horowitz-W.Hill: The art of Electronics (Cambridge publications)
5. Neil Weste- K.Eshraghian : Principles of CMOS/VLSI design (Pearson Education)
6. J. Bhaskar VHDL Primer (Pearson Education)

8XN3

VLSI DESIGN SECTION-A

Unit I: Digital Design Fundamentals: Review of techniques of using a truth table, canonical forms to develop the AND/OR or OR/AND combinational circuit models, minimization techniques, Hazards and Hazard free circuits. Difference between combinational and sequential circuits. General model of sequential machine, timing and triggering considerations.

Unit II: Basic HDL Constructs: VLSI Design flow, Overview of different modeling styles in VHDL, Data types and data objects in VHDL, Dataflow Modeling, Behavioral Modeling, using VHDL for combinational Circuits and sequential Circuits.

Unit III: Hardware Description Language: Structural Modeling, Subprograms, Packages and Libraries, Generics, Configurations, attributes. Comparison of various Hardware Description Languages.

SECTION-B

Unit IV: Programmable Logic Devices: Introduction to CPLDs: Function block architecture, input/output block, switch matrix, Study of architecture of CPLDs of Altera /Xilinx. Introduction to FPGAs: Configurable logic block, input/output block and interconnect, Study of architecture of FPGAs of Xilinx /Altera.

Unit V: CMOS Circuits: Different logic families, MOS Transistor, CMOS as an inverter, propagation delay, power consumption/dissipation issues, simple circuits using CMOS.

Unit VI: CMOS Processing & Digital Circuit Verification: CMOS Fabrication: Different steps of fabrication, CMOS p-well, nWell and twin tub processes, CMOS Layout and Design rules. Simple Test Bench, Simulation and Synthesis issues, case study of ALU/ Sequence Detector.

TEXT BOOKS:

- 1) Neil H. Weste and Kamran Eshraghian, Principles of CMOS VLSI design.
- 2) J. Bhaskar, VHDL Primer. Addison Wesley
- 3) Douglas Perry, VHDL Tata McGraw HILL
- 4) William I. Fletcher An Engineering approach to Digital Design, Prentice Hall India.

REFERENCE BOOKS:

- 1) Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with VHDL Design. Tata McGraw HILL
- 2) Wayne Wolf: VLSI Technology
- 3) VLSI Test Principles and Architectures by Laung Terng Wang, Elsevier

PROFESSIONAL ELECTIVE -II 8XN4(1) SYSTEM ON CHIP

SECTION-A

UNIT I: SYSTEM DESIGN

Concept of system, importance of system architectures, introduction to SIMD, SISD, MIMD and MISD architectures, concept of pipelining and parallelism.

UNIT II : INTRODUCTION TO SOC

Typical SOC architecture, SOC design flow, Differences between Embedded systems and SOC's, Designing microprocessor / Microcontroller based system and embedded system. System design issues in SOC's

UNIT III : SOC PROCESSORS

Introduction to CISC , RISC, Von Neumann and Harvard Architecture, Concept of Soft processors , Study of IBM's power PC, Spartan-III FPGA , Picoblaze processor, Microblaze processor

SECTION –B**UNIT IV : SYSTEM BUSES**

Introduction to busses used in SOC's. Introduction to AMBA bus. Detailed study of IBM's core connect bus, concept of PLB-processor local bus and OPB-on chip peripheral bus.

UNIT V : SOC IMPLEMENTATION

Study of features like embedded RAM's, multipliers, Digital clock management etc. Introduction to tools used for SOC design, Xilinx embedded development kit.

UNIT VI : SOC DEVELOPMENT TOOLS

Developing simple systems by interfacing simple peripherals to **Spartan III Tools** : Xilinx ISE and Xilinx EDK, Latest versions SOC system design, tutorial designing an image processing system with interface to host using either UART/PCI/USB bus.

REFERENCE BOOKS:

1. Wyne wolf , "FPGA based system design" by Prentice Hall of India.
2. Giovanni De Micheli, Rolf Ernst and Wayne Wolf "Readings in hardware/software co-design". Morgan Kaufman publishers
3. Computers as components : principles of embedded computing system Design" Morgan Kaufman publishers
4. Ahmed jerry, Wayne wolf , "Multiprocessors systems-on-chips" Morgan Kaufman Publishers
5. Core connect architecture at <http://www.chips.ibm.com/products/coreconnect>
6. EDK power PC tutorial at <http://www.xilinx.com/EDK>
7. Spartan III handbook from Xilinx
8. Power PC info http://www.chips.ibm.com/products/powerPC/cores/405sde_pb.html
9. White papers from xilinx.com and <http://www.chips.ibm.com>

10. Arm processor details at WWW.arm.com
11. Amba bus architecture at <http://www.arm.com/products/solutions/Ambahomepage.html>

PROFESSIONAL ELECTIVE-II
DIGITAL SIGNAL PROCESSORS

8XN4(2)

SECTION-A**Unit I : INTRODUCTION TO DSP PROCESSORS**

Advantages of DSP Processors, Characteristics of DSP Processors, Applications of DSP Processors, Types of Architectures: Von-Neumann Architecture, Harvard Architecture, Super Harvard Architecture, VLIW Architecture.

Unit II: ARCHITECTURE FOR PROGRAMMABLE DSP DEVICES

Basic Architectural features, DSP computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed issues Features for External interfacing.

Unit III: EXECUTION CONTROL AND PIPELINING

Hardware looping, Interrupts, Stacks, Relative Branch Support, Pipelining and performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, pipeline Programming models.

SECTION-B**Unit IV: PROGRAMMABLE DIGITAL SIGNAL PROCESSORS**

Commercial Digital signal-processing Devices, Architecture of TMS320C67XX Processors, Data Addressing modes of TMS320C67XX Processors, Memory space of TMS320C67XX Processors, Program Control, TMS320C67XX instructions and Programming, On-Chip peripherals, Interrupts of TMS320C67XX processors, Pipeline Operation of TMS320C67XX Processors.

Unit V: Analog DSP Processor family

Analog 21061 series SHARC Processor block diagram, Interrupt Hardware, Memory quantization, Central arithmetic logic unit, system control etc.

Unit VI: IMPLEMENTATION OF BASIC DSP ALGORITHMS

FIR Filters, IIR Filters, interpolation Filters, Decimation filters, Adaptive Filters, 2-D Signal Processing.

TEXT BOOKS & REFERENCES :

1. Analog Devices & Texas Instruments Users Manual of TMS320C67XX and ADSP21061.
2. Architectures for Digital Signal Processing- P. Pirsch, John Wiley
3. Digital Signal Processors- Kuo and Gan, Pearson Education
4. DSP Processor Fundamentals: architectures and Features, by Phil Lapsley, Wiley
5. DSP Applications using C and the TMS320C6x DSP

**PROFESSIONAL ELECTIVE-II
ARTIFICIAL INTELLIGENCE & ROBOTICS**

8XN4(3)**SECTION-A**

Unit I: Fundamental Concepts - Agents, environments, general model; Problem solving techniques. Search Techniques - Uninformed search, heuristic search, adversarial search and game trees; Solution of constraint satisfaction problems using search.

Unit II: Knowledge Representation - Propositional and predicate calculus, semantics for predicate calculus, inference rules, unification, semantic networks, conceptual graphs, structured representation, frames, scripts.

Unit III: Prolog - Basic constructs, answer extraction. Bayesian Reasoning - Bayesian networks, dynamic Bayesian networks. Planning - State-space search, planning graphs. Learning - Inductive learning, decision tree learning.

SECTION - B

Unit IV: Robotics - Basic concepts, definition and origin of robotics, different types of robots, robot classification, applications, robot specifications. Introduction to automation - Components and subsystems, basic building block of automation, manipulator arms, wrists and end-effectors.

Unit V: Transmission elements - Hydraulic, pneumatic and electric drives. Gears, sensors, materials, user interface, machine vision, implications for robot design, controllers. Kinematics, dynamics and control - Object location,

Unit VI: three dimensional transformation matrices, inverse transformation, kinematics and path planning, Jacobian work envelope, manipulator dynamics, dynamic stabilization, position control and force control, present industrial robot control schemes.

TEXT BOOKS:

1. Russell, S., Norvig, P, *Artificial Intelligence: A Modern Approach*, Pearson Education, 2006.
2. Spong and Vidyasagar, *Robot Dynamics and Control*, John Wiley & Sons, 1990.
3. Rich, E., Knight, K., *Artificial Intelligence*, TMH, 2006.
4. Asfahl C.R, *Robots and Manufacturing Automation*, John Wiley & Sons, 1992.

REFERENCES:

1. Nilsson, N. J., *Artificial Intelligence: A New Synthesis*, Morgan Kaufmann, 1998
2. Bratko, I., *Prolog Programming for Artificial Intelligence*, 3/e, Pearson Education, 2001.
3. Klafter, R.D., Chmielewski, T.A, Negin, M., *Robotic Engineering An Integrated Approach*, PHI, 2007
4. Schilling, R. J., *Fundamental of Robotics: Analysis and Control*, PHI, 2007.
5. Fu, K. S, Gonzalez, R.C, Lee, C.S.G., *Robotics, Control, Sensing, Vision and Intelligence*, McGraw- Hill, 1987.

**PROFESSIONAL ELECTIVE-II
DIGITAL IMAGE PROCESSING**

8XN4(4)**SECTION-A**

UNIT-I: Introduction to digital image processing, Digital Image Fundamental, Elements of Visual Perception, Simple Image Model, Sampling and Quantization, Basic Relationships between Pixel Imaging Geometry, Gray scale image representation. (8)

UNIT-II: Image Transforms: Introduction to the Fourier Transform, DFT, Properties of Two Dimensional Fourier Transform, FFT, Hadamard, Harr, DCT, Slant Transform. (8)

UNIT-III: Image Enhancement : Basic Techniques, Enhancement by point processing, Spatial Filtering, Enhancement in Frequency domain, histogram based processing, homomorphic filtering. (8)

SECTION-B

UNIT-IV: Image Restoration: Degradation model, Diagonalisation concept, Algebraic approach to Restoration. Inverse filtering, Weiner (CNS) filtering Restoration in Spatial domain, Basic morphological concept, morphological principles, binary morphology, Basic concepts of erosion and dilation. (9)

UNIT-V: Image Compression: Fundamentals, Image compression models, Elements of Information theory, Lossy and predictive methods, vector quantization, runlength coding, Hauff coding, and lossless compression, compression standards. (9)

UNIT-VI: Image Segmentation : Detection of discontinuities, Edge Linking and boundary detection, Thresholding, Regional oriented Segmentation. (8)

TEXT BOOKS :

- 1) Gonzalez and Woods: "Digital Image Processing", Addison / Wesley.
- 2) Milan Sonka, Vaclav Hlavac, Roger Boyle : Image processing Analysis and Machine Vision, Book / Cole 2nd Edition.

REFERENCE BOOKS:

- 1) A. K. Jain : "Digital Image Processing", PHI
- 2) William K. Pratt : "Digital Image Processing", 3rd ed. , John Wiley and Sons Publications.

PROFESSIONAL ELECTIVE-II DIGITAL COMMUNICATION

8XN4 (5)

SECTION-A

Unit I:- 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 II :- 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 vs Bandwidth Tradeoff (12)

Unit III:- 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 IV:- 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 V:- 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 VI:- 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 Rinehart 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. Wcy Lee : "Mobile Cellular Telecommunications Systems", Mc- Graw Hill International Editions, 1990
4. Glover and Grant : "Digital Communication", Prentice Hall Publication

PROFESSIONAL ELECTIVE -II SMART SENSORS & NETWORKS

8XN4 (6)

SECTION-A

- Unit I:** Review: Sensor, actuator and transducer- Classification of sensors on the basis of energy source and type of output signals. Signal conditioning. Meaning and types of smart sensors. MEMS Sensors: Concept and methods of making MEMS devices, Sensors and Actuators, Examples.
- Unit II:** Smart Sensor Technologies: Thick-film, thin-film and monolithic IC technologies and their use in making smart sensors. Bulk and surface micromachining technologies, Wafer bonding, LIGA process, Plasma etching, and their use in making smart sensors.
- Unit III:** Intelligent and Network Sensors: Concept and architecture of intelligent sensors, Concept and architecture of network sensors. Sensor Networking: 7-Layer OSI model of communication system, device-level networks, introduction to protocols and technologies for wired and wireless LANs.

SECTION-B

- Unit IV:** Ethernet, RS-485 and Foundation Fieldbus protocols. Wi-Fi. Zigbee and Bluetooth protocols. Concept of adhoc networks. Smart Transducer Interface Standard IEEE 1451.
- Unit V:** Introduction to Sensor network computing: Applications, Constraints/Challenges, Wireless and wired networking issues for sensor nets.
- Unit VI:** Networking for sensor nets- Directed diffusion, Aggregation, Network discovery/initialization, Location/Time service, Routing, Large-scale analysis, Power-aware computing and Communication.

TEXT BOOKS:

1. Fraden J., Handbook of Modern Sensors: Physics, Design and Applications, AIP press, 2003.
2. Feng Z. and Leonidas G, Wireless Sensor Networks, Elsevier Eastern Limited, 2007.
3. Anna Hac, Wireless Sensor Network Design, John Wiley & Sons, Ltd, 2004.

REFERENCES:

1. Frank R., Understanding Smart Sensors, Artech House publishers. 2000.
2. Yamasaki H., Intelligent Sensors, Elsevier Eastern Limited. 1996.
3. Ramon P. A. and Webster J. G., Sensors and Signal Conditioning, 2/e, John Wiley and Sons.
4. Elena Gaura, Robert Newman, Smart MEMS and Sensor systems, Imperial College Press, 2006.
5. Mohammad Ilyas, Sensor Network Applications, Architecture and Design, CRC Publishers, 2006.

8XN5: UHF & MICROWAVES LAB

Minimum 8 experiments uniformly distributed based on the syllabus of 8XN1 (UHF and Microwaves)

8XN6: ELECTRONIC CIRCUIT DESIGN AND VLSI DESIGN-LAB

Minimum 4 experiments uniformly distributed based on the syllabus of 8XN2 (Electronic Circuit Design) and minimum 4 experiments uniformly distributed based on the syllabus of 8XN3 (VLSI Design)

8XN7: PROJECT AND SEMINAR

**SYLLABUS PRESCRIBED FOR BACHELOR OF ENGINEERING
INSTRUMENTATION ENGINEERING
SEMESTER PATTERN (C. G. S.)
SEVENTH SEMESTER**

7IE 01 PLC & SCADA SYSTEMS

UNIT I: Introduction to PLC, Types of PLC, Block diagram, processor section, Specification of advance PLC, Input modules & output module (Analog, Digital, Discrete). Communication modules, limit switches, scan time.

UNIT II: Symbols of ladder diagram, Programming instruction (Input, output, timer, counter, bit, comparison, file move, data handling, branch instruction, skip & bypass IO).

UNIT III: Development of ladder diagrams: Various types for ladder programming, development of ladder diagram, flowchart, ladder programming for logic gates, flip-flop (JK, RS, D, T), ladders programming for various industrial process.

UNIT IV: System configuration:- Hardware, system, Sizing & selection, Wiring diagram, PLC installation, Safety enclosure, temperature noise, hook up Consideration, operator interrupts, interfacing of PC field bus, PLC Simulator.

UNIT V: Introduction to supervisory control: Introduction, Block diagram, SCADA system integrated with PLC, Channel, Scanning, Interrupt Scanning, Data processing, Distributed SCADA system, RTU.

UNIT VI: Industrial Application of SCADA system, Relay control card, stepper motor control card, PC based Add-on Card, benefits of SCADA, Comparison of SCADA, DCS, PLC.

PRACTICALS:

Students are expected to perform minimum 8 experiments based on above syllabus.

TEXT BOOKS:

- 1 Programmable control logic principle and application By John W. Webb (PHI)
- 2 Computer Based Industrial Control by Krishnakant.
- 3 Process Control Instrumentation Technology, by C.D. Johnson, (7e)
- 4 Programmable Logic control By John R. Hackworth (Pearson Education)
- 5 Process control by Surekha Bhanot

REFERENCE BOOK:

- 1 Hand book Process control By B.G.Liptak Vol. II

7IE 02 COMPUTER-AIDED CONTROL

UNIT I: Introduction to PC in plant control, role of computer in process control, Element of computer aided process control, classification of computer aided process control, benefits using computer control. Types of computer control software.

UNIT II: Data acquisition and processing system: Introduction, Techniques of Data acquisition (synchronous, multi channel, fast) data acquisition board.

UNIT III: Data logger system, microprocessor/ microcontroller based DAS. Direct digital control: Introduction, DDC structure, DDC software (position algorithms, Velocity algorithms)

UNIT IV: Distributed control system: Functional block diagram and generic futures, system architecture.
DCS sub system: Field station, presentation & monitoring devices, DCS interfacing with PLC & PC.

UNIT V: ISO / OSI reference model, network protocol.
Field bus: Introduction, network topology, profibus, modbus, Comparison of DCS with PLC,

UNIT VI: Configuration and performance characteristics of virtual instrumentation system, Lab view, Fault finding and trouble shooting technique of instrument and system, causes and remedy of faults.

TEXT BOOKS:

- 1 Process control concept, dynamic and application by S. K. Singh (PHI)
- 2 Computer Based Industrial Control by Krishnakant.
- 3 Process Control Instrumentation Technology, by C.D. Johnson, (7e)

REFERENCE BOOKS:

- 1 Hand Book: Process Control by B.G. Liptak.
- 2 Electronic Instruments Hand book (2/e), 1997 by Clyde F. Coombs, TMH

7 IE 03 BIOMEDICAL INSTRUMENTATION

Unit I: Introduction to Biomedical Instrumentation: sources of biomedical potentials, Different bioelectric signals like ECG, EMG & EEG

Biopotential electrodes: basic electrode theory, nernst equation, electrical conductivity of electrode gels & creams, skin contact impedance & its measurement. Electrodes for ECG, EEG & EMG.

Unit II : Cardiovascular system : physiology of heart & cardiovascular system, ECG lead configuration, ECG recorders, Vector cardiograph, Phonocardiograph, measurement of cardiac output, blood flow & blood pressure.

Unit III : Nervous System: anatomy of nervous system, neuronal communication, neuronal receptors. Types of nervous system (central & peripheral), spinal reflexes. , EEG measurements, 10-20 electrode placement system , Recorder for EEG & EMG.

Unit IV : Therapeutic equipments : cardiac pacemakers, types of pacemaker, programmable pacemaker , ventricular synchronous pacemaker , cardiac defibrillators, Diathermy unit : shortwave, micro wave & ultrasonic.

Unit V: Medical Imaging System : Instrumentation for diagnostics X-Ray : properties, X-ray units, X-ray machines & generation process, special imaging techniques for X-rays.
Ultrasonic Imaging System : Physics of ultrasound, basic modes of transmission, Ultrasonic display modes : A scan, B scan & M scan with applications. Biological effects of ultrasound.

Unit VI : Electrical safety: general consideration for biomedical recorder amplifiers, sources of noise in zero level recording circuits, physiological effects of electrical currents, electric shock hazards, leakage currents, methods of accident prevention. Test instruments for checking safety parameters of biomedical equipments.

PRACTICALS:

Students are expected to perform minimum 8 experiments based on above syllabus.

TEXT BOOKS:

- 1) Handbook of Biomedical Instrumentation by R.S.Khandpur, TMH Pub.
- 2) Biomedical Instrumentation & Measurements by L.Cromwell, F.Weibell, E.A. Pfciffer, PHI Pub.

REFERENCE BOOKS :

- 1) Introduction to Biomedical Equipment by Carr & Brown.
- 2) Medical Instrumentation by J.G.Webster, 3rd edition, John Wiley.

7 IE 04 PROJECT PLANNING ESTIMATION AND ASSESSMENT

Unit I: Definition of Project, Purpose, Scope, Organization Structure, Project implementation and Cost estimation , Documentation, I & C document, Manpower Planning, Project time Schedule.
Quality management: Concepts and applications of Kaizen, quality circle, ISO 9000 series, just-in-time, quality Planning and total quality management, elements of TQM, Quality Circles.

Unit II: Project monitoring and control: PERT/CPM techniques, Project Bar Chart, Tendering procedure, Bid evaluation and procurement procedure, project coordination, multi-agency interaction.

Unit III: Specification, Configuration and Design Criteria : Degree of automation, Manpower matching, instrument Specification sheet, area classification and Instrument selection, control system specification .
Control console, centers and panels: Types, Design, Inspection, and specification.
Intelligent operator interface (IOI).

Unit IV: Test Procedure, Installation and Commissioning: Factory acceptance and Site acceptance test , Inspection reports and check list, installation and Commissioning, control schedule , site activities up to hand over, ,Spares management, Maintenance, annual maintenance contract.

Unit V: Project Engineering and documentation, standard symbols and legends, process flow sheet, P and I diagrams, control Schematics, instrument list, interlock diagrams, plant G. A. diagrams, power/air distribution, loop schematics and termination diagram, installation sketches and bill of material, control system documentation.
Cable Engineering: Different classes of conductors , NEMA Standards. Types and specifications of cables, Cable schedule, routing of cables, types of glands, ferruling and terminations.

Unit VI: Discrete State control system: Two state control system, non-interactive Variables, sequential system, Time sequence system and composite sequential system.
Field bus Wiring: Terminator, Power Conditioners, Spurs, Segments, and repeaters.
Networking: Hubs, routers, LAN cards, and Cat cables. (52)

PRACTICALS:

Students are expected to perform minimum 8 experiments based on above syllabus.

TEXT BOOKS :

1. Applied Instrumentation in Process Industries, Vol. I & II by Andrew & William.
2. Batch Control System By T. G. Fisher.
3. Management System by John Bacon.

REF. BOOK :

1. Applied Instrumentation in process Industries Volume I, II By Andrew & William

7 IE 05

PROFESSIONAL ELECTIVE -I
(1) FUZZY LOGIC AND NEURAL NETWORKS

UNIT-I: Introduction :

Biological Neurons and their artificial models introduction to neural computing, Components of neuron, input and output weight, threshold, weight factors, transfer functions, concepts of supervised and unsupervised learning. (8)

UNIT-II: Supervised Learning : Single layer network, perceptron, Linear separability, Training algorithm and limitations.

Multilayer Network : Architecture of feed forward network, Learning rule, generalized delta rule, learning function. Back propagation algorithm. (9)

UNIT-III: Unsupervised Learning : Introduction, Counter propagation networks, Kohonen's self organizing maps.

Hopfield networks. (8)

UNIT-IV: Introduction : Uncertainty in information, basic concepts of Fuzzy sets, operations on fuzzy sets, properties.

Fuzzy relations : operations, properties, value assignments. (8)

UNIT-V: Membership functions : Features, fuzzification, membership value assignments, Fuzzy Rule based systems, Graphical technique of inference.

Defuzzification : Lambda-cuts for Fuzzy sets and Fuzzy relations, Defuzzification methods. (9)

UNIT-VI: Applications:

1. Fuzzy pattern Recognition - feature analysis, partitioning of feature space, single sample identification multifeature pattern recognition.
2. Simple Fuzzy logic controller - Control system design stages, Assumptions in a Fuzzy control system design, general fuzzy logic controllers, simple examples. (8)

TEXT BOOKS :

1. J.M. Zurada : Introduction to Artificial Neural Systems, Jaico Publishing House.
2. Meherotra Kishan, Mohan C.K., Ranka Sanjay : Elements of artificial neural networks, Penram Int. Pub., Mumbai
3. Timothy Koss : Fuzzy Logic with Engineering Applications, McGraw Hill International Edition.

REFERENCE BOOKS

1. N. K. Bose and P. Liang : Neural Network Fundamental with Graphs, Algorithms and Applications, Tata McGraw Hill Edition.
2. G.J. Klir and T.A. Folger : Fuzzy sets, Uncertainty and Information, PHI Publication
3. Kosko Bart : Neural Networks & Fuzzy systems, Prentice Hall of India Pvt.Ltd., New Delhi

7 IE 05

PROFESSIONAL ELECTIVE-I
(2) ROBOTICS & AUTOMATION

UNIT-I: Definition of a Robot, A brief introduction to Robot Technology, Sensory perception, Intelligence, End Effectors, Sensory feedback, Robot Vision / Computer Vision and its fundamental components, Tactile Sensing, Range finding and real world navigation Speech synthesis and recognition.

Robot control fundamentals : The Artificial intelligence view point, comparison of human brain and computer in the context of intelligent behaviour, problem representation in A.I. system problem solving technique in A.I. (12)

UNIT-II: Definition of knowledge, Domain and logic : Elements of logic, proportional calculus, predicate calculus, pros and cons of logic, production system and their basis elements, semantic Nets and their characteristics, Frames, A Brief about Expert system comparison of various methods of knowledge representation.

(10)

UNIT-III: Elements of speech, Time Domain Analysis / Synthesis of speech and waveform digitization, frequency Domain Analysis / Synthesis of speech phoneme Speech Synthesis, various type of speech recognition Systems and their basics ideas, Isolated word Recognition, Connected Speech understanding.

(12)

UNIT-IV: Elements of vision, Image Transformation, Image Analysis, Image Understanding of Machine perception, Industrial Vision System.

(9)

UNIT-V: Triangulation Method, Time of Flight (TOF), Ranging Method, Robot Position and Proximity Sensing, Tactile-Sensing System, Sensing Joint Forces and their importance in Robot programming, sensing touch and slip. (9)

UNIT-VI: Various Robot Programming Languages and their characteristics, characteristics of Robot Task Level language, comparison of Robot programming language, features of the high level languages used in conventional programming language, featuring with the high level language used in conventional programming. (12)

BOOKS RECOMMENDED

1. Staugard A.C. : Robot and AI, Prentice Hall, Engle Wood Cliff N.J. 1987.
2. Lee C.S.G., Fu K. S., Gonzalez R.C. : Robot-Control, Sensing and Intelligence, Mc-Graw Hill, Singapore, 1987.
3. Klaffertal : Robotics
4. Parent M. and Laugreau C. : Robot Technology (Vol.4 : Logic and programming), Kogan Page, London, 1985.
5. Aleksander I., Farreny H. and Ghallab M. : Robot Technology (Vol-1).
6. Decision and Intelligence Kogan Page, 1986.

7 IE 0 5/7XT03/7XN03/7IT01 PROFESSIONAL ELECTIVE-I (3) DIGITAL SIGNAL PROCESSING

UNIT-I: Introduction to DSP, Frequency domain description of signals & systems, Discrete time sequences systems, Linearity unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems, Solutions of linear difference equations. (9)

UNIT-II: Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, Sampling of continuous time signal, Reconstruction of continuous time signal from sequences, Z-Transform and its properties, complex Z-plane, ROC Determination of filter Coefficients, relationship between Fourier Transform and Z-Transform, Inverse Z-Transform. (12)

UNIT-III: DFT and its properties, Circular convolution, Linear convolution from DFT, FFT, Decimation in time and frequency algorithm. Introduction to wavelet transform. (10)

UNIT-IV: Filter categories, Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Frequency sampling structures for F.I.R. filter, Steps in Filter Design, Design by Pole Zero Placements, FIR filter design by Windowing method, Rectangular, Triangular and Blackman window. (8)

UNIT-V: Analog filter types, Butter worth, Elliptic filter, Specification and formulae to decide to filter order, Methods to convert analog filter into IIR digital, Mapping of differential, Impulse invariant, Bilinear, Matched Z transformation. (8)

UNIT-VI: Multi rate DSP, Introductory concept of multi rate signal processing, Design of Practical sampler, Rate converters, Decimators and Interpolator, Filter Bank application and examples. (8)

TEXT BOOKS :

1. Oppenheim & Scheffer : Discrete time Processing (PHI)
2. Proakis & Monolakis D.G : Digital Signal Processing (PHI)
3. Mitra S.K. : Digital Signal Processing (PHI)

REFERENCES

1. Roman Kuc : Digital Signal Processing (MCW)
2. Ifeather E.C., Jervis B. W. : Digital Signal Processing (Addison Wesley)
3. P. P. Vaidyanathan : DSP and Multirate Systems (PHI)
4. Rabiner and Chrocherie : Multirate DSP (PHI)

7 IE 0 5 PROFESSIONAL ELECTIVE I (4) OPTOELECTRONIC INSTRUMENTATION

UNIT I: Light and Elements of solid state physics, nature of light, wave nature of light, light sources black body radiation, units of light, Energy bands in solids, semiconductor types, work function.

UNIT II: DISPLAY DEVICES : Luminescence, Insestion Lurninescence and the light emitting diode, Radiative recombination processes, LED materials, Commercial LED materials, LED construction, response time of LEDs, LED drive circuitry plasma display liquid crystal displays.
ZASERS : Emission population inversion, optical feedback classes of laser, doped insulator lasers. Semiconductor lasers, gas lasers, liquid dye lasers, laser applications, measurement of distance holography.

UNIT III: OPTICAL FIBERS :-

Classification of optical fiber, principle of light transmission through a fiber, fabrication of optical fibers, material consideration loss and band width limiting mechanism, perform

fabrication technique, fiber drawing, fiber optic communication system.

UNITIV: Fiber optic sensors, intensity modulated sensors, microben strain intensity modulated sensor, liquid level types hybrid sensor, internal effect intensity modulated sensor, phase sensor, diffraction grating sensors, sensors using single mode fiber, interferometric temperature sensor, distributed fiber optic sensors, polarization problem in interferometric sensors using single mode fiber.

UNITV: Medical applications of fiber sensors, Fabry-Perot fiber optic sensors, Electric field and voltage sensors, Chemical fiber optic gyroscopes, magnetic field and current fiber sensor, military and aerospace applications, important applications of integrated optic fiber technology, Local area networks.

UNITVI: Special applications, ADM, video link, satellite link, computer link, nuclear reactor link, digital video transmission in optical fiber networks, video compression, N.A. measurement, working of OTDR, microprocessor based OTDR, applications of OTDR, dispersion measurements, Bit Error Rate (BER) measurement, attenuation measurement using OTDR, cut-off wavelength measurement, microbending loss measurement. (52)

TEXT BOOK :-

- 1) Subir Kumar Sarkar : Optical Fibers & Fiber Optic Communication Systems, S. Chand & Co., 2001.

REFERENCE BOOKS:

- 1) Morris Tischler : Optoelectronics : Fiber Optics and Lasers, A Lab Text Manual, 2nd Edition, McGraw Hill, 1992.
- 2) Frederick C. Allard : Fiber Optics Handbook for Engineers & Scientist (Optical & Electro-optical Engineering Series), McGraw Hill, 1990.
- 3) John M. Senior : Optical Fiber Communications, Principles & Practice, 2nd edition, Prentice Hall of India, 1996.

EIGHTH : SEMESTER

8 IE 01 INSTRUMENT AND SYSTEM DESIGN

SECTION - A

UNITI: Basic concept of instrument Design: Functional requirements and Specification. Operational environment: - commercial, industrial, military. NEMA, DIN, BIS, ANSI standards.

UNITII: Printed Circuit board Design: General components, layout scheme, grid system, PCB size, mechanical stress, Design rules for digital circuit PCB and analog circuit PCBs. Single and multilayer boards Designing technique for small signal ckt.

UNITIII: Automation and computer use in PCB design artwork, CAD packages and tools, soldering techniques, component assembly, testing.

SECTION - B

UNITIV: Reliability, MTTR, MTBF, concepts of availability, component screening, infant mortality and bath tube curve, Component ageing. Failure rate analysis, Statistical-sampling criteria. Sampling for units with low failure rates, Redundancy.

UNITV: Electronic design guidelines: Noise in electronics circuit, the design of low noise circuits, Components limits, sensitive device, sensitive inputs, input Filtering, damping, suppressors.

UNITVI: Enclosure Design guidelines: Grounding and shielding techniques, protection against electromagnetic interference and electrostatic discharge. Packaging for various operational environments including IP-51 & IP-54.

TEXT BOOKS:

- (1) The Art of Electronics (Second edition 1989), Hill & Horowitz, Cambridge University Press.
- (2) Electronics, Discharge & Electronics Equipments by Warren.
- (3) Reliability Engineering by E. Balguruswamy.
- (4) Printed Circuit Boards by Walter Bosshart.

REFERENCE BOOKS:

1. Electronics Instrument Handbook, 1999 by Coombs.
2. Basic concept of instrument Design.
3. PC Based PCB design.
4. Electronic design guidelines.
5. Enclosure Design guidelines.

8 IE 02 PROCESS MODELLING & OPTIMIZATION

UNITI : Classification of models, major activity in model building, use of mathematical models, scope of coverage, principles of formulation.

Fundamental laws: Continuity equations, energy equations, equations of Motions, Transport equations, Equations of state equilibrium, Chemical kinetics.

UNIT II: Solving the mathematical models for dynamic system, heat transfer system, tanks types reactor systems, vaporizer, flashdrum, batch reactors, continuous distillation in multi-tray columns, dynamic modelling of process controlling loop.

UNIT III: Computer simulation; Newton Raphson method, False position, Euler method, Runge-Kutta (fourth order), Adams-Bashforth method.

UNIT IV: Process Identification: Purpose, Time domain 'Eyeball' fitting of step test data, direct sine, pulse, and step signal testing. ATV identification.

UNIT V: The nature & organization of optimization problems, formulation of objective function, cost, time, value of money, measure of probability, methods of least squares.

UNIT VI: Single & multivariable optimization, linear programming and simplex method, sequential quadratic programming & reduced gradient optimization technique, Introduction to geometric programming & dynamic programming.

PRACTICALS:

Students are expected to perform minimum eight experiments based on above syllabus.

TEXT BOOKS: —

- 1) Process Modeling & Simulation Control for Chemical Engineers by W.L. Luten, McGraw Hill.
- 2) Optimization of Chemical Process by Edgar.

8 IE 03 PROCESS INSTRUMENTATION

UNIT I: Introduction to Process control, Types of processes, process characteristics and controllability, time constant of a process, dead time in process, classification of process variables, difficulties and requirement of process control implementation, self-regulating and non-self-regulating Processes, interacting & non-interacting processes.

UNIT II: Multiloop & multivariable process control systems, Feedback control, feed forward control, Cascade control, ratio control, auto selective control, adaptive control system, Coupling & decoupling control system, scaling the instruments.

UNIT III: Boiler instrumentation: combustion control, Air to fuel ratio control, 3-element drum level control, steam pressure, temp control, burner management and control, safety interlocks.

Furnace control, FB-FF-CS of heat exchanger, Evaporator control.

UNIT IV: Distillation column control: Flow control of distillate and bottoms products, reflux control, composition control, pressure & Temperature control.

Reactor control:- Flow, temp, Pressure, endpoint controls, Reactor safety interlocks. Dryer control, pumps & compressor control, cooling Tower control, water treatment control.

UNIT V: Application of DCS: Distillation columns, power plants, Iron and steel plants, cement plants, oil and gas fields, paper and pulp industries.

UNIT VI: Introduction to Intelligent controllers: optimal controller, predictive controller, Expert system and controllers, Artificial Neural networks controllers, fuzzy logic & Neurofuzzy control system, linear and non linear controllers, Single loop and multiloop controllers., model based PID controllers.

PRACTICALS:

Students are expected to perform minimum eight experiments based on above syllabus.

TEXT BOOKS:

- 1) Process Control Handbook by Bela G. Liptak
- 2) Process Control concept, dynamics and application by S.K. Singh. (PHI)
- 3) Computer Based Industrial Control by Krishnakant. (PHI)
- 4) Process Instrumentation & Control Handbook by Considine.

REFERENCE BOOK:

1. Hand book Process control By B.G.Liptak Vol. II

8 IE 04 PROFESSIONAL ELECTIVE-II (1) ENVIRONMENTAL INSTRUMENTATION

UNIT I: Environmental definition, Constituents, biochemical cycle, causes of pollution, types of pollution and their measurement, effects of pollution, different sensors for measurement of pollution, difference between off-line measurement and continuous monitoring.

Environmental toxicology and hazards. Common toxic agents, their analysis and safety measures. Environmental regulation and standards.

UNIT II: Review of standard methods of pollution analysis, sampling operation, Devices and techniques as related to environmental engineering.

Air pollution Analysis: Analysis of aerosols and Monitoring of gaseous pollutants like SO₂, H₂S, NO-NO_x, CO-CO₂, ozone, NH₃, and organic gases, Vapor Analysis Monitoring of suspended particulate matter and trace matter and trace metal pollutants.

UNIT III: Water pollution Analysis Physical Examination-colour, conductivity, temp, odour, turbidity, hardness. Chemical Characterization-Ca²⁺, Mg²⁺, Na⁺, K⁺, Cl⁻, SO₄²⁻, HCO₃⁻, Al³⁺, Ba²⁺, Boron, F⁻, NO₃⁻, PO₄³⁻, Fe³⁺, Mn²⁺, SiO₂, Biological investigation-DO, BOD, bacteriological examination, water quality monitoring instrumentation. (pH meters, conductivity meters etc.) Water hardness testing & its removal, Water purification methods.

UNIT IV: Effluent Analysis, Physical Methods of characterization density, viscosity, temperature, conductivity, turbidity, volatile, and dissolved solids, oil and immiscible liquids, colour odour, radioactivity, analysis of organic pollutants, BOD, COD, TOC Specific analysis of Organic pollutants. Analysis of metal pollutants, Analysis of anion and dissolved gases dissolved oxygen, PH, dissolved chlorides, suspended Solids, nitrogen, sludge index.

UNIT V: Soil pollution and pesticide Analysis : Analysis of Micronutrients, trace elements pesticides, Chromatographic Characterization. Polarographic and Spectroscopy Analysis of pesticides.

Noise Pollution and its Measurement: Units Devices and Maps Noise Control System.

Radiation Pollution and its Measurement and Control.

UNIT VI: Instrumentation setup for different type of pollution control like Wastewater treatment, HVAC control etc.

Environmental testing, Dry heat, Dry cold, Damp Heat, Salt Spray, Dust, Altitude bump, Vibration drop/Topple, free fall, and study of ISO 14001. (52)

TEXT BOOKS :

- 1) Environmental Pollution Analysis by S. M. Khopkar 1st ed, Wiley Eastern 1993.
- 2) Basic Concepts of Analytical Chemistry by S. M. Khopkar.
- 3) Environmental Engineering by Peary H. S. and others.
- 4) Sensor Systems for Environmental Monitoring by Campbell.
- 5) Basic Environmental Technology-(Ed-1997) by J. A. Nathanson.
- 6) Environmental Tech. Series, V,I,II,III,IV by Neal K. Ustler.

8 IE 04

PROFESSIONAL ELECTIVE-II

(2) ADVANCED BIOMEDICAL INSTRUMENTATION

UNIT I: Patient monitoring system : system concept, bedside patient monitors, central monitors, average reading heart monitor, intensive care monitoring, ambulatory monitoring. Biotelemetry: single channel & multichannel telemetry, telephone & computer based telemetry.

UNIT II: Magnetic resonance imaging system : principles of NMR imaging system, image reconstruction techniques, basic NMR components, applications, advantages & disadvantages of NMR, imaging techniques, Biological effects of NMR imaging.

UNIT III: Computer applications in medical field: biomedical computer applications, computerized patient monitoring system, computer aided ECG analysis, computerized catheterization laboratory, basics of Computer Axial Tomography (CAT).

UNIT IV: Laser applications in biomedical field : principle of operation of Laser, types of Lasers, applications of lasers in endoscopy, angiography, ophthalmology & removal of kidney stone.

UNIT V: Regulation of water & electrolyte balance, kidney structure, filtration & reabsorption, renal acid base control, artificial kidney, dialysis system.

UNIT VI: Biosignal conversions & averaging : sampling basics, simple conversion systems, conversion requirements for biomedical signals, signal conversion cks., basics of signal averaging, signal averaging as a digital filter, software for signal averaging, limitations of signal averaging.

TEXT BOOKS :

- 1) R.S.Khandpur : Handbook of Biomedical Instrumentation (TMH)
- 2) L.Cromwell & F. Weibell : Biomedical Instrumentation & Measurements (PHI)
- 3) W.J.Tompkins : Biomedical Digital Signal Processing (Eastern Economy Education)
- 4) Cass & Brown : Introduction to Biomedical Equipment Technology.
- 5) J.G.Webster : Medical Instrumentation, 3rd edition, John Wiley.

8 IE 04

PROFESSIONAL ELECTIVE-II

(3) POWER PLANT INSTRUMENTATION

UNIT I: Thermal power plant : unit overview, types of boilers, turbine generators, condensers, variable speed pumps and fans, material handling system.

UNIT II : Comparison of thermal, hydro, nuclear power plant, boiler safety standards, boiler inspection procedures.

UNIT III: Boiler instrumentation : control and optimization, combustion control, air to fuel ratio control, 3-element drum level control, steam temperature and pressure control, Oxygen/CO/CO₂ in flue gases, furnace draft, electrical megawatt controls, boiler interlocks, sequence event recorder, supervisory control, data acquisition systems, burner management systems and controllers.

UNIT IV: Automation strategy of thermal power plant (PLC, DCS, SCADA) and open system application, block schematic, control equipment, boiler automation, diagnostic functions and protection, digital electro-hydraulic governor, man-machine interface, software system, graphic display of automated power plant, application functions, variable pressure control.

UNIT V : Turbine instrumentation : speed calculation, valve actuation, auto-start-up, thermal stress control, condition monitoring and power distribution instrumentation.

UNIT VI: Hydroelectric power generation, regulation and monitoring of voltage and frequency, pollution and effluent monitoring and control.
Nuclear power generation and control station.

TEXT BOOKS :

- 1) Payne and Thompson : Efficient Boiler Operation Source Book
- 2) Popovic & Bhatkar : Distributed Computer Control for Industrial Automation, Dekker.
- 3) Dickinson and Cheremisinoff : Solar Energy Technology, Vol. I and II, Dekker.
- 4) Krishna Kant : Computer Based Industrial Control, PHI.
- 5) W.C.Turner : Energy Management Handbook.

REFERENCE BOOKS :

- 1) D.M.Considine : Energy Technology Handbook (MAH)
- 2) B.G.Liptak : Process Control, (Chilton)

8 IE 04

PROFESSIONAL ELECTIVE-II (4) INSTRUMENTATION FOR AGRICULTURE AND FOOD PROCESSING

UNIT I : Introduction, necessity of Instrumentation and control for Food processing and Agriculture, Sensor Requirements; Remote Sensing, Biosensors in agriculture, Standards for food quality.

Soil science and sensors; pH conductivity, resistivity, temperature, soil moisture and salinity, ion concentration, measurements, methods of soil analysis.
Instrumentation for environmental conditioning of seed germination and growth.

UNIT II : Flow Diagram of Sugar Plant. Sensors and Instrumentation set-up for it. Flow Diagram of Fermenter and Control (Batch process). Oil Extraction Plant and Instrumentation Set-up. Pesticides Manufacturing Process and Control. Flow Diagram of Dairy and Confectionery industry and Instrumentation set-up, Juice Extraction control set-up.

UNIT III: Application of SCADA for Dam parameters and control. Water Distribution and Management Control, Auto-drip Irrigation Systems. Irrigation Canal Management, upstream and downstream control concept, Supervisory control.

UNIT IV: Green Houses and Instrumentation; Ventilation Cooling and Heating, Wind speed, temp. And humidity, rain gauge, carbon and dioxide enrichment measurement and control.

UNIT V : Automation in Earth Moving Equipment and Farm Implements, Pneumatic, Hydraulic and Electronic Control Circuits in Harvesters, cotton pickers, tractors etc.
Application of SCADA and PLC in packaging industry.

UNIT VI: Leaf Area, length, Evapotranspiration, Temperature, wetness and respiration measurements and data logging. Electromagnetic, radiation, photosynthesis, infrared and UV, Biosensors methods in agriculture.
Agrometeorological Instrumentation Weather Stations.

TEXT BOOKS :

- 1) Industrial Instrumentation ñ Patranabis, TMH.
- 2) Instrumentation Handbook ñ Process Control by B.G.Liptak
- 3) Process Control and Instrumentation Technology by C.D. Johnson.
- 4) Outline of Chemical Technology By M. Gopala Rao, Marshall Sittig (3/e)

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
COMPUTER SCIENCE & ENGINEERING
SEMESTER PATTERN (C. G. S.)**

SEVENTH SEMESTER

7KS01 DIGITAL SIGNAL PROCESSING

- Unit I:** Discrete Time Signals and Systems: Introduction to DSP, Advantages, basic elements of DSP system, sampling theorem, A/D, D/A conversion, quantization. Elementary discrete-time sequences. Discrete-time systems: description, representation, classification (linear, time-invariant, static, casual, stable) (08Hrs)
- Unit II:** Analysis of DTLTI systems: The convolution sum, properties of convolution, Analysis of causal LTI systems, stability of LTI systems, step response of LTI systems, difference equation, recursive & non recursive discrete time systems, solution of difference equations, Impulse response of LTI recursive system. Correlation of discrete time signals. (08Hrs)
- Unit III:** z- Transform and Analysis of LTI Systems: Definition of z- Transform, properties, rational z-Transforms, evaluation of the inverse z- Transforms, analysis of linear time invariant systems in z-domain, transient and steady-state responses, causality, stability, pole-zero cancellation, the Schur-Cohn stability test. (08Hrs)
- Unit IV:** Fourier Transforms, the DFT and FFT: Definition & properties of Fourier transform, relation with z-transform. Finite duration sequences and the discrete Fourier transform(DFT), properties, circular convolution, Fast algorithms for the computation of DFT: radix-2 and radix-4 FFT algorithms (08 Hrs)
- Unit V:** Design of Digital Filters: Classification of filters: LP, HP, BP, FIR and IIR filters, filter specifications. Design of FIR filters using Windows and by Frequency sampling methods. Design of IIR filters from Analog filters using approximation of derivatives, Impulse invariant transformation, Bilinear transformation and Matched z-Transformation, Commonly used Analog filters and IIR Filter design example. (08Hrs)
- Unit VI:** Realization of Discrete-Time systems: Structures for realization of Discrete-Time systems, realization of FIR systems: Direct Form, Cascade Form, Frequency sampling and Lattice structures. Realization of IIR filters: Direct Form, Signal flow graph and Transposed structures, Cascade form, Lattice and Lattice ladder. Realization for IIR systems. (08Hrs)

TEXT BOOK :

J G Prokis and D G Manolokis, óDigital Signal Processing: Principles Algorithms and applications (Pearson Education)

REFERENCE BOOKS:

1. S K Mitra: óDigital Signal Processing: A Computer-Based Approach (McGraw Hill)
2. E C Ifeachor and B W Jervis óDigital Signal Processing A Practical Approach (Pearson)
3. A V Oppenheim, R W Schafer with J R Buck óDiscrete Time Signal Processing (PHI)
4. P Ramesh Babu: óDigital Signal Processing Scitech Publications.

7KS02/7KE02

COMPUTER NETWORKS

- UNIT I:** Introduction: Brief history of computer networks & Internet, Layered architecture, Internet protocol stack, Network entities & layers, Application layer: Principles of protocols, HTTP, FTP, SMTP and DNS protocols. (08Hrs)
- UNIT II:** Transport layer: services & principles, multiplexing & demultiplexing applications, UDP, principles of reliable data transfer, TCP details, principles of congestion control, TCP congestion control. (08Hrs)
- UNIT III:** Network layer: network service model, routing principles, hierarchical routing, Internet Protocol (IP) & ICMP details, routing in the Internet, router internals, IPV6. (08Hrs)
- UNIT IV:** Link layer: Introduction, services, multiple access protocol, LAN addresses & ARP, CSMA / CD, PPP details. (08 Hrs)
- UNIT V:** Network security: Basic issues, principles of cryptography, authentication and authentication protocol, version, integrity: digital signatures, message digests, hash function algorithm, key distribution & certification, secure e- mail, E-Commerce: SSL & SET, IP Sec details. (08 Hrs)
- UNIT VI:** Firewalls: Packet filtering and Application gateway, Network Management: Basic principles, infrastructure for network management, The Internet Network management framework: SMI, MIB, SNMP details, security and administration, ASN.1 (08 Hrs)

TEXT BOOK:

James F. Kurose & K W Ross: Computer Networking, Pearson Education (LPE)

Reference Books:

1. Douglas E. Comer: Computer Network & Internet, Addison Wesley.
2. Andrew S. Tanenbaum: Computer Networks, PHI (5E)
3. Leon Garcia & Widjaja: Communication Networks, TMH
4. William Stallings: Data & Computer Communication, Pearson Education.

7KS03 DESIGN AND ANALYSIS OF ALGORITHMS

- Unit I:** Iterative Algorithm Design Issue: Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion.
- Unit II:** Divide And Conquer: Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Convex Hulls, Drawbacks of D & C & Timing Analysis.
- Unit III:** Greedy Methods: Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstra's Shortest Path Algorithm.
- Unit IV:** Dynamic Programming: Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.
- Unit V:** Backtracking: Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.
- Unit VI:** Efficiency of Algorithm: Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

TEXT BOOK:

Dave and Dave: "Design and Analysis of Algorithms" Pearson Education

REFERENCE BOOKS:

1. Aho, Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
2. G. Brassard, P. Bratley: "Fundamentals of Algorithmics", PHI
3. Horowitz & Sahani: "Fundamental Algorithms", Galgotia.
4. Cormen, T.H, Lierson & Rivest: "Introduction to Algorithms", McGraw-Hill

7KS04 OBJECT ORIENTED ANALYSIS AND DESIGN

- UNIT-I:** Modeling Concept: Introduction, Object orientation, OO Development, OO themes, Modeling as a design technique, Class Modeling. Abstraction, The three models, Object and class concepts, Link and association concepts, Generalization & Inheritance, Navigation of class models. (08Hrs)
- UNIT II:** Advanced object and class concepts, Association Ends, N-ary association, Aggregation, Abstract classes, Multiple inheritance, Metadata, Reification, Constraints, Derived data, Packages, State Modeling: Events, States, Transitions and Conditions, State diagrams, State diagram behavior. (08Hrs)
- UNIT III:** Nested state diagram, Signal Generalization, Nested states, Concurrency, Relation of class and state models, Use case model, Sequence models, Activity models, Use case relationships, Procedural sequence model, Special constructs for activity models. (08 Hrs)
- Unit IV:** Development stages, Development life cycle, Devising a system concepts, Elaborating a concepts, Preparing a problem statements, Overview of analysis, Domain class models, Domain state model, Domain Interaction model. (08 Hrs)
- Unit V:** Application Analysis. Overview of System Design, Estimating Performance, Making a reuse plan, Breaking a system into subsystems, Identifying Concurrency, Allocation of subsystems, Management of data storage, Handling global resources, Choosing a software control strategy, Handling boundary conditions, Setting trade-off priorities, Architecture of the ATM system. (08 Hrs)
- Unit VI:** Overview of class design, Realizing the use cases, Designing algorithm, Recursing Downwards, Refactoring, Design Optimization, Reification of behavior, Adjustment of Inheritance, Organizing a class design, ATM examples (08 Hrs)

TEXT BOOK :

Blaha, Rumbaugh: "Object Oriented Modeling and Design with UML" (2/e) Pearson Education.

REFERENCE BOOKS:

1. Dathan, Ramnath: "Object Oriented Analysis, Design & Implementation", OUP.
2. McRobb & Farmer: "Object Oriented System Analysis & Design" McGraw Hill.
3. Booch, Rumbaugh & Jacobson: "The UML User guide" Pearson Education.

4. Whitten & Bentley: "System Analysis & Design Methods" Tata McGraw Hill.
5. Booch: "Object Oriented Analysis & Design with Applications", Pearson Education.

7KS05 PROFESSIONAL ELECTIVE -I
(I) COMPUTER GRAPHICS

- Unit I:** An overview of Computer Graphics and Graphics System: video display devices, Raster-Scan systems, Random-Scan systems, Graphics monitors and workstations, input devices, hard copy devices, Graphics software. (08 Hrs)
- Unit II:** Output primitives : Point and Lines, Line drawing algorithms, loading the frame buffer, line function, circle and ellipse generating algorithms, curves, parallel curves algorithms, Pixel addressing, filled-area primitives, functions, Cell array, character generation. (08 Hrs)
- Unit III:** Attributes of output primitives : Line and curve attributes, color and grayscale levels, area fill attributes. Character attributes, bundled attributes, antialiasing. (08 Hrs)
- Unit IV:** 2-D geometric transformations : basic transformations, matrix representations, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations. Two- Dimensional viewing : viewing coordinates, Window-to viewport coordinate transformation, viewing functions, clipping : point, line, polygon, curve, text, exterior. (08Hrs)
- Unit V:** Structures and hierarchical modeling : concepts, editing structures, basic modeling concepts, hierarchical modeling, GUI and interactive input methods : the user dialogue, input of graphical data, functions, initial values for input device parameters, interactive picture - construction techniques, virtual reality environments. (08Hrs)
- Unit VI:** Three dimensional concepts : display methods, graphics, Bezier curves and surfaces, B-spline curves and surfaces, Beta-splines, three dimensional geometric and modeling transformations : translation, rotation, scaling, three dimensional viewing : viewing pipeline, viewing coordinates, projections. (08Hrs)

TEXT BOOK:

D. Hearn, M.P.Baker : Computer Graphics, Second Edition, Pearson Education.

REFERENCES:

1. F.S.Hill: Computer Graphics Using Open GL, II edition, Pearson Education.
2. W.M.Newman & R.F.Sproul: Principles of Interactive Computer Graphics, 2/e, McGraw Hill.
3. F.S.Hill : Computer Graphics, McMillan.
4. D.Hearn & M.P.Baker : Computer Graphics, Prentice Hall.
5. Hamington : Computer Graphics, McGraw Hill.

7KS05 PROFESSIONAL ELECTIVE -I
(II) MULTIMEDIA TECHNOLOGIES

- Unit I:** Multimedia Authoring and Data Representations: Introduction, Components of Multimedia, Hypermedia and Multimedia, Overview of Multimedia Software Tools, Multimedia Authoring and Tools: Multimedia Authoring, VRML. Graphics and Image Data Representations: Graphics/Image Data Types, 1-Bit Images, 8-Bit Gray-Level, Images, Image Data Types, Popular File, Formats, GIF, JPEG, PNG, TIFF, EXIF, Graphics Animation Files, PS and PDF, Windows WMF, Windows BMP, Macintosh PAINT and PICT, X Windows PPM. (08Hrs)
- Unit II:** Color in Image and Video: Color Science, Color Models in Images, and Color Models in Video. Fundamental Concepts in Video: Types of Video Signals, Component Video, Composite Video, S-Video, Analog Video, NTSC Video, PAL Video, SECAM Video, Digital Video, Chroma Sub sampling CCIR Standards for Digital Video, High Definition TV. (08Hrs)
- Unit III:** Basics of Digital Audio: Digitization of Sound, Digitization, Nyquist Theorem, Signal-to-Noise Ratio (SNR), Signal-to-Quantization-Noise Ratio (SQNR), MIDI: Musical Instrument Digital Interface, Hardware Aspects of MIDI, Structure of MIDI Messages, General MIDI, MIDI-to-WAV Conversion, Quantization and Transmission of Audio, Coding of Audio, Pulse Code Modulation, Differential Coding of Audio, Lossless Predictive Coding, DPCM, DM, ADPCM. (08Hrs)
- Unit IV:** Multimedia Data Compression: Lossless Compression Algorithms: Basics of Information Theory, Run-Length Coding, Variable-Length Coding (VLC), Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression. The JPEG Standard. (08Hrs)
- Unit V:** Basic Video Compression Techniques: Introduction, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261, Intra-Frame (I-Frame) Coding, Inter-

Frame (P-Frame) Predictive Coding, Quantization in H.261, H.261 Encoder and Decoder, H.261 Video Bitstream Syntax, MPEG-1, Motion Compensation in MPEG-1, Major Differences from H.261 (08Hrs)

Unit VI: Basic Audio Compression Techniques: ADPCM, Vocoders, Phase Insensitivity, Channel Vocoder, Formant Vocoder, Linear Predictive Coding, CELP. MPEG Audio Compression: Psychoacoustics, Equal-Loudness Relations, Frequency Masking, Temporal Masking, MPEG Audio, MPEG Layers, MPEG Audio Strategy, MPEG Audio Compression Algorithm, MPEG-2 AAC (Advanced Audio Coding). (08Hrs)

TEXT BOOK:

Ze-Nian, Li, Mark S. Drew "Fundamentals of Multimedia" (Pearson Education)

REFERENCE BOOKS:

1. Rajan Parekh "Principles of Multimedia" (Tata McGraw-Hill)
2. S.J.Gibbs & D.C.Tsichritzis "Multimedia Programming", Addison Wesley 1995
3. P.W.Agnew & A.S.Kellerman "Distributed Multimedia", Addison-Wesley 1996
4. C.A.Poynton, "A Technical Introduction to Digital Video" Wiley 1996
5. F.Fluckiger, "Understanding Networked Multimedia", Prentice-Hall 1995

7KS05

PROFESSIONAL ELECTIVE - I (III) WEB ENGINEERING

UNIT I: Introduction to the Web: History of web, Protocol governing the web, Web architecture, Major issues in Web solution development, Web servers, Web browsers, Internet Standards, TCP/IP protocol suites, IP Address, MIME, Cyber laws. Hypertext Transfer Protocol (HTTP): Introduction, web server and client, Resources, URL and its Anatomy, Message Format, Examples, Persistent and non persistent Connections, Web caching, Proxy. (08Hrs)

Unit II: Hypertext Markup language (HTML): History of HTML, 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. Cascading Style Sheet (CSS): Introduction, advantages, Adding CSS, Browser compatibility, CSS and page layout, Selectors, Grouping, Type Selectors. (08Hrs)

Unit III: Extensible Markup Language (XML): Common Usage, Role of XML, Prolog, Body, Elements, Attributes, Validation, Displaying XML, Namespaces. XML DTD, Introduction to DTD, Purpose of DTD, DTD in XML document, element type declaration, Attribute declaration, Entity declaration, DTD validation. 08 Hrs

Unit IV: W3C XML Schema: Introduction, limitation of DTD, strengths of schema, 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, Objects. (08Hrs)

Unit VI: Common Gateway Interface (CGI): Internet programming paradigm, Server side programming, Language for CGI, Applications, Server environment, Environment variables, CGI building blocks, CGI scripting using C, 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.

REFERENCES:

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.

7KS05

PROFESSIONAL ELECTIVE - I (IV) HUMAN COMPUTER INTERFACE

UNIT I: Human factors of interactive software: Goals of system engineering & User-interface design, motivation for human factors, accommodation of human diversity, High level theories, Object-Action interface model, Recognition of the diversity, Eight golden rules of interface design, Preventing errors, Guidelines for data display and data entry, Balance of automation and human control. (08 Hrs)

UNIT II: Managing design process, Organizational design to support usability, the three pillars of design, Development methodologies, ethnographic observation, Participatory Design,

Scenario Development, Social impact statement for early design review, legal issues, Software tools: specification methods, Interface-Building tools, Evaluation and Critiquing tools.

(08 Hrs)

UNIT III: Direct manipulation and virtual environments, example of direct manipulation system, Explan ations of direct manipulation, OAI model, Visual thinking and icons, direct manipulation programming, home automation, Remote Direct manipulation, Virtual environments.

(08 Hrs)

UNIT IV: Interaction devices: Keyboards and function keys, Pointing devices, Speech recognition , digitization and generation, Image and Video Displays, Printers. Response time and Display rate: Theoretical foundations, Expectations and attitudes, User Productivity, Variability.

(08 Hrs)

UNIT V: Multiple window strategies, Individual windows design, Multiple window design, Coordination by tightly coupled windows, Image browsing and tightly coupled windows, Personal role management and elastic windows. Computer supported cooperative work: Goals of cooperation , Asynchronous interaction, Synchronous distributed and face-to-face, Applying CSCW to education.

(08 Hrs)

UNIT VI: Information search and visualization, Database Query and phrase search in textual documents, multimedia documents searches, Information visualization, advanced filtering. Hypermedia and the World Wide Web, Genres and goals and designers, Users and their tasks, Object action interface model for web site design.

(08 Hrs)

TEXT BOOK:

Ben Shneiderman: "Designing the User Interface", Pearson Education.

REFERENCE BOOKS:

1. R. Beale, A.J. Dix, J. E. Finlay, G. D. Abowd "Human-Computer Interaction", Prentice-Hall.
2. Joann Hackos, Janice Redish, "User and Task Analysis for Interface Design", Wiley.
3. Jeff Raskin, "The Humane Interface", Pearson Education.
4. Jesse James Garrett, "The Elements of User Experience", New Riders.

7KS06 DIGITAL SIGNAL PROCESSING - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

7KS07 DESIGN & ANALYSIS OF ALGORITHMS - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

7KS08 OBJECT ORIENTED ANALYSIS & DESIGN - 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.

7KS09 PROJECT AND SEMINAR

Seminar should be preferably based on the proposed project to be completed in final year. The seminar should be conducted in seventh semester and evaluated. Each candidate shall submit a seminar report, deliver the seminar and face the viva-voce. The distribution of internal 50 marks shall be as follows.

- | | |
|---|----------|
| 1. Seminar report preparation and submission :- | 10 marks |
| 2. Seminar delivery/ presentation:- | 20 marks |
| 3. Seminar viva-voce:- | 10 marks |
| 4. Attendance in all seminar sessions:- | 10 marks |

SEMESTER : EIGHT

8KS01 ARTIFICIAL INTELLIGENCE

Unit I : Introduction: Definition of AI, AI Techniques, Tic-Tac-Toe, Pattern Recognition, Level of the model, Critical for Success, Problems and Problem Specifications, Defining the Problems, Production Systems, Control Strategies, Futuristic Search, Problem Characteristics, Decomposition of Problems, Solution steps, Predictability, Absolute & Relative Solutions.

Unit II: Basic Problem Solving methods: Reasoning, Problem trees and graphs, Knowledge Representation, Matching indexing with variables, Heuristic Functions, Weak Methods, Problem reduction, Constraints Satisfaction, Means-ends analysis, Analysis of Search Algorithms.

Unit III: Games Playing, Minimax Search Procedure, adding alpha beta cutoffs, additional refinements, waiting for quiescence, Secondary Search, Using Book moves limitations.

Unit IV : Knowledge Representation using Predicate Logic: Representing simple facts in logic, augmenting the representation, resolution, conversion to clause form, Resolution in Propositional Logic and Predicate Logic, Unification Algorithms, Question Answering and Natural Deduction.

Unit V : Structural representation of knowledge: Some common known structures, choosing the level of representation, finding the right structure as needed, declarative representation, semantic nets, Conceptual Dependency, Frames, Scripts, Semantic- Semantic, Spectrum and procedural representation.

Unit VI : Natural Language Understanding: Concepts of Understanding, Keyword matching, Syntactic and Semantic analysis, Understanding single and multiple sentences, Using Four, Cover structures, Schemes and Scripts in Understanding, Dialogue Understanding.

TEXT BOOK:

Elaine Rich & Knight: "Artificial Intelligence", McGraw Hill.

REFERENCE BOOKS:

1. Nils Nilson: "Principles of Artificial Intelligence". (Addison-Wesley)
2. R. J. Winston: "Artificial Intelligence". (Wiley)
3. Patterwson "Introduction to Artificial Intelligence and Expert Systems" (PHI).
4. Rolston "Principles of Artificial Intelligence and Expert Systems", McGraw Hill.

8KS02/8KE02

EMBEDDED SYSTEMS

Unit-I Introduction to Embedded System: Embedded Systems Vs General Computing Systems. History, classification, major application areas and purpose of Embedded Systems. Components of Embedded system: General Purpose and Domain Specific Processors, Memories for embedded systems.

Unit-II Components of Embedded system: Sensors & Actuators, Communication Interface, Embedded Firmware and other components. Characteristics of Embedded System, Quality Attributes of Embedded System. Embedded Systems Examples: Washing machine. Automotive application.

Unit-III Introduction to 8051 Microcontroller: 8051 Architecture, 8051 Memory Organization, Registers, Oscillator Unit, Ports, 8051 Interrupt System, Timer units, the Serial Port, 8051 Power Saving Modes.

Unit-IV: Programming the 8051 Microcontroller: Addressing modes. 8051 Instruction Set: Data transfer instructions, Arithmetic instructions, Logical instructions, Boolean instructions, and Program Control Transfer instructions. Assembly Language based Embedded Firmware development.

Unit-V : Programming in Embedded C: Review of various constructs in C. Constant declarations, "volatile" type qualifier, Delay generation and Infinite loops in Embedded C. Coding Interrupt Service Routines, Recursive and Re-entrant Functions, Dynamic memory allocation.

Unit-VI : VxWorks Real Time Operating System (RTOS): Characteristics, Real Time Kernel, Hard/Soft Real time. VxWorks Task Creation, Management and Task Scheduling, Kernel Services, Inter Task Communication, VxWorks Task Synchronization and Mutual Exclusion, Interrupt Handling, Watchdog for task Execution monitoring, Timing and Reference in VxWorks.

TEXTBOOK:

Shibu K V "Introduction to Embedded Systems" McGraw-Hill.

REFERENCES:

1. Rajkamal , "Embedded Systems, Architecture, Programming & Design" TMH.
2. Tammy Noergaard "Embedded Systems Architecture" Elsevier Newness Publication.
3. Vahid and Givargis "Embedded System Design" John Wiley & Sons P Ltd.
4. Peter Marwedel "Embedded Systems Design" Springer, Netherland.

8KS03/8KE03

SOFTWARE ENGINEERING

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. W5HH principles, critical practice. (08 Hrs)

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. (08 Hrs)

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. (08 Hrs)

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. (08 Hrs)

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. (08 Hrs)

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. (08 Hrs)

TEXTBOOK:

Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH.

REFERENCE BOOKS:

1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Fairly R: Software Engineering (McGraw Hill)
3. Davis A: Principles of Software Development (McGraw Hill)
4. Shooman, M.L: Software Engineering (McGraw-Hill)

8KS04 PROFESSIONAL ELECTIVE -II (I) DISTRIBUTED COMPUTING

UNIT-I: Basic distributed system: Introduction, Distributed computing models, Software concepts, Issues in designing distributed system, Client Server model, Case studies. (08 Hrs)

UNIT II: Inter process Communication: Message passing Group Communication, Remote Communication: Introduction, Remote procedural call basics, RPC Implementation, RPC Communication, Other RPC Issues, Remote method, Invocation basics, RMI Implementation. (08 Hrs)

UNIT III: Synchronization: Introduction, Clock Synchronization, Logical clocks, Global state, Mutual Exclusion, Election algorithms, Deadlock in Distributed systems. (08 Hrs)

UNIT IV: Distributed system management: Introduction Research management, Task assignment approach, Load balancing

approach, Load sharing approach, Process management in a distributed environment, Process migration, Threads, Fault tolerance. (08 Hrs)

UNIT V: Distributed shared memory: Introduction, Basic concepts of DSM, Hardware DSM, Design Issues in DSM, Issues in implementing DSM systems, Heterogeneous and other DSM systems. (08 Hrs)

UNIT VI: Distributed File System: Introduction to DFS, File models, DFS design, Semantics of file sharing, DFS Implementation, File catching in DFS, Replication in DFS. (08 Hrs)

TEXT BOOK :

Sunita Mahajan & Seema Shah: Distributed Computing Oxford University Press

REFERENCE BOOKS:

1. Tanenbaum: Distributed Operating Systems Pearson Education.
2. Sinha: Distributed Operating Systems Concepts & Design PHI.
3. Tanenbaum & Van Steen: Distributed Systems Principles & Paradigms PHI, Second Edition.
4. Crichlow: Distributed Systems- Computing Over Networks PHI.

8KS04 PROFESSIONAL ELECTIVE -II (II) MOBILE COMPUTING

Unit I : Introduction: Applications, History of wireless communication, A simplified reference model, Wireless Transmissions: Frequencies for Radio Transmissions, Signals, Antennas, Signal Propagations, Multiplexing, Modulation, Spread Spectrum, Cellular System. (08 Hrs)

Unit II: Medium Access Control: Motivations for a specialized MAC, SDMA, FDMA, TDMA, CDMA, Comparison of S/T/F/CDMA, Telecommunications System: GSM, DECT, TETRA, UMTS and IMT-2000. (08 Hrs)

Unit III: Satellite Systems: History, Applications, Basics, Routing, Localizations, Handover, Examples, Broadcast Systems: Cyclical Repetition of Data, Digital Audio Broadcasting, Digital video Broadcasting, Convergence of Broadcasting and mobile communications. (08 Hrs)

Unit IV: Wireless LAN: Infra Red Vs Radio Transmission, Infrastructure and Ad-hoc Network, IEEE 802.11, HIPERLAN, Bluetooth. (08 Hrs)

Unit V: Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol, Mobile Ad-hoc Networks, Mobile Transport Layer:

Traditional TCP, Classical TCP improvements, TCP over 2.5/3G Wireless Networks. (08 Hrs)

Unit VI: Support for Mobility: File Systems, World Wide Web, Wireless Application Protocol (version 1.X) Architecture, i-mode, SyncML, WAP2.0. (08 Hrs)

TEXT BOOK :

ochen Schiller: óMobile Communicationô Pearson Education, Second Edition.

REFERENCE BOOKS:

1. Mazliza Othman: óPrinciples of Mobile Computing and Communicationsô, Auerbach.
2. Agrawal and Zeng: óIntroduction to Wireless and Mobile Systemsô Cengage Learning.
3. Upena Dalal: óWireless Communicationô Oxford University Press.
4. Raj Kamal: óMobile Computingô Oxford University Press.

**8KS04 PROFESSIONAL ELECTIVE -II
(III) SOFT COMPUTING**

UNIT-I: Fundamental of Neural Network: Basic concepts of Neural Network, Human Brain, Model of artificial neurons, Neural Network architecture, Characteristics of Neural Network, Learning methods, Taxonomy of Neural Network architecture, Early Neural Network architecture. (08 Hrs)

UNIT-II: Architecture of a Backpropagation Network, The Perceptron Model, The solution, Single Layer Artificial Neural Network, Model for Multiayer Perceptron, Back propagation learning, Input Layer, Hidden Layer and Output Layer Computation, Calculation of error, Training of Neural Network, Method of Seepst Descent, Effect of Learning rate, Adding a momentum Term, Backpropogation Algorithm. (08Hrs)

UNIT-III: Fuzzy Set Theory: Fuzzy verses Crisp, Crisp sets, Operations and Properties of Crisp Sets, Partition and Covering, Fuzzy sets, Membership Function, Basic Fuzzy Set Operation, Properties of Fuzzy Sets, Crisp Relations, Cartesian product, other relations, Operations on Relations, Fuzzy Relations, Fuzzy Cartesian Product, Operations on Fuzzy Relations. (08Hrs)

UNITIV: Fuzzy Systems: Crisp logic, Laws of Propositional logic, Inference in Propositional logic, Predicate logic, Interpretations of Predicate Logic Formula, Inference in Predicate Logic, Fuzzy logic, Fuzzy Quantifiers and Inference, Fuzzy rule based system, Defuzzification methods, applications. (08 Hrs)

UNITV: Fundamental of Genetic Algorithm: Genetic Algorithms, Basic Concepts, Creation of offspring, Working Principle, Encoding, Binary, Octal, Hexadecimal, Permutation, Value, Tree, Fitness function, Reproduction. (08 Hrs)

UNITVI: Genetic Modeling: Inheritance Operators, Cross over, Inversion & Deletion, Mutation Operator, Bit wise operator, Bit wise operator used in GA, Generational cycle, Convergence of genetic algorithm, Application, Multilevel Optimization, Real life problem, Differences and similarities between GA and other traditional methods, Advances in GA. (08 Hrs)

TEXT BOOK:

S. Rajesekaran, G. A. Vijayalakshmi Pai: óNeural Network, Fuzzy logic, and Genetic algorithms Synthesis and Applicationsô PHI.

REFERENCE BOOKS:

1. S. Haykin: óNeural Networksô Pearson Education.
2. Jang, Sun and Mezutani: óNeuro Fuzzy and Soft Computingô .McGraw-Hill
3. J. Yen, R. Langari: óFuzzy Logic: Intelligence, Control & Information ô. Pearson Education.
4. N.P. Pahey: óArtificial Intelligence and Intelligent Systemsô, Oxford University Press.

**8KS04 PROFESSIONAL ELECTIVE -II
(IV) NETWORK SECURITY**

Unit I: Introduction: Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Internetwork Security, Internet Standards and the Internet Society. Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. (08 Hrs)

Unit II: Public-Key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public Key Cryptography Principles, Public Key Cryptography Algorithms, Digital Signatures, Key Management. (08 Hrs)

Unit III: Authentication Applications: Kerberos, X.509 Authentication Service, Public-Key Infrastructure, Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME, (08 hrs)

Unit IV: IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management, Web Security: Web Security Considerations, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). (08 Hrs)

Unit V: Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3, Intruders: Intruders, Intrusion Detection, Password Management. (08 Hrs)

Unit VI: Malicious Software: Viruses and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks, Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation. (08 Hrs)

TEXT BOOK:

William Stallings: Network Security Essentials Applications and Standards Pearson Education, Third Edition.

REFERENCE BOOKS:

1. Atul Kahate: Cryptography and Network Security Mc Graw Hill.
2. Forouzan and Mukhopadhyay: Cryptography and Network Security Mc Graw Hill.
3. Matt Bishop: Computer Security: Art & Science Pearson Education.
4. Brijendra Singh: Network Security & Management PHI.

8KS05 ARTIFICIAL INTELLIGENCE -LAB.

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

8KS06 EMBEDDED SYSTEMS -LAB.

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

8KS07 PROJECT & SEMINAR

The project shall be internally evaluated (for 75 Internal Marks) in three phases based on the progress of the project work. Each phase shall be internally evaluated for 25 marks as follows:

Phase I: - Problem Definition and Design

Phase II: - Problem Implementation and Testing

Phase III: - Project Demonstration & Report submission.

The external evaluation of the project shall be based on demonstration of the project and viva-voce

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

SEVENTH SEMESTER

7KE01

SIGNALS AND SYSTEMS

Unit I: Continuous time and discrete time signals, transformation of the independent variable, exponential and sinusoidal signals, unit impulse and unit step functions, operations on signals like folding, time-shifting, amplitude scaling and time-scaling, mixing of signals and modulation. (08Hrs)

Unit-II: Continuous time and discrete time systems, basic system properties, discrete time LTI systems, Continuous time LTI systems, Properties of linear time invariant systems, Causal LTI systems described by differential and difference equations, Singularity functions. (08 Hrs)

Unit III: Fourier Series representation of periodic signals: Response of LTI systems to complex exponentials, Fourier representation of continuous time periodic signals, convergence of the Fourier series, Properties of continuous time Fourier series, Fourier series representation of discrete time periodic signals, properties of discrete time Fourier series, Fourier series and LTI systems, filtering. (08 Hrs)

Unit IV: Continuous Time Fourier Transform: Development of the Fourier transform representation of an aperiodic signal, the Fourier transform for periodic signals, properties of the continuous time Fourier transform, the convolution property, multiplication property, Linear constant coefficient differential equations. (08 Hrs)

Unit V: Sampling: Representation of continuous time signals by its samples, reconstruction of a signal from its samples, aliasing, discrete time processing of continuous time signals, sampling of discrete time signals. (08 Hrs)

Unit VI: Z- Transform: Z- transform, the region of convergence for the z-transform, Inverse z- transform, properties of Z transform, analysis and characterization of LTI systems using z transforms, System function algebra and block diagram representations, the unilateral z transform. (08 Hrs)

TEXT-BOOK:

Oppenheim, Willsky, Nawab Signals and Systems Pearson Education.

REFERENCE BOOKS:

1. Fred Taylor & Principles of Signals and Systems TMH.
2. Nagrath, Sharan, Ranjan Rakesh and Kumar Sukhbinder : & Signals and Systems TMH
3. Sudhakar & Signals and Systems TMH
4. Rawat: & Signals and Systems Oxford University Press.

7KS02/7KE02 COMPUTER NETWORKS

- UNIT I:** Introduction: Brief history of computer networks & Internet, Layered architecture, Internet protocol stack, Network entities & layers, Application layer: Principles of protocols, HTTP, FTP, SMTP and DNS protocols. (08Hrs)
- UNIT II:** Transport layer: services & principles, multiplexing & demultiplexing applications, UDP, principles of reliable data transfer, TCP details, principles of congestion control, TCP congestion control. (08Hrs)
- UNIT III:** Network layer: network service model, routing principles, hierarchical routing, Internet Protocol (IP) & ICMP details, routing in the Internet, router internals, IPV6. (08Hrs)
- UNIT IV:** Link layer: Introduction, services, multiple access protocol, LAN addresses & ARP, Carrier Sense Multiple Access with Collision Detection (CSMA / CD), PPP details. (08 Hrs)
- UNIT V:** Network security: Basic issues, principles of cryptography, authentication and authentication protocol, version, integrity: digital signatures, message digests, hash function algorithm, key distribution & certification, secure e- mail, E-Commerce: SSL & SET, IP Sec details. (08 Hrs)
- UNIT VI:** Network Management: Basic principles, infrastructure for network management, The Internet Network management framework: SMI, MIB, SNMP details, security and administration, ASN 1, Firewalls: Packet filtering and Application gateway. (08 Hrs)

TEXT BOOK:

James F. Kurose & K W Ross: Computer Networking, Pearson Education (LPE)

REFERENCE BOOKS:

1. Douglas E. Comer: Computer Network & Internet, Addison Wesley.
2. Andrew S. Tanenbaum: Computer Networks, PHI (5E)
3. Leon Garcia & Widjaja: Communication Networks, TMH
4. William Stallings: Data & Computer Communication, Pearson Education.

7KE03**MICROPROCESSOR AND INTERFACING**

- UNIT I:** Pin configuration of 8086, Functions of various pins, Register organization. Physical memory organization and segmentation, General bus organization, I/O addressing, 8086 minimum mode system and timings.
- UNIT II:** 8086 Instruction set: Addressing modes of 8086. Group of instructions: data transfer group, arithmetic/logic group, branch group, machine control & I/O group of instructions. 8086 Programming using these instructions.
- UNIT III:** 8086 I/O address space. I/O instructions & bus cycle. 8255 PPI, pin diagram, internal organization, modes of operation, strobed modes, interrupt driven mode, BSR mode. 8086 & I/O Interfacing through 8255.
- UNIT IV:** 8086 interrupt signals & system. Priority & Interrupt Vector table. Programmable Interrupt Controller 8259, pin diagram, ICWs, OCWs, modes of operation and interfacing details, cascaded mode, SFNM, polled mode, SMM.
- UNIT V:** Programmable Timer Counter 8254, pin diagram, internal architecture, modes of operation. Interfacing 8254 with 8086. Memory types. Interfacing memory with 8086: Static RAM and Dynamic RAM interfacing examples.
- UNIT VI:** DMA controller 8237, pin diagram, internal architecture, transfer modes and interfacing with 8086 processor. USART 8251, pin diagram, internal architecture, modes of operation synchronous and asynchronous modes and interfacing with 8086.

TEXT BOOK:

John P Uffenbeck, 8086/8088 Families: Designing, Programming and Interfacing (PHI)

REFERENCE BOOKS:

1. Liu & Gibson & 8086/8088 Microprocessors (PHI)
2. Douglas Hall & 8086 Microprocessors & Interfacing (McGraw-Hill)
3. Barry B Bray & The Intel Microprocessors (9/e) (PHI).
4. Triebel & A Singh & The 8086/8088 Microprocessors 4/e (PHI).

7KE04**MOBILE COMPUTING**

- Unit I:** Introduction: Applications, History of wireless communication, A simplified reference model, Wireless Transmissions: Frequencies for Radio Transmissions, Signals, Antennas, Signal Propagations, Multiplexing, Modulation, Spread Spectrum, Cellular System. (08 Hrs)

- Unit II:** Medium Access Control: Motivations for a specialized MAC, SDMA, FDMA, TDMA, CDMA, Comparison of S/T/F/CDMA, Telecommunications System: GSM, DECT, TETRA, UMTS and IMT-2000. 08 Hrs
- Unit III:** Satellite Systems: History, Applications, Basics, Routing, Localizations, Handover, Examples, Broadcast Systems: Cyclical Repetition of Data, Digital Audio Broadcasting, Digital video Broadcasting, Convergence of Broadcasting and mobile communications. 08 Hrs
- Unit IV:** Wireless LAN: Infra Red Vs Radio Transmission, Infrastructure and Ad-hoc Network, IEEE 802.11, HIPERLAN, Bluetooth. 08 Hrs
- Unit V:** Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol, Mobile Ad-hoc Networks, Mobile Transport Layer: Traditional TCP, Classical TCP improvements, TCP over 2.5/3G Wireless Networks. 08 Hrs
- Unit VI:** Support for Mobility: File Systems, World Wide Web, Wireless Application Protocol (version 1.X) Architecture, i-mode, SyncML, WAP2.0. 08 Hrs

TEXT BOOK:

Jochen Schiller: "Mobile Communication" Pearson Education, Second Edition.

REFERENCE BOOKS:

1. Mazliza Othman: "Principles of Mobile Computing and Communications" Auerbach.
2. Agrawal and Zeng: "Introduction to Wireless and Mobile Systems" Cengage Learning.
3. Iti Saha Misra: "Wireless Communications and Networks" McGraw Hill.
4. Raj Kamal: "Mobile Computing" Oxford University Press.

7KE05

PROFESSIONAL ELECTIVE -I
(I) ARTIFICIAL INTELLIGENCE

- Unit I:** Introduction: Definition of AI, AI Techniques, Tic Tac Toe, Pattern Recognition, Level of the model, Critical for Success, Problems and Problem Specifications, Defining the Problems, Production Systems, Control Strategies, Futuristic Search, Problem Characteristics, Decomposition of Problems, Solution steps, Predictability, Absolute & Relative Solutions.
- Unit II:** Basic Problem Solving methods: Reasoning, Problem trees and graphs, Knowledge Representation, Matching indexing with

- variables, Heuristic Functions, Weak Methods, Problem reduction, Constraints Satisfaction, Means-ends analysis, Analysis of Search Algorithms.
- Unit III:** Games Playing, Minimax Search Procedure, adding alpha beta cutoffs, additional refinements, Waiting for quiescence, Secondary Search, Using Book moves limitations.
- Unit IV:** Knowledge Representation using Predicate Logic: Representing simple facts in logic, augmenting the representation, resolution, conversion to clause form, Resolution in Propositional Logic and Predicate Logic, Unification Algorithms, Question Answering and Natural Deduction.
- Unit V:** Structural representation of knowledge: Some common known structures, choosing the level of representation, finding the right structure as needed, declarative representation, semantic nets, Conceptual Dependency, Frames, Scripts, Symantic- Semantic, Spectrum and procedural representation.
- Unit VI:** Natural Language Understanding: Concepts of Understanding, Keyword matching, Syntactic and Semantic analysis, Understanding single and multiple sentences, Using Four, Cover structures, Schemes and Scripts in Understanding, Dialogue Understanding.

TEXT BOOK:

Elaine Rich & Knight: "Artificial Intelligence", McGraw Hill.

REFERENCE BOOKS:

1. Nils Nilson: "Principles of Artificial Intelligence" (Addison-Wesley)
2. R. J. Winston: "Artificial Intelligence" (Wiley)
3. Patterwson "Introduction to Artificial Intelligence and Expert Systems" (PHI).
4. Rolston "Principles of Artificial Intelligence and Expert Systems", McGraw Hill.

7KE05

PROFESSIONAL ELECTIVE -I
(II) COMPUTER GRAPHICS

- Unit I:** An overview of Computer Graphics and Graphics System: video display devices, Raster-Scan systems, Random-Scan systems, Graphics monitors and workstations, input devices, hard copy devices, Graphics software. (08 Hrs)
- Unit II:** Output primitives : Point and Lines, Line drawing algorithms, loading the frame buffer, line function, circle and ellipse generating algorithms, curves, parallel curves algorithms,

Pixel addressing, filled-area primitives , functions, Cell array, character generation. (08 Hrs)

Unit III : Attributes of output primitives : Line and curve attributes,color and grayscale levels, area fill attributes. Character attributes, bundled attributes, antialiasing. (08 Hrs)

Unit IV: 2-D geometric transformations: basic transformations, matrix representations, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations. Two- Dimensional viewing : viewing coordinates, Window-to viewport coordinate transformation, viewing functions, clipping : point, line, polygon, curve, text, exterior. (08Hrs)

Unit V: Structures and hierarchical modeling : concepts, editing structures, basic modeling concepts, hierarchical modeling, GUI and interactive input methods : the user dialogue, input of graphical data, functions, initial values for input device parameters, interactive picture - construction techniques, virtual reality environments. (08Hrs)

Unit VI: Three dimensional concepts : display methods, graphics, Bezier curves and surfaces, B-spline curves and surfaces,Beta-splines, three dimensional geometric and modeling transformations : translation, rotation, scaling, three dimensional viewing : viewing pipeline, viewing coordinates, projections. (08Hrs)

TEXT BOOK:

D. Hearn, M.P.Baker : Computer Graphics, Second Edition, Pearson Education.

REFERENCE BOOKS:

1. F.S.Hill: Computer Graphics Using Open GL, II edition, Pearson Education.
2. W.M.Newman & R.F.Sproul: Principles of Interactive Computer Graphics, 2/e, McGraw Hill.
3. F.S.Hill : Computer Graphics, McMillan.
4. D.Hearn & M.P.Baker : Computer Graphics, Prentice Hall.
5. Hamington : Computer Graphics, McGraw Hill.

7KE05 PROFESSIONAL ELECTIVE -I (III) DESIGN AND ANALYSIS OF ALGORITHMS

Unit I: Iterative Algorithm Design Issue: Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion.

Unit II: Divide And Conquer: Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Convex Hulls, Drawbacks of D & C & Timing Analysis.

Unit III: Greedy Methods: Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstra's Shortest Path Algorithm.

Unit IV: Dynamic Programming: Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.

Unit V: Backtracking: Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, Some typical State Spaces.

Unit VI: Efficiency of Algorithm: Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

TEXT BOOK:

Dave and Dave: Design and Analysis of Algorithms, Pearson Education

REFERENCE BOOKS:

1. Aho,Hopcroft & Ullman The Design & Analysis of Computer Algorithms, Addison-Wesley
2. G.Brassard, P.Bratley: Fundamentals of Algorithmics, PHI
3. Horowitz & Sahani: Fundamental Algorithms, Galgotia.
4. Cormen, T.H, Lierson & Rivest: Introduction to Algorithms, McGraw-Hill

7KE05 PROFESSIONAL ELECTIVE -I (IV) HUMAN COMPUTER INTERACTION

UNIT I: Human factors of interactive software: Goals of system engineering & User-interface design, motivation for human factors, accommodation of human diversity, High level theories, Object-Action interface model, Recognition of the diversity, Eight golden rules of interface design, Preventing errors, Guidelines for data display and data entry, Balance of automation and human control. (08 Hrs)

UNIT II: Managing design process, Organizational design to support usability, the three pillars of design , Development

methodologies, ethnographic observation, Participatory Design, Scenario Development, Social impact statement for early design review, legal issues, Software tools: specification methods, Interface-Building tools, Evaluation and Critiquing tools.

(08 Hrs)

UNIT III: Direct manipulation and virtual environments, example of direct manipulation system, Explanations of direct manipulation, OAI model, Visual thinking and icons, direct manipulation programming, home automation, Remote Direct manipulation, Virtual environments.

(08 Hrs)

UNIT IV: Interaction devices: Keyboards and function keys, Pointing devices, Speech recognition, digitization and generation, Image and Video Displays, Printers. Response time and Display rate: Theoretical foundations, Expectations and attitudes, User Productivity, Variability.

(08 Hrs)

UNIT V: Multiple window strategies, Individual windows design, Multiple window design, Coordination by tightly coupled windows, Image browsing and tightly coupled windows, Personal role management and elastic windows. Computer supported cooperative work: Goals of cooperation, Asynchronous interaction, Synchronous distributed and face-to-face, Applying CSCW to education.

(08 Hrs)

UNIT VI: Information search and visualization, Database Query and phrase search in textual documents, multimedia documents searches, Information visualization, advanced filtering. Hypermedia and the World Wide Web, Genres and goals and designers, Users and their tasks, Object action interface model for web site design.

(08 Hrs)

TEXT BOOK:

Ben Shneiderman: "Designing the User Interface", Pearson Education.

REFERENCE BOOKS:

1. R. Beale, A.J. Dix, J. E. Finlay, G. D. Abowd "Human-Computer Interaction", Prentice-Hall.
2. Joann Hackos, Janice Redish, "User and Task Analysis for Interface Design", Wiley.
3. Jeff Raskin, "The Humane Interface", Pearson Education.
4. Jesse James Garrett, "The Elements of User Experience", New Riders.

7KE06 COMPUTERNETWORK - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

7KE07 MICROPROCESSOR & INTERFACING - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

7KE08 MOBILE COMPUTING - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

7KE09 PROJECT AND SEMINAR:

Seminar should be preferably based on the proposed project to be completed in final year. The seminar should be conducted in seventh semester and evaluated. Each candidate shall submit a seminar report, deliver the seminar and face the viva-voce. The distribution of internal 50 marks shall be as follows.

- | | | |
|----|--|----------|
| 1. | Seminar report preparation and submission :- | 10 marks |
| 2. | Seminar delivery/ presentation:- | 20 marks |
| 3. | Seminar viva-voce:- | 10 marks |
| 4. | Attendance in all seminar sessions:- | 10 marks |

SEMESTER: EIGHT

8KE01 DIGITAL SIGNAL PROCESSING

Unit I: Discrete Time Signals and Systems: Introduction to DSP, Advantages, basic elements of DSP system, sampling theorem, A/D, D/A conversion, quantization. Elementary discrete-time sequences. Discrete-time systems: description, representation, classification (linear, time-invariant, static, casual, stable)

(08Hrs)

Unit II: Analysis of DTLTI systems: The convolution sum, properties of convolution, Analysis of causal LTI systems, stability of LTI systems, step response of LTI systems, difference equation, recursive & non recursive discrete time systems, solution of difference equations, Impulse response of LTI recursive system. Correlation of discrete time signals.

(08Hrs)

Unit III:- Transform and Analysis of LTI Systems: Definition of z-Transform, properties, rational z-Transforms, evaluation of the inverse z-Transforms, analysis of linear time invariant systems in z-domain, transient and steady-state responses, causality, stability, pole-zero cancellation, the Schur-Cohn stability test.

(08Hrs)

Unit IV: Fourier Transforms, the DFT and FFT: Definition & properties of Fourier transform, relation with z-transform. Finite duration

sequences and the discrete Fourier transform (DFT), properties, circular convolution., Fast algorithms for the computation of DFT: radix-2 and radix-4 FFT algorithms (08 Hrs)

Unit V: Design of Digital Filters: Classification of filters: LP, HP, BP, FIR and IIR filters, filter specifications. Design of FIR filters using Windows and by Frequency sampling methods. Design of IIR filters from Analog filters using approximation of derivatives, Impulse invariant transformation, Bilinear transformation and Matched z-Transformation, Commonly used Analog filters and IIR Filter design example. (08Hrs)

Unit VI: Realization of Discrete-Time systems: Structures for realization of Discrete-Time systems, realization of FIR systems: Direct Form, Cascade Form, Frequency sampling and Lattice structures. Realization of IIR filters: Direct Form, Signal flow graph and Transposed structures, Cascade form, Lattice and Lattice ladder. Realization for IIR systems. (08Hrs)

TEXT BOOK :

J G Prokis and D G Manolokis, *Digital Signal Processing: Principles Algorithms and applications* (Pearson Education)

REFERENCE BOOKS:

1. S K Mitra: *Digital Signal Processing: A Computer-Based Approach* (McGraw Hill)
2. E C Ifeachor, B W Jervis *Digital Signal Processing* (Pearson Education)
3. A V Oppenheim, R W Schaffer with J R Buck *Discrete Time Signal Processing* (PHI)
4. P Ramesh Babu: *Digital Signal Processing* Scitech Publications.

8KS02/8KE02

EMBEDDED SYSTEMS

Unit-I: Introduction to Embedded System: Embedded Systems Vs General Computing Systems. History, classification, major application areas and purpose of Embedded Systems. Components of Embedded system: General Purpose and Domain Specific Processors, Memories for embedded systems.

Unit-II: Components of Embedded system: Sensors & Actuators, Communication Interface, Embedded Firmware and other components. Characteristics of Embedded System, Quality Attributes of Embedded System. Embedded Systems Examples: Washing machine. Automotive application.

Unit-III: Introduction to 8051 Microcontroller: 8051 Architecture, 8051 Memory Organization, Registers, Oscillator Unit, Ports, 8051 Interrupt System, Timer units, the Serial Port, 8051 Power Saving Modes.

Unit-IV: Programming the 8051 Microcontroller: Addressing modes. 8051 Instruction Set: Data transfer instructions, Arithmetic instructions, Logical instructions, Boolean instructions, and Program Control Transfer instructions. Assembly Language based Embedded Firmware development.

Unit-V: Programming in Embedded C: Review of various constructs in C. Constant declarations, *volatile* type qualifier, Delay generation and Infinite loops in Embedded C. Coding Interrupt Service Routines, Recursive and Re-entrant Functions, Dynamic memory allocation.

Unit-VI: VxWorks Real Time Operating System (RTOS): Characteristics, Real Time Kernel, Hard/Soft Real time. VxWorks Task Creation, Management and Task Scheduling, Kernel Services, Inter Task Communication, VxWorks Task Synchronization and Mutual Exclusion, Interrupt Handling, Watchdog for task Execution monitoring, Timing and Reference in VxWorks.

TEXT BOOK:

Shibu K V *Introduction to Embedded Systems* McGraw-Hill.

REFERENCE BOOKS:

1. Rajkamal, *Embedded Systems, Architecture, Programming & Design* TMH.
2. Tammy Noergaard *Embedded Systems Architecture* Elsevier Newness Publication.
3. Vahid and Givargis *Embedded System Design* John Wiley & Sons P Ltd.
4. Peter Marwedel *Embedded Systems Design* Springer, Netherland.

8KS03/8KE03 SOFTWARE ENGINEERING

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. W5HH principles, critical practice. (08 Hrs)

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.

(08 Hrs)

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. (08 Hrs)

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. (08 Hrs)

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. (08 Hrs)

Unit VI: Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software. (08 Hrs)

TEXT BOOK:

Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH.

REFERENCE BOOKS :

1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Fairly R: Software Engineering (McGraw Hill)
3. Davis A: Principles of Software Development (McGraw Hill)
4. Shooman, M.L: Software Engineering (McGraw-Hill)

8KE04 PROFESSIONAL ELECTIVE - II (I) NETWORK SECURITY

Unit I: Introduction: Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Internetwork Security, Internet Standards and the Internet Society. Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. (08 Hrs)

Unit II: Public-Key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public Key Cryptography Principles, Public Key Cryptography Algorithms, Digital Signatures, Key Management. (08 Hrs)

Unit III: Authentication Applications: Kerberos, X.509 Authentication Service, Public-Key Infrastructure, Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME, (08 hrs)

Unit IV: IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management, Web Security: Web Security Considerations, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). (08 Hrs)

Unit V: Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3, Intruders: Intruders, Intrusion Detection, Password Management. (08 Hrs)

Unit VI: Malicious Software: Viruses and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks, Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation. (08 Hrs)

TEXT BOOK:

William Stallings: Network Security Essentials Applications and Standards (3/e) Pearson.

REFERENCE BOOKS:

1. Atul Kahate: Cryptography and Network Security Mc Graw Hill.
2. Forouzan and Mukhopahyay: Cryptography and Network Security Mc Graw Hill.
3. Matt Bishop: Computer Security: Art & Science Pearson Education.
4. Brijendra Singh: Network Security & Management PHI.

8KE04 PROFESSIONAL ELECTIVE - II (II) MULTIMEDIA TECHNOLOGIES

Unit I: Multimedia Authoring and Data Representations: Introduction, Components of Multimedia, Hypermedia and Multimedia, Overview of Multimedia Software Tools, Multimedia Authoring and Tools: Multimedia Authoring, VRML. Graphics and Image Data Representations: Graphics/Image Data Types, 1-Bit Images,

8-Bit Gray-Level, Images, Image Data Types, Popular File, Formats, GIF, JPEG, PNG, TIFF, EXIF, Graphics Animation Files, PS and PDF, Windows WMF, Windows BMP, Macintosh PAINT and PICT, X Windows PPM. (08Hrs)

Unit II: Color in Image and Video: Color Science, Color Models in Images, and Color Models in Video. Fundamental Concepts in Video: Types of Video Signals, Component Video, Composite Video, S-Video, Analog Video, NTSC Video, PAL Video, SECAM Video, Digital Video, Chroma Sub sampling CCIR Standards for Digital Video, High Definition TV. (08Hrs)

Unit III: Basics of Digital Audio: Digitization of Sound, Digitization, Nyquist Theorem, Signal-to-Noise Ratio (SNR), Signal-to-Quantization-Noise Ratio (SQNR), MIDI: Musical Instrument Digital Interface, Hardware Aspects of MIDI, Structure of MIDI Messages, General MIDI, MIDI-to-WAV Conversion, Quantization and Transmission of Audio, Coding of Audio, Pulse Code Modulation, Differential Coding of Audio, Lossless Predictive Coding, DPCM, DM, ADPCM. (08Hrs)

Unit IV: Multimedia Data Compression: Lossless Compression Algorithms: Basics of Information Theory, Run-Length Coding, Variable-Length Coding (VLC), Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression. The JPEG Standard. (08Hrs)

Unit V: Basic Video Compression Techniques: Introduction, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261, Intra-Frame (I-Frame) Coding, Inter-Frame (P-Frame) Predictive Coding, Quantization in H.261, H.261 Encoder and Decoder, H.261 Video Bitstream Syntax, MPEG-1, Motion Compensation in MPEG-1, Major Differences from H.261 (08Hrs)

Unit VI: Basic Audio Compression Techniques: ADPCM, Vocoder, Phase Insensitivity, Channel Vocoder, Formant Vocoder, Linear Predictive Coding, CELP. MPEG Audio Compression: Psychoacoustics, Equal-Loudness Relations, Frequency Masking, Temporal Masking, MPEG Audio, MPEG Layers, MPEG Audio Strategy, MPEG Audio Compression Algorithm, MPEG-2 AAC (Advanced Audio Coding). (08Hrs)

TEXT BOOK:

Ze-Nian, Li, Mark S. Drew óFundamentals of Multimediaö (Pearson Education)

REFERENCE BOOKS:

1. Rajan Parekh óPrinciples of Multimediaö (Tata McGraw-Hill)
2. S.J.Gibbs & D.C.Tsichritzis óMultimedia Programmingö, Addison Wesley 1995
3. P.W.Agnew & A.S.Kellerman óDistributed Multimediaö, Addison-Wesley 1996
4. C.A.Poynton, óA Technical Introduction to Digital Videoö Wiley 1996
5. F.Fluckiger, óUnderstanding Networked Multimediaö, Prentice- Hall 1995

8KE04 PROFESSIONAL ELECTIVE - II (III) EXPERT SYSTEM DESIGN

Unit I: Expert Systems: Definition, Components and characteristics of an expert system, Acquiring knowledge, representing knowledge, Controlling reasoning, Explaining solutions. Knowledge Representation: Principles and techniques, Examples: STRIPS and MYCIN. (08 Hrs)

Unit II: Rule-Based Systems: Canonical systems, Production systems for problem solving, The syntax of rules, The working memory, Controlling the behavior of the interpreter, Conflict resolution, Forward and backward chaining, Rules and meta-rules. (08 Hrs)

Unit III: Associative Nets and Frame Systems: Graphs, trees and associative networks, type-token distinction and cognitive economy, adequacy of associative nets, Representing typical objects and situations. Introduction to frame, Complex nodes in a network, Defaults and demons, multiple inheritance and ambiguity, Comparison of nets and frames. (08 Hrs.)

Unit IV: Representing Uncertainty: Sources of uncertainty, Expert system and probability theory, Conditional probability, Certainty factors, Certainty factors versus conditional probabilities, Vagueness and possibility, Fuzzy sets, Fuzzy logic, Possibility theory, The uncertain state of uncertainty. (08 Hrs)

Unit V: Knowledge Acquisition: Theoretical analyses of knowledge acquisition, Stages of knowledge acquisition, Different levels in the analysis of knowledge, Ontological analysis, Expert system shells, Knowledge acquisition methods, Knowledge-based knowledge acquisition. (08 Hrs)

Unit VI: Constructive Problem Solving: Motivation and overview, case study: R1/XCON, Elicitation, evaluation and extensibility. Design for Explanation: Rule based explanation, Frame based explanation, Explanation and automatic programming, Explanation facilities. (08 Hrs)

TEXT BOOK:

Peter Jackson: Introduction to Expert Systems Pearson Education, Third Edition.

REFERENCE BOOKS:

1. Donald A Waterman: A Guide to Expert Systems Pearson Education.
2. James P. Ignizio: Introduction to Expert Systems Mc Graw Hill.
3. Dan W. Patterson: Introduction to Artificial Intelligence and Expert Systems PHI.
4. Janakiraman, Sarkesi and Gopakrishanan: Introductions of Artificial Intelligence and Expert Systems, Macmillan India Limited.

8KE04 PROFESSIONAL ELECTIVE -II (IV) SOFT COMPUTING

UNIT-I: Fundamental of Neural Network: Basic concepts of Neural Network, Human Brain, Model of artificial neurons, Neural Network architecture, Characteristics of Neural Network, Learning methods, Taxonomy of Neural Network architecture, Early Neural Network architecture. (08 Hrs)

UNIT II : Backpropagation Networks: Architecture of a Backpropagation Network, The Perceptron Model, The solution, Single Layer Artificial Neural Network, Model for Multiayer Perceptron, Back propagation learning, Input Layer, Hidden Layer and Output Layer Computation, Calculation of error, Training of Neural Network, Method of Steepest Descent, Effect of Learning rate, Adding a momentum Term, Backpropagation Algorithm. (08Hrs)

UNIT-III: Fuzzy Set Theory: Fuzzy versus Crisp, Crisp sets, Operations and Properties of Crisp Sets, Partition and Covering, Fuzzy sets, Membership Function, Basic Fuzzy Set Operation, Properties of Fuzzy Sets, Crisp Relations, Cartesian product, other relations, Operations on Relations, Fuzzy Relations, Fuzzy Cartesian Product, Operations on Fuzzy Relations. (08Hrs)

UNITIV: Fuzzy Systems: Crisp logic, Laws of Propositional logic, Inference in Propositional logic, Predicate logic, Interpretations of Predicate Logic Formula, Inference in Predicate Logic, Fuzzy logic, Fuzzy Quantifiers and Inference, Fuzzy rule based system, Defuzzification methods, applications. (08 Hrs)

UNITV: Fundamental of Genetic Algorithm: Genetic Algorithms, Basic Concepts, Creation of offspring, Working Principle, Encoding, Binary, Octal, Hexadecimal, Permutation, Value, Tree, Fitness function, Reproduction. (08 Hrs)

UNITVI: Genetic Modeling: Inheritance Operators, Cross over, Inversion & Deletion, Mutation Operator, Bit wise operator, Bit wise operator used in GA, Generational cycle, Convergence of genetic algorithm, Application, Multilevel Optimization, Real life problem, Differences and similarities between GA and other traditional methods, Advances in GA. (08 Hrs)

TEXT BOOK:

S. Rajesekaran, G. A. Vijayalakshmi Pai: Neural Network, Fuzzy logic, and Genetic algorithms Synthesis and Applications PHI.

REFERENCE BOOKS:

1. S. Hykin: Neural Networks Pearson Education.
2. Jang, Sun and Mezutani: Neuro Fuzzy and Soft Computing.
3. Zurada: Artificial Neural Networks.
4. N.P. Padhey: Artificial Intelligence and Intelligent Systems, Oxford University Press.

8KE05 DIGITAL SIGNAL PROCESSING - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

8KE06 EMBEDDED SYSTEMS - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

8KE07 PROJECT & SEMINAR:

The project shall be internally evaluated (for 75 Internal Marks) in three phases based on the progress of the project work. Each phase shall be internally evaluated for 25 marks as follows:

Phase I: - Problem Definition and Design

Phase II: - Problem Implementation and Testing

Phase III: - Project Demonstration & Report submission.

The external evaluation of the project shall be based on demonstration of the project and viva-voce

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
TEXTILE ENGINEERING
SEMESTER PATTERN (C. G. S.)**

SEVENTH SEMESTER

7 TX 01

TEXTILE MATHEMATICS

SECTION - A

- Unit-I:** Fibres-Introduction, Fibre Dimension, Tensile strength, work of rupture. Trash & lint Content of cotton, Oils, Fats, Sizes & Resins in Fibre samples. Qualitative analysis of fibre mixture.
- Unit-II:** Yarns-Opening & Cleaning, drafting, calculations on Card mechanism, Draw Frame, Draft in Combing machines.
- Unit-III:** Yarns- The speed frame, yarn dimension twist in yarn, irregularity, Ring frame.

SECTION - B

- Unit-IV:** Yarn preparation- Introduction, winding rate wind & traverse ratio, cone winding, yarn tension & tensioning devices, yarn clearing & clearing devices.
- Unit-V:** Warp preparation, sizing & weft preparation.
- Unit-VI:** Fabrics-Woven fabric structures Weaving Mechanisms.

Note: Only numerical in the Examination will be asked

REFERENCE BOOK:

1. Textile Mathematics, vol.1, vol.2, vol. 3 by J.E Booth

7 TX 02

TEXTILE TESTING-III

SECTION-A

- Unit-I:** Serviceability: Introduction, Snagging, Pilling, Factors affecting pilling of fabric. Pilling test, Abrasion resistance, factors affecting abrasion resistance. Abrasion tests, wear. Wearer Trials, Advantages & Disadvantages of Wearer Trials vis a vis Laboratory Tests.
- Unit-II:** Comfort: Introduction. Thermal Comfort, Heat balance. Heat loss, Air Permeability & its Measurement. Effect of Air Permeability on fabric properties, Measurement of Thermal

Resistance & Transmittance of fabrics. Moisture transport, sensorial comfort, water absorption, water repellency. Measurement of water vapour permeability, water repellency & water permeability. Hydraulic bursting strength tester,

- Unit-III:** Objective evaluation of fabric handle: Bending Length, stiffness, Handle, Drape, Crease recovery, shear. Bias extension, formability, fabric friction, Kawabata system. Fabric assurance by simple testing.

SECTION-B

- Unit-IV:** Flammability terms used relating to flammability, factors affecting flame resistance, flammability testing, and recent progress in flammability testing, flame proofing & flame resistance finishes. Dimensional stability: Introduction, Hygral expansion, Relaxation shrinkage, swelling shrinkage, felting shrinkage, methods of measuring dimensional stability.
- Unit-V:** Colour fastness testing: Introduction, sample preparation, outline of colour fastness tests. Colour fastness to Washing, Rubbing, Light, Heat (sublimation), Perspiration, Sea Water, Hypochlorite, Peroxide, Chlorinated Water, Dry Cleaning Agents, Saliva.
- Unit-VI:** Testing of Technical Textiles: - Bacterial filtration efficiency, cone drop penetration test, Testing of Tribological properties of Composites. Tension meters, stroboscope, tachometer, Nep counting. Quality: Definition of quality. Types of Quality. Quality Control, Quality assurance, ISO 9000. Textile Product labeling, Voluntary & Mandatory Care Labels.

REFERENCE BOOKS:

- 1) Principles of Textile Testing -J.E. Booth
- 2) Physical Testing of Textiles - B.P.Saville
- 3) Textile Testing - Grover & Hamby.
- 4) Handbook of Technical Textiles:- Anand & Harrocks.

7 TX 03

CHEMICAL PROCESSING-I

SECTION-A

- Unit-I:** Sequence of wet processing for cotton material:- Grey inspection, shearing, cropping, singeing and different singeing methods. Desizing- Object, chemistry and technology of different desizing process (Acid, enzymatic, oxidative, novel methods), batch and continuous methods of desizing.

Unit-II: Scouring- object, chemistry of scouring(saponification, emulsification, detergency, surface tension), technology of scouring (lime-acid-soda ash process, caustic boiling, soap soda ash process for colour goods), bio-scouring batch and continuous scouring process. Bleaching- Objective, Chemistry and technology of Hypochlorite, peroxide & chlorite bleaching. Preparation process for synthetic and blended fabric in brief, batch and continuous process.

Unit-III: Mercerization- Chemistry and technology (Chainless, Padless, Pad chain), Physical chemical effect of mercerization. Evaluation of Desizing, scouring (Copper number method, methylene blue absorption method and bleaching performance (test methods).and mercerization.

SECTION-B

Unit-IV: Dyeing - Define dye, classification of dyes based on method of application, chemical constitution and different term used in dyeing. Dyeing machines ñ Principal and working of different dyeing machines for fiber, yarn and fabrics. Latest Technological features of different dyeing machines.

Unit-V: Dyeing for cellulosic ñ direct dye, Vat dye, solublised vat dye, Azoic dye and Sulphur dye, reactive dye. Effect of Process parameters on dyeing performance, various dyeing faults their causes and remedies.

Unit-VI: Dyeing of Protein and synthetic fiber- Acid, basic, mordant and disperse dye. Dyeing of blend like polyester ñ cotton, polyester-viscose and polyester-wool. Effect of process and material parameter on dye performances, various dyeing faults their causes and remedies

REFERENCE BOOKS:

1. Textile Chemistry, Vol. II by R.H. Peters,
2. Textile Scouring and Bleaching by E.R. Trotman
3. Chemical Technology in the Pretreatments in processes of textile By S.R.Karmakar
4. Technology of Bleaching and Mercerising by V.A. Shenai,
5. Mercerization by J.T. Marsh
6. Technology of Textile processing, Vol. II, by V.A. Shenai
7. Chemistry of Dyes and Principles of Dyeing by V.A. Shenai,
8. Technology of Textile processing, Vol. VI, by V.A. Shenai
9. Technology of Dyeing by V.A. Shenai,

10. Dyeing and Chemical Technology of Textile Fibres by E.R. Trotman,
11. Chemical Processing of Synthetic Fibres and Blends by K.V. Datye and A. A. Vaidya.
12. Textile Preparation and Dyeing by Asim Kumar Roychowdhury.

7 TX 04

TEXTILE MILL MANAGEMENT

SECTION-A

Unit- I: Factors governing of site selection for textile mill, plant layout: - objective, kinds of layout their advantages & disadvantages, effect of automation on plant layout, advantages of a good layout, symptoms of bad layout.

Unit- II: Introduction - Management, management function, principal of scientific management, personal management- Concept, personal functions, manpower planning, need of training, objects of remuneration, fringed benefits. Motivation, Promotion, Transfer.

Unit- III: Marketing management Concept, marketing function, pricing practice, need of advertising & sales promotion, market research. Sources of funds for textile industry, Introduction to working capital, Balance sheet, Profit & Loss Account, Budget, Budgeting, Auditing.

SECTION - B

Unit- IV: Separation of organisation with respect to manpower, machinery for spinning mill for spinning of cotton carded, combed as well as manmade fibres & blended yarns & organisation of quality control and their check and their standard norms at various levels in spinning.

Unit- V: Preparation of organisation of weaving department with respect to manpower & machine with conventional, modern preparation and weaving machine for weaving cotton & blended fabrics. Overall process control schemes for weaving their norms at various levels.

Unit- IV: Brief outline of factory act - 1948 and labour law in textile industry. (Trade union, collective bargaining, workers participation, industrial disputes) Architectural and structural aspects of textile mill building morphology- general principles of building construction & building foundation, material for construction with special reference to wall, roof, floors and fire resistance, noise in textile mills, its measurement and control, colour scheme for building interior and machinery in textile mills.

REFERENCE BOOKS:

- 1) Management of textile industry - Dubeja
- 2) Practical cotton mills management - Benjamin
- 3) Ind. Engg. and Management - O.P.Khanna

7 TX 05 PROFESSIONAL ELECTIVE - I
(1) ADVANCED NON-WOVEN TECHNOLOGY

SECTION - A

- Unit-I:** Global Nonwoven Market Scenario And Development Of Nonwovens. Status Of Various Technologies Of Nonwoven Fabrics. Detail Applications of Non Woven In Technical Textiles, Geotextile, Medical Textile And Their Product Wise Property Requirement.
- Unit-II:** Nonwoven Nanostructure Fabrics Formation Process With Reference To Electro Spinning, Nonwoven Composite Fabrics, Manufacturing Processes And Development Improvements In Spun lace Technologies: - Isojet System.
- Unit-III:** Evolon Fabric Technology- Introduction, Manufacturing Process, Characteristics & Application of Evolon Fabrics, Future Potential of Evolon Fabric Application. Airlaid Technology: - Introduction, Raw Material, Manufacturing Process, Characteristics And Application Of Airlaid Fabrics.

SECTION - B

- Unit-IV:** Nonwoven fabric finishing: Introduction, Wet finishing, Application of chemical finishes, Lamination, Mechanical finishing, Surface finishing, Developing technologies.
- Unit - V:** Characterisation & testing of nonwoven fabrics: Introduction, Fabric weight, thickness, density and other structural parameters, General standards for testing nonwovens, Measurement of basic parameters, fibre orientation distribution, porosity, pore size and pore size distribution, tensile properties.
- Unit-VI:** Permeability characteristics (gas-liquid-water vapour), wetting and liquid absorption behaviour, thermal conductivity and insulation behaviour. Compressional behaviour & Frictional characteristics of nonwoven fabrics

REFERENCE BOOKS:

1. Non-woven fabrics by Banarjee.

2. Non-woven bonded fabrics by J. Lunescdors.
3. Hand Book of Nonwoven by S. J. Russell
4. Non-woven fabrics ñ production and applications by M.L. Gulrajani.

7 TX 05 PROFESSIONAL ELECTIVE - I
(2) ADVANCED KNITTING TECHNOLOGY

SECTION - A

- Unit-I:** Yarn preparation:- Methods of Yarn Preparation, Indirect/ Mill Warping and Direct warping. Direct warping equipments for filament Yarns, Elastomeric yarns, Spun yarns, High-Modulus yarns, Pattern Beams.
- Unit-II:** Weft knitting:-Development in weft knitting machines :- needles, sinkers, cams, yarn feeder, fabric take down, yarn supply, auxiliary systems, machine drive, machine frame, in creel, yarn feeder, yarn feeler, yarn tension controller.
- Unit-III:** Warp knitting:-Multi guide bar machines and fabrics : Development of raschel lace, pattern guide bars, guide bar nesting, multi bar tricot lace machines, chain links and electronic control of shogging, raschel mesh structures, Jacquard raschel, Mayer jacquardtronic multi-bar lace raschel.

SECTION - B

- Unit-IV:** Double needle bar warp knitting machines: - Operating principles, double needle bar basic lapping principles, using two fully-threaded guide bars, simplex machine, double needle bar raschel. Jacquard Knitting: knitting principle of jacquard, Raschel jacquard Machine, Guide Deflection, jacquard designing, jacquard products.
- Unit-V:** Advance knitting techniques: Weft insertion technique, fall plate technique, cut and miss press technique, laying in technique, Spot or knop effects, Terry by the press-off method. Terry fabric Production, sinker pile fabrics. Speciality fabrics and machines: The range of speciality fabrics, The production of fleecy on sinker-top machines, Fleecy interlock, Plush, The bearded needle sinker wheel machine, Sinker plush knitted on single-jersey latch needle machines, Full-density patterned plush, Cut loop, Double-sided plush, Sliver or high-pile knitting, Wrap patterning
- Unit-VI:** Electronics in knitting:- The disadvantages of mechanical control, The disadvantages of mechanical programming, The advantages of electronic control and programming, The compatibility of electronic signals and knitting data, Microprocessors and computers, The computerised knitting

machine, Computer graphics and pattern preparation, The Stoll CAD pattern preparation system, The Shima total design system. Electronic Patterning equipment: Hell-Zangs, The DEC pattern Computer, An Improved DEC system.

REFERENCE BOOKS:

1. Knitting technology by David J. Spencer.
2. Warp knitting by Ajgaonkar.
3. Warp Knitting Production by Dr. S. Raz
4. Knitting technology NCUTE
5. Latest textile machines used globally NCUTE.

7TX06 PROJECT & SEMINAR

7TX07 TEXTILE TESTING III-LAB

10 to 12 Practicals based on syllabus of 7 TX 02

7TX08 CHEMICAL PROCESSING -LAB

10 to 12 Practicals based on syllabus of 7 TX 03

SEMESTER EIGHT

8TX01 PROCESS CONTROL IN TEXTILE MANUFACTURING

SECTION-A

Unit-I: Introduction, scope of process control in spinning and Weaving, key variables, establishing norms, Collection & interpretation of data for process control, Maximizing quality & Cost evaluation of fibre quality, Linear programming for cotton mixing, Yarn realization, Estimation & control of yarn realization, Waste & their norms.

Unit-II: Control of waste in Blow room, Carding and Comber. Control of cleaning efficiency in Blowroom and Carding. Factors affecting cleaning efficiency and Fibre Transfer efficiency. Fractionating efficiency of comber. Control of Quality, Productivity and variability in Blowroom, Carding, Comber, Drawframe and Speed Frame. Optimization of drafting performance. Controlling of roving stretch and break. Measurement and assessment of unevenness of sliver and roving. Different types of defects in spinning preparatory processes, their causes, control and remedies.

Unit-III: Scope of Process control in Ring spinning- Control of yarn quality-Control of count, strength and their variability within and between bobbin variations. Factors affecting yarn strength, Measurement and assessment of unevenness of yarn. Types of yarn irregularities, Measurement and assessment of imperfections, Causes of yarn imperfections, Control of yarn and unevenness and imperfections. Control of End breakages and Hairiness of yarn. Control of Efficiency, Productivity and waste. Yarn faults and package defects, Slubs, Crackness, Spinners doubles, Bad piecing and double gaiting, Slough off. Control, Causes and Remedies of yarn faults.

SECTION-B

Unit-IV: A system of process control for weaving:- Scope for process control- Loom productivity and contributing factor, Approach and methodology of control. Scope for process control in winding,- Introduction, Control of, Productivity and Waste in winding. Quality control of knot, splice and package, Controlling of yarn tension and end breakage rate. Optimization of yarn fault removal.

Unit-V: Process control in Warping, Sizing and Pirn winding: Warping:- Introduction, Control of end breakages, Quality of beams, control of productivity, Causes of low productivity. Sizing:- Introduction, Choice of size recipe and size pick-up, control of yarn sketch. Quality of size beam, devices for improving weavability of sized yarn, control of productivity and waste. Control of size loss. Pirn winding: Introduction, Control of quality, productivity and waste in Prin winding.

Unit-VI: Loom shed control (Productivity)- Scope for process control in Loom shed, introduction, control of speed, efficiency and loom stoppages. Loom performance. Control of loss of efficiency by snap reading. Calculation of expected loom efficiency for non automatic and automatic loom. Quality of grey fabric, Control of quality, productivity and waste in loom shed etc. Productivity - definition of indices of productivity. Measurement and analysis of productivity. Means to improve productivity, maximizing machine efficiency, controlling end breakage rate. Control on consumption of accessories: Introduction, selection of accessories.

REFERENCE BOOKS:

- 1) Process control in Spinning by ATIRA.
- 2) Process control in Weaving by ATIRA.

8 TX 02 ADVANCE FABRIC MANUFACTURING TECHNOLOGY**SECTION-A**

Unit-I : Introduction to unconventional weaving machine:-limitations of shuttle loom, large weft supply package, weft accumulator, weft measuring systems, weft cutters, selvages on unconventional looms. Classification of shuttleless looms.

Unit - II : Projectile loom:- introduction, main features, advantages, transfer of weft end from projectile feeder to projectile, projectile picking mechanism, electronically controlled projectile brake, weft insertion cycle, let-off motion, beat-up mechanism, tuck in selvage, projectile monitoring, setting, weft tension variation, modern developments, energy utilization, scope and limitations.

Unit - III : Rapier loom -classification of rapier looms, rigid and flexible rapiers, methods of weft insertion, rapier driving for rigid and flexible rapiers, rapier heads, displacement and velocity of rapier, interference of rapier with warp threads, Hunts let off, weft tension variation, modern developments, energy utilization, scope and limitations.

SECTION-B

Unit- IV : Air jet loom - working Principle of Maxbo loom, different phases of weft insertion, weft measuring system, air requirements, air jet nozzles, buckling of weft and traverse aids for maintaining air flow confuser system, profile read and relay nozzles, methods of air jet control, timings of air jet loom, Weft yarn tension behaviour, automatic weft repair, multihole relay nozzles, Water jet loom - weft supply system, requirement of water, phases of weft insertion, weft insertion system (pump, nozzle) timing of water jet loom, quick style changing timing of water jet loom, Weft yarn tension behavior. Modern developments, energy utilization, scope and limitations of air and water jet looms. Techno economics unconventional weaving systems.

Unit- V : Weaving of certain commercial fabrics - Geotextile, denim, tire cord fabrics. Definition and quality particulars of standard woven fabrics bagging and slacking, belting, blankets, blazer cloth, chiffon ,corduoy cotton suiting and trousering, crepe fabrics ,denim, dhotis ,drills ,felts, flannel, gabardine , jean, khaki, lawn, long cloth, moiré, muslin, pile, plain cloth , poplin, quilts, saree, satin , sateen, sheeting, shirting, velvet, woollen cloth, worsted cloth.

Unit- VI: Special weaving: - Ribbon weaving machines, Classification, manufacturing, advantages and uses of multiphase, multiaxial, three dimensional weaving.

REFERENCE BOOKS:

- 1) Weaving machine, mechanism management by D.B.Ajagaonkar & M.K.Talukdar
- 2) Weaving operations by Allen Armord
- 3) Principle of Weaving by R.Marks & A.T.C.Robinson
- 4) Weaving mechanism (vol 2) by N.N.Bannerjee
- 5) Shuttleless loom by J.J.Vincent

8 TX 03 CHEMICAL PROCESSING–II**SECTION -A**

Unit-I : Printing ñ Definition of printing ,difference between dyeing and printing , different steps Involved in printing viz, preparation of material ,Ingredients of printing paste, different thickener their chemical and theological behavior , drying of print , fixation of print (after treatments of printing).

Unit-II : Styles of printing viz direct, resist, discharge and their comparison, flock printing and batik printing. Different methods of printing viz block, roller, screen (flat bed and rotary). Nonconventional methods like transfer printing,inkjet/Digital prints machines.

Unit-III : Printing recipe ñ Standard recipes for printing with various types of dyes such as direct, reactive , azoic ,vat , sulphur , disperse ,acid dyes and pigment colour with relevant after treatments .Different faults of printing and their prevention. Evaluation of different fastness properties (wash, light, rubbing,perspiration, sublimation and other allied fastness properties).

SECTION-B

Unit-IV : Finishing ñ Object of finishing, classification of finishes, concept of anti crease, wash n wear and durable press finish. Concept of specialty finishes like ant shrink, antistatic, soil release, water repellent, water proof ,flame retardant, Parchmentisation, , softening finish, etc Novelfinishes ñAntimicrobial finish, cool finish, Aroma finish

Unit-V : Detail study of various finishing machine viz calendaring (types of calendars) , sanforising , stenter , drying machine testing of

finishes ñ anti crease, ant shrink, fire retardant, water proof and water repellent, antimicrobial.

Unit-VI: Computer Colour Matching Concept of colour and brief idea about the relation between colour and chemical constitution, factors governing transmission, tristimulus value, , kubelka munk's equation, methods of colour estimation, -manual, their limitations, instrumental, pass-fail criteria, brief idea of computer colour matching and formulation.

REFERENCE BOOKS:

1. Textile printing by L.W.C.Miles
2. An introduction of Textile Printing by W Clarke.
3. Technology of Printing by V.A. Shenai,
4. Textile finishing by A.J.Hall
5. Introduction to textile finishing by J T Marsh
6. Technology of Finishing by V.A. Shenai,
7. Instrumental colour measurements and computer aided colour matchings for textiles By Shah and Gandhi
8. Modern concept of colour and appearance by Asim Kumar Roychowdhury.

8 TX 05 PROFESSIONAL ELECTIVE - II (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, Theory of dust collection and solid liquid separation, Filtration requirements, Concept of pore size and particle size, 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- Application of hollow fibres paper making clothes.

Unit-III: Geotextiles: Definition of geo textiles - Basic functions of geo textiles, Brief idea about geosynthetics and their uses, Essential properties of geotextiles, - types of geo textiles -classification of geo textiles - woven geo textiles - Non-woven geo textiles - knitted geo textiles- Bio degradable geo textiles - advantages,

materials used - composites and its uses. 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; Textiles for plantations; Non-implantations textiles; Textiles for extra-corporeal, AntImicrobial textiles - suture thread natural and synthetic - different types used - PTFE suture, coated polyester, high strength, Dialysate textiles - characters required - materials employed - cellulosic hollow fibres as membrane- Cuprammonium regenerated Acrylic and PVA membranes - requirements and fibres used for cardio vascular textiles - woven, knitted - requirements of artificial blood vessels. Details of textiles used for vascular adhernia 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 re-inforced products; Transports bags and sheets; Fabrics to control oil spills; Canvas cover and tarpaulins.

REFERENCE BOOKS:

1. ôHandbook of Technical Textilesô, Ed. A R Horrocks and S C Anand, Woodhead Publication Ltd., Cambridge, 2000.
2. ôWellington Sears Handbook of Industrial Textilesô, 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, The 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 8703738 7.
8. Medical Textiles-International Conference on Medical Textiles, Bolton, Woodhead Publication, Cambridge, 1997
9. John, N.W.M "Geotextile" Blackie publication, Glasgow, 1987
10. Industrial Textiles - Horrocks

8 TX 04 PROFESSIONAL ELECTIVE - II
(2) NEW FIBRE SCIENCE

SECTION - A

- Unit-I :** New generation fibers: Introduction, Background, Transition to new fibers, The super-fiber with new performance: Introduction, Basic classes of super-fiber, Need for a strong fiber, Concept of "gel-spinning", Final stage of pitch-based carbon fiber development, Use of super fibres, The future of super-fibers
- Unit-II :** High-tech fibers: A silk-like fiber surpassing natural silk, Ultra-fine fibers, Skin-like fabrics, Chameleonic fabrics, Photochromic-controlled clothing material, Perfumed fibers, Power fibers that store solar energy, Iridescent textiles, Protein plastics with the feel of human skin.
- Unit-III :** The aramid fiber race, Polyacetal fiber, Strong Vinylon RM, New liquid crystalline polymers: engineering plastics, Vectran: a fully aromatic polyester fibre, Developing polyallylate fiber Fibres from biomass of crab and shrimp shells, New applications of silk, Fibers produced by bacteria, New functions for cellulose.

Section- B

- Unit-IV:** Progression of high-tech fibers: Introduction, Biotechnology and fibers, Electronics and fibers, Cars and fibers, Fibers in space, Fibers and nuclear power, Fibers in sport, Fibers for geotextiles, Fibers in the ocean. New high-tech fibers: Various categories of high-tech fibers, Development of Shingosen, Design of specialist fibers, Fabrics for relaxation using 1/ f fluctuations.

- Unit-V :** Cellulosic fibers: New solvent systems, New cellulosic fiber derivatives, New environmental and cost saving developments, Life-cycle assessment, Cellulose: the renewable resource. Carbon fibres : Introduction to carbon fibres, special application of carbon fibres - properties and end uses of carbon fibre. Aramide fibres, Brief study on Nomex and Kevlar fibres.

- Unit-VI:** Fibers for the next generation: High-tenacity and high-modulus fibers, Microdenier (ultra-fine) fibers and Biomimetics, The next stage: technological improvements, New frontier fibers (super-function fiber materials, etc.), Super-biomimetic fiber materials, Super-natural materials, resources recycling, Fibers for health.

REFERENCE BOOKS:

1. New Fibres by Hongu and Phillips
2. Polymers for Engineering Applications by R. B. Seymour
3. High technology Fibres: Handbook of Fibre Science and Technology, Vol. III, Ed. by Lewin and Preston.
4. "A Text Book of Fibre Science and Technology", New Age International (P) Limited, 1st Edn, 2000.

8 TX 05 PROJECT & SEMINAR

8 TX 06 ADVANCE WEAVING TECHNOLOGY-LAB

08 to 10 Practicals based on syllabus of 8 TX 02

8 TX 07 CHEMICAL PROCESSING II - LAB

10 to 12 Practicals based on syllabus of 8 TX 03

**FOUR YEAR DEGREE COURSE IN
BTECH CHEMICAL ENGINEERING
CREDIT & GRADE SYSTEM
(MASS TRANSFER-II)**

SEMESTER: SEVEN

**7CH01 CHEMICAL ENGINEERING OPERATION -III
SECTION -A**

- UNIT I:** Liquid-liquid extraction: Liquid equilibria, Representation in equilateral triangular and rectangular coordinates, choice of solvent: Selectivity Distribution coefficient, Recoverability, Density, Determination of plait point lever rule, single and multistage extraction:
- 1) Cross current extraction
 - 2) Counter current extraction, fractional extraction. Applications in petrochemical industries, extraction of nuclear fuels and recent advancements in applications. (8)
- UNIT II:** Continuous or differential extraction, Calculation of NTU & HTU, Classification of extraction equipments, stagewise:
- i) The mixer settle, Baffle plate columns, Scheibel columns. Differential
 - ii) Spray column, Sieve Tray column, packed columns, pulsed columns, centrifugal extractors, and their applications, Design of continuous-contact towers. (7)
- UNIT III:** Principles of leaching, Types of equilibrium, Multistage cross-current, counter current leaching and their graphical and RAT representation. Continuous counter current decantation verify types of solid-liquid extractors, shank system, Rotocel, Ballmann extractor, Extractor for cellular material, extraction of oil from cellular material, agricultural material and seeds. (7)

SECTION - B

- UNIT IV:** Distillation: Thermodynamics of vapour-liquid equilibrium, Relative volatility, partial pressures, Dalton's, Raoult's and Henry's laws Methods of distillations: - Differential, Flash or equilibrium, Rectification and Batch distillations No. of plates by McCabe Thiele method. (8)
- UNIT V:** Ponchon Savarit, Lewis method, Reflux ratio, minimum reflux ratio, and Azeotropes, Antonic, Van Laar. Consistency of system, Generation of Vapour-liq equilibria for unknown system Herington's consistency test. (7)

- UNIT VI:** Introduction to multicomponent distillation Azeotropic distillation, extractive distillation, steam distillation of plate columns, Sieve trays, valve trays, plate efficiency, factors determining column performance, Bubble cap trays, Packed column : Packings, calculation of enrichment in packed column and design of distillation column. (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 Vol. II: Coulson & Richardson
- 3) Transport Phenomena and Unit Operations: Geankoplis

**7CH02 CHEMICAL REACTION ENGINEERING-I
SECTION - A**

- UNIT I:** Classification of chemical reactions. Variables affecting the rates of reaction. Kinetics & Thermodynamics. Thermodynamics of chemical reactions. Classification of reactors. Order of reaction & rate constant. (7)
- UNIT II:** Rates of Homogeneous Reactions. Fundamentals of rate equation. Rate equations from proposed mechanism Analysis of simple & complex rate equation. Evaluation of rate equation from Laboratory data. (8)
- UNIT III:** Interpretation of rate data, Scale up and Design. Constant volume batch reactor. Variable volume Batch reactor. Temperature and reaction rate. (7)

SECTION - B

- UNIT IV:** Single ideal reactors. Ideal Batch Reactor. space time and space velocity, steady state mixed flow reactors, steady state plug flow reactor, Holding-time & space time for flow system. (7)
- UNIT V:** Design for single reactions Size comparison of single reactors Batch reactor, Mixed versus plug flow reactors Variation of reactant rates. General Graphical comparison. Autocatalytic reactions. (8)
- UNIT VI:** Design for multiple reactor system. Reactions in parallel & in series, series-parallel reactions. Batch recycle reactor, Flow recycle reactor. Temperature & pressure effects in single and multiple reactions. Optimum temperature profile. (8)

TEXT BOOKS:

- 1) Chemical Reaction Engineering: Octane Levenspiel, Wiley Eastern Ltd.
- 2) Chemical Engineering Kinetics: Smith J.M. McGraw Hill

REFERENCE BOOKS:

- 1) Reaction Kinetics for Chemical Engineers, Walas McGraw Hill
- 2) Elements of Chemical Reaction Engineering, H. Scott Fogler, Prentice Hall

7CH03 PROCESS DYNAMICS AND CONTROL
SECTION - A

UNIT I: Transmit response of control systems, optimization. (7)

UNIT II: Stability, Root locus, Transient response. Application of root locus to control system. Frequency response methods. Design of Nyquist criteria. (8)

UNIT III: Process applications, Controller mechanisms. (7)

SECTION - B

UNIT IV: Development and control systems for various chemical industries case studies. (7)

UNIT V: Introduction on advanced control techniques as feed forward, control, cascade control, ratio control, adaptive control and digital computer control. (8)

UNIT VI: Dynamics and control of chemical equipments such as heat exchangers, distillation columns, absorption column, etc. (8)

TEXT BOOKS:

- 1) Process Control: Peter Harriott, McGraw Hill, New York
- 2) Process System Analysis and Control: Koppel Conghawoner McGraw Hill

REFERENCE BOOKS:

- 1) Automatic Process Control: D.P. Eckman, Wiley
- 2) Chemical Process Control: George Stephanopoulos - Prentice Hall of India Pvt. Ltd.
- 3) Process Systems Analysis & Control: Donald R. Coughanour, McGraw Hill

7CH04

PROFESSIONAL ELECTIVE - I
(I) INDUSTRIAL WASTE TREATMENT

Objectives:

- i) To impart the knowledge about disposal of effluents and the standards for disposal.
- ii) To impart the knowledge about biological treatment methods and advanced treatment methods.

SECTION - A**UNIT I: Disposal Effects on Environment**

Effects of industrial wastes on streams, land, air - wastewater treatment plants - water quality criteria. Effluent standards - Process modification - Bioassay studies - Environmental legislation Pollutants Reduction: Waste minimisation - House keeping - Volume and strength reduction - Material and process modifications - recycle, reuse and by-product recovery - Environmental audit. (7)

UNIT II: Effluent Treatment

Conventional methods of treatment and disposal of industrial wastes - Equalisation and Neutralisation - Separation of solids - Sedimentation and filtration - Coagulation and flocculation, absorption, chemical precipitation, chemical oxidation, Physiochemical treatment methods - Removal of dissolved impurities - Residue management - Combined treatment of industrial and municipal wastes. (8)

UNIT III: Biological Treatment Methods

Principles and methods for removal of suspended impurities and organics - aerobic and anaerobic decomposition of organic matter, Stabilization ponds, activated sludge process, Oxidation ditch. (7)

SECTION - B**UNIT IV: Advanced Waste Water Treatment:**

Nitrogen removal - Phosphorous removal - Removal of refractory Organics - Removal of dissolved inorganic substances - Chemical precipitation - ion exchange - Reverse Osmosis - Electro dialysis. (8)

UNIT V: Industrial Process and Waste Treatment - I

Manufacturing process, waste water characteristics, composition, effects and appropriate treatment - flow sheets for chemical industries - Petro-chemical industries, Refineries, Pharmaceutical, Textiles - Apparel industries - Metallurgical industries - Steel plants, mines - Power industries - Fertilizer plants - Cement industry. (8)

UNIT VI: Industrial Process and Waste Treatment - II

Manufacturing process, waste water characteristics, composition effects and appropriate treatment flow sheets for Pulp and paper industry - Agro-industries, Sugar - Distilleries, Food processing industry - meat packing, pickles, poultry dairy - Leather tanning. (7)

TEXT BOOKS:

1. Rao.M.N. and Dutta, Waste Water Treatment, Oxford and IBH Publishing Ltd., Calcutta, 2008.
2. Eckenfelder, W.W., Industrial Waste Pollution Control, McGraw Hill Book Co., New Delhi, 2003.

REFERENCE BOOK:

1. Nemerow, N.L., Theory and Principles of Industrial Waste Treatment, Addison Wesley, Reading Mass, 1993.

7CH04 PROFESSIONAL ELECTIVE - I
(2) NEW SEPARATION TECHNIQUES

SECTION - A

UNIT I: Adsorption separations - Review of fundamentals, mathematical modelling of column contactors, pressure swing adsorption, ion chromatography, affinity chromatography, gradient chromatography, parametric pumping, counter-current, simulated counter-current and multidimensional chromatography. (7)

UNIT II: Membrane separation processes - basic concepts, membrane modules, structure and characteristics of membranes. (7)

UNIT III: Design considerations of Reverse Osmosis, Ultra Filtration, Electro Dialysis, Gas permeation membranes, Pervaporation, Nano filtration and micro filtration. (8)

SECTION - B

UNIT IV: Detailed theories for membrane separations - concentration polarization, gel formation and fouling, mathematical models for membrane systems with and without concentration polarization, Transport inside the membranes, solution diffusion membranes, porous membranes. (8)

UNIT V: Surfactant based separations - fundamentals of surfactants at surfaces and in solution, liquid membrane permeation, and foam separations, micellar separations. (7)

UNIT VI: Supercritical fluid extraction - Physicochemical principles, thermodynamic modelling, process synthesis and energy analysis. (8)

TEXT BOOKS:

1. P. C. Wankat, "Large scale adsorption and chromatography", CRC Press, 1986
2. R.T. Yang, "Gas Separation by Adsorption Processes", Imperial College Press, 1997

REFERENCE BOOKS:

1. P.C. Wankat, "Rate Controlled Processes", Springer Publications, 2005
2. Seader, "Separation Process Principles", Wiley Publication, Second Edition, 2008
3. R. W. Rousseau, "Handbook of separation process technology", John Wiley and Sons, 1987
4. M. C. Porter, "Handbook of industrial membrane technology", Noyes Publication, Park Ridge, New Jersey, 1990
5. J. F. Scamehorn and J. H. Harwell, "Surfactant based separation processes, T. A. Hatton in Vol. 23 of Surfactant science series", Marcel-Dekker., 1989
6. M. A. McHugh and V. J. Krukonis, "Supercritical fluid extraction", Butterworth, 1985

7CH04 PROFESSIONAL ELECTIVE - I
(3) OPTIMIZATION OF CHEMICAL PROCESSES

SECTION - A

UNIT I: Nature and organization of optimization problems, fitting models to data, method of least squares, factorial experimental designs, formulation of objective functions. (7)

UNIT II: Optimization theory and methods - basic concepts of optimization, optimization of unconstrained functions, one dimensional search, multivariable optimization. (8)

UNIT III: Linear programming and applications, nonlinear programming with constraints, optimization of staged and discrete processes. (7)

SECTION - B

UNIT IV: Optimum recovery of waste heat, optimum shell and tube heat exchanger design, optimization of heat exchanger networks. (7)

UNIT V: Optimization of multistage evaporators, optimization of liquid-liquid extraction processes, optimal design and operation of staged distillation columns. (8)

UNIT VI: Optimal pipe diameter, minimum work of gas compression, economic operation of fixed bed filter, optimal design of gas transmission network, optimal design and operation of chemical reactors. (8)

TEXT BOOKS:

1. T.F.Edger and D.M.Himmelblau, óOptimization of Chemical Processesô, Mc.Graw Hill, 2001
2. G.S.Beveridge and R.S.Schechter, óOptimization Theory and Practiceô, Mc.Graw Hill, 1970

REFERENCE BOOKS:

1. Kalyanmoy Deb, óOptimization for Engineering Designô, John Wiley, 1995
2. V.Kafarov, óCybernetic Methods in Chemistry and Chemical Engineeringô, MIR Publishers, 1976

7CH04 PROFESSIONAL ELECTIVE - I
(4) POLYMER SCIENCE AND TECHNOLOGY

SECTION - A

UNIT-I: Introduction - Definitions and concepts, polymerisation reactions, polymer structure, functionality and degradation, Characterisation of polymers. (7)

UNIT-II: Different types of polymers - natural and modified natural products, synthetic polymers, addition and condensation products and their preparations. (7)

UNIT-III: Methods of polymerisation - mass, solution, emulsion and suspension polymerisation processes, reactions and equipments used. (7)

SECTION - B

UNIT-IV: Polymer processing - Moulding, cold and hot compression moulding, injection and jet type moulding, extruding, calendaring and skiving. (8)

UNIT-V: Polymer processing - sheet forming, atmospheric and fluid pressure forming, lamination and impregnating. (8)

UNIT-VI: Polymer processing - coating, expanding, casting, embedding, spinning and finishing. (8)

TEXT BOOKS:

1. Fred.W.Billmeyer, óText Book of Polymer Scienceô, John Wiley and sons, 1980.
2. V.R.Gowarikar, óPolymer Scienceô, New Age International, Second Edition, 2006

REFERENCE BOOKS:

1. David J. Williams, óPolymer Science and Engineeringô, Prentice Hall, 1971
2. Stanley Middleman, óFundamentals of Polymer Processingô, McGraw

Hill, 1977

3. Herman S. Kaufman and Joseph J Falcetta, óIntroduction to Polymer Science and Technologyô, JohnWiley and sons, 1977
4. Rakesh K.Gupta and Anil Kumar, óFundamentals of Polymersô, International edition, 1998

7CH05 PLANT DESIGN & PROJECT ENGINEERING

Objectives:

Learning fundamentals and applications of chemical engineering plant design, value engineering, optimization with emphasis on chemical engineering applications, fundamentals of engineering economics and the management decision making processes that are used in engineering problem solving. Understanding the concept of interest and equivalence, learning the methods of engineering economic analysis like present worth, rate of return, annual cash flow and benefit-cost ratio, depreciation, etc.

SECTION - A

UNIT I: Basic considerations in chemical engineering plant design, project identification, project identification, preliminary techno-economic feasibility, process selection, laboratory developments and its importance, pilot plant, scale-up methods, flow diagrams. Selection of process equipments: standard vs. Special equipments, materials of construction of process equipments, specification sheets. (7)

UNIT II: Plant Location: Objectives, levels of location problems, factors influencing location of a plant, locational analysis, selection criteria, significance, theories of plant location.
 Plant Layout: Meaning of plant layout, design importance and scope, essentials, types of layout, factors influencing layout, dynamics of plant layout, planning for plant design. (7)

UNIT III: Cost estimation: equipment costs, cost indices, William's point sixth rule, methods of estimation of fixed capital, product cost estimation. Interest formulae and their applications, time value of money, simple and compound interest, discrete, nominal and continuous rate of return and their relationships, issue and evaluation of bonds, concept of equivalence. (8)

SECTION - B

UNIT IV: Depreciation: Introduction, straight line method of depreciation, declining balance method of depreciation, sum of the years-digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation. (8)

UNITV: Replacement and Maintenance analysis: Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset, capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely, practical factors in alternative and replacement investment.

(8)

UNITVI: Inventory control, scheduling a project using CPM/PERT, project management, optimum conditions, optimum production rates in plant operations, optimum conditions in cyclic operations, design reports.

(7)

TEXT BOOKS:

1. Max Peters, Plant design and economics for chemical engineers, McGraw Hill
2. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001

REFERENCE BOOKS:

1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002
2. Donald G. Newman, Jerome P. Lavelle, "Engineering Economics and analysis", Engg. Press, Texas, 2002

7CH06 CHEMICAL ENGINEERING OPERATION-III LAB (MASS TRANSFER-II)

List of Experiments:

1. To prepare boiling point (B.P.) diagram and plot x-y data on the equilibrium diagram.
2. Verification of Rayleigh's equation for differential (Batch) distillation.
3. To construct equilibrium curve from vapour liquid equilibrium (VLE) data.
4. To find the composition of distillate and residue after distilling n-butanol-methyl alcohol mixture by simple distillation.
5. To determine vaporization efficiency and thermal efficiency in case of steam distillation.
6. To construct a ternary diagram for acetic acid-water-benzene system.
7. To study the performance of sieve tray extraction column and compare it with packed column (or spray column).
8. To find out number of stages in multistage continuous counter current operation and in single stage multiple contact of operation for solid liquid extraction (Leaching).
9. To compare single stage with two stage cross current liquid-liquid extraction with partially miscible solvent.
10. To compare single stage with two stage cross current extraction for a system in which solvents are immiscible.

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.

7CH07 CHEMICAL REACTION ENGINEERING-I LAB

List of Experiments:

1. To determine the rate constant of saponification of ethyl acetate characterised by an acid like HCL.
2. To determine the activation energy of hydrolysis of an ester such as ethyl acetate.
3. To determine the kinetic of reaction between ethyl acetate and sodium hydroxide at room temperature using differential method of analysis.
4. To determine the kinetics of reaction between ethyl acetate and sodium hydroxide at room temperature by integral method.
5. Show that the decomposition of H₂O₂ in aqueous solution is first order reaction and determine value of rate constant.
6. To determine void volume porosity of catalyst particle.
7. To determine the RTD curve for packed bed reactor.
8. To determine the RTD curve for PFR.
9. To determine the RTD curve for mixed flow reactor.
10. Verification of performance equation of batch reactor.

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.

7CH08 PROCESS DYNAMICS AND CONTROL-LAB

List of Experiments:

1. Sketch the response of the first order system for impulse change.
2. To find the response of a bare measuring thermometer. c) +ve step change d)-ve step change.
3. To find the response of mercury thermometer (kept in a thermal cell) for bare thermometer) +ve step change d)-ve step change.
4. To study underdamped response of manometer fluid with pressure change function.
5. To study the response of non-interacting system use in two tank for step change in flow rate.
6. To study the response level in one tank c) step change d) impulse change.
7. To verify efficiency of transportation lag when coupled with first order system.
8. To study a liquid level on-off controller.

9. To study the temperature control system.
10. To study the temperature control system.
11. To measure liquid level by bubbler system.

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.

7CH09 PROFESSIONAL ELECTIVE-I - LAB

Minimum EIGHT experiments based on the syllabus are to be performed.

7CH10 INDUSTRIAL TRAINING

During the course of study from III to VII semester each student is expected to undertake a minimum of two industrial visits and undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of VII semester for 50 marks.

7CH11 PROJECT & SEMINAR SEMINAR:

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for 50 marks. The Seminar Report will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of VIII Semester.

PROJECT:

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of Chemical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks by way of oral presentations. The university examination at the end of VIII Semester carries 75 marks will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

SEMESTER: EIGHT

8CH01 TRANSPORT PHENOMENON SECTION-A

UNIT I: Transport properties and mechanism, Rate process, flux, types of fluids, phenomenological laws, Rheology of non-Newtonian fluids, flow through circular pipes, Mathematical foundation, types of time derivatives, Divergence, Operators. (8)

UNIT II: Control Volume, Overall mass, momentum and energy balances, Extended Bernoulli's equation, Reynold's transport equation, mass balance with chemical reaction. (7)

UNIT III: Equation of change based on differential balance, equation of continuity, Navier-Stokes equation, energy equation, application of Navier-Stokes equations to various flows through different geometric shapes, applications of energy equation, potential streamline, creeping and ideal flow. (8)

SECTION-B

UNIT IV: Flow around submerged solids, flow past flat plate, boundary layer, Prandtl equation, expressions for viscous drag, thermal boundary layer. Von Karman's integral momentum equation, analysis of integral equation, displacement thickness. (8)

UNIT V: Turbulent flow mechanism, intensity of turbulence, Reynold's stresses, Prandtl mixing length, turbulent flow through circular pipes. Analogies of transfer processes, profiles of gradients, Reynold's Prandtl, Von Karman, Chilton-Coulburn analogies, J factors, Dittus-Boelter's equation. (8)

UNIT VI: Review of classical mass transfer problems, mass transfer in binary systems with or without chemical reactions. Theories of interphase mass transfer. Mass transfer analogies. (7)

TEXT BOOKS:

- 1) Transport Phenomenon: Bird, Stewart, Light Foot, John Wiley
- 2) Momentum, Heat and Mass Transport: Bennett and Myers, McGraw Hill

REFERENCE BOOKS:

- 1) Principles of Unit Operations: A.S. Foust, et-al, Wiley Toppan Int. Ed., Latest Edition
- 2) Fluid Dynamics and Heat Transfer: J.G. Kundsen and Katz, McGraw Hill, Latest Edition
- 3) Transport Phenomenon and Unit Operations: Geankoplis

8CH02 CHEMICAL REACTION ENGINEERING-II

SECTION - A

- UNIT I:** Residence time distribution. Models for non-ideal flow. (7)
- UNIT II:** Mixing concept and models: Rate equation for Heterogeneous reactions, fluid particle Reactions. Determination of rate controlling step. Application to Design. (8)
- UNIT III:** Fluid-Fluid reaction: The rate equation for different cases and application to design. (7)

SECTION - B

- UNIT IV:** Heterogeneous processes, catalysis and adsorptional determination of surface area, void volume. Pore volume distribution catalyst preparation, promoters and inhabitation catalyst reactivation. (8)
- UNIT V:** Rate equation for third solid catalytic, reactions. Internal External transport process in Heterogeneous Reactions. (7)
- UNIT VI:** Design of Heterogeneous catalytic reactors, fixed broad reactors, isothermal and adiabatic fixed bed reactor, non-isothermal & non-adiabatic fixed bed reactor. Fluidized bed, Drickle bed, slurry reactor. (8)

TEXT BOOKS:

1. Chemical Reaction Engineering, Octave Levenspil, Wiley Eastern Ltd.
2. Chemical Engineering Kinetics, Smith J.M., McGraw Hill

REFERENCE BOOKS:

1. Elements of Chemical Reaction Engineering - H. Scott Fogler, Prentice Hall
2. Chemical Reactor Analysis & Design, Gilberth F. Froment & Kenneth B. Bischoof, John Wiley & Sons
3. Chemical Reactor Design, Vol. I & II, M. W. Rase

8CH03 SYSTEM MODELLING

SECTION - A

- UNIT I:** Introduction - models and model building, principles of model formulation, fundamental laws - continuity equation, energy equation, equations of motion, transport equations, equations of state, equilibrium and kinetics, classification of mathematical models. Numerical solutions of model equations ñ Linear and non linear algebraic equations in one and more than one variables, ordinary differential equations in one and more than one variables. (8)

- UNIT II:** Lumped Parameter Models:
Formulation and solution techniques to be discussed for Vapour liquid equilibrium models, dew point and flash calculations for multicomponent systems, boiling operations, batch and continuous distillation models, tank models, mixing tank, stirred tank with heating. (7)
- UNIT III:** CSTR with multiple reactions. Non-isothermal CSTR - mutiplicity and stability, control at the unsteady state. Non-ideal CSTR models - multi-parameter models with dead space and bypassing, staged operations. (7)

SECTION - B

- UNIT IV:** Distributed Parameter Models (Steady State):
Formulation and solution of split boundary value problems - shooting technique, quasilinearization techniques, counter current heat exchanger, tubular reactor with axial dispersion, counter current gas absorber, pipe line gas flow, tubular permeation process, pipe line flasher. (8)
- UNIT V:** Unsteady State Distributed Parameter Models:
Solution of partial differential equations using finite difference method, convective problems, diffusive problems, combined convective and diffusive problems. Unsteady state conduction and diffusion, unsteady state heat exchangers, dynamics of tubular reactor with dispersion. Transfer function models for distributed parameter systems. (8)
- UNIT VI:** Model Parameters Estimation:
Introduction, method of least squares, curve fitting, parameter estimation of dynamic transfer function models ñ step and impulse response models, Auto regressive Moving Average models, least square and recursive least square methods, parameter estimation of RTD models - moments method. (7)

TEXT BOOKS:

1. Roger E. Franks, óModelling and Simulation in Chemical Engineeringô, John Wiley and Sons, 1972
2. W.F. Ramirez, óComputational Methods in Process Simulationô, Butterworth Publishers, 1989

REFERENCE BOOKS:

1. Seinfeld and Lapidus, óMathematical Methods in Chemical Engineeringô, Prentice Hall, 1974
2. W.L. Luyben, ô Process Modelling, simulation and Control for Chemical Engineersô, 1990
3. Santosh Kumar Gupta, óNumerical Methods for Engineersô, Tata McGraw Hill, 1995

8CH04 PROFESSIONAL ELECTIVE - II
(1) PETROLEUM PROCESSING TECHNOLOGY
SECTION - A

UNIT I: Petroleum Exploration Production and Refining of Crude oils
 Crude oils: Chemistry and composition (Characteristics and constituents of crude oils, Classification of crude oils). (7)

UNIT II: Quality Control of Petroleum Products Classification of laboratory tests, distillation, vapour pressure, flash and fire points, octane number, performance number, cetane number, aniline point, viscosity index, calorific value, smoke point, char value, viscosity, viscosity index, penetration tests, cloud and pour points, drop point of grease, melting and settling points of wax, softening point of Bitumen, induction period of gasoline, thermal stability of jet fuels, gum content, Total Sulphur, Acidity and Alkalinity, Copper Strip Corrosion Test, Silver ñ Strip Corrosion Test for ATF, Ash, Carbon Residue (Conradson method, Ramsbottom method) Colour, Density and Specific gravity, Refractive index of hydrocarbon liquids, water separation index (modified) (WSIM), ductility. (8)

UNIT III: Petroleum Products: Composition, Properties & Specification of LPG, Naphthas, motor spirit, Kerosine, Aviation Turbine Fuels, Diesel Fuels, Fuel Oils, Petroleum Hydrocarbon Solvents, Lubricating oils (automotive engine oils, industrial lubricating oils electrical insulating oils, Jute Batching oils, white oils, steam turbine oils, metal working oils, etc.) Petroleum Waxes Bitumens, Petroleum coke.
 Crude Oil Distillation: Desalting of crude oils, Atmospheric distillation of crude oil, Vacuum distillation of atmospheric residue.
 Thermal Conversion Process: Thermal Cracking Reactions, Thermal Cracking, Visbreaking, (Conventional Visbreaking and Soaker Visbreaking) Coking (Delayed Coking, Fluid Coking, Flexicoking), Calcination of Green Coke. (8)

SECTION - B

UNIT IV: Catalytic Conversion Process Fluid catalytic cracking; Catalytic reforming; Hydrocracking Catalytic Alkylation, Catalytic Isomerization; Catalytic Polymerization. (7)

UNIT V: Finishing Process Hydrogen sulphide removal processes; Sulphur conversion processes; Sweetening processes (Caustic treatment, Solutizer process; Doctor treating process; Copper chloride sweetening,; Hypochlorite sweetening ;Air and inhibitor treating process; Merox processes; Sulphuric acid treatment;

Clay treatment); Solvent extraction processes (Edeleanu process, Udex process, Sulfolane process), Hydrotreating processes. (7)

UNIT VI: Lube Oil Manufacturing Process Evaluation of crude oils for lube oil base stocks, Vacuum distillation, Solvent deasphalting Solvent extraction of lube oil fractions (Furfural, NMP and Phenol), Solvent dewaxing, Hydrofinishing, Manufacture of petroleum waxes (Wax sweating, Solvent deoiling) Manufacture of Bitumens Selection of crude oil, Methods of manufacture of bitumens, (Distillation, Solvent precipitation, Air blowing). (8)

TEXT BOOKS:

1. Nelson, W.L., Petroleum Refining Engineering, McGraw Hill
2. Mall, I D , Petrochemical Process Technology, McMillan India

REFERENCE BOOK:

1. Sarkar, G.N., Advance Petroleum Refining, Oscar Publication

8CH04 PROFESSIONAL ELECTIVE - II
(2) CORROSION ENGINEERING
SECTION - A

UNIT I: Basic aspects, introduction, classification, economics and cost of corrosion, emf series, Galvanic series, corrosion theories derivation of potential- current relationship of activation controlled and diffusion corrosion processes. Potential- pH diagrams Fe-H₂O system, application and limitations. Passivation, definition, anodic passivation, theory of passivation, oxidation laws, effects of oxygen and alloying on oxidation rates. (8)

UNIT II: Forms of corrosion-definition, factors and control methods of various forms of corrosion such as pitting, inter granular, crevice, stress corrosion, corrosion fatigue, hydrogen embrittlement, corrosion processes and control methods in fertilizers, petrochemical and petroleum refineries. (7)

UNIT III: Environmental aspects: Atmospheric corrosion- classification, factors influencing atmospheric corrosion, temporary corrosion preventive methods, corrosion in immersed condition, effect of dissolved gases, salts, pH, temperature and flow rates on corrosion, Underground corrosioncorrosion process in the soil, factors influencing soil corrosion. (8)

SECTION - B

UNIT IV: Corrosion control aspects: Electrochemical methods of protection-theory of cathodic protection, design of cathodic protection, sacrificial anodes, anodic protection. Corrosion

inhibitors for acidic, neutral and alkaline media, cooling water system-boiler water system. Organic coatings surface preparation, natural synthetic resin, paint formulation and applications. Design aspects in corrosion prevention, corrosion resistant materials. (8)

UNITV: Corrosion Testing, monitoring and inspection, laboratory corrosion tests, accelerated chemical tests for studying different forms of corrosion. (7)

UNITVI: Electrochemical methods of corrosion rate measurements by DC and AC methods, corrosion monitoring methods, chemical and electrochemical removal of corrosion products. (7)

TEXT BOOKS:

1. S.N. Banerjee, An Introduction to Corrosion and Corrosion Inhibition, Oxonian Press Ltd., New Delhi.
2. L.L Shrier Corrosion Vol. I & II, George Nownons Ltd., London Edition II

REFERENCE BOOKS:

1. M.G. Fontana & N.D. Greene, Corrosion Engineering, McGraw Hill, New York, Edition III
2. H.H. Uhlig, Corrosion and Corrosion Control. A Wiley- Inter Science. Publication John Wiley & Sons, New York
3. C.T.Munger- Organic Coatings
4. Jain & Jain, Engineering Chemistry, Dhanpat Rai & Sons, New Delhi

8CH04 PROFESSIONAL ELECTIVE - II (3) BIOCHEMICAL ENGINEERING

SECTION -A

UNIT I: Introduction - principles of microbiology, structure of cells, microbes, bacteria, fungi, algae, chemicals of life - lipids, sugars and polysaccharides, amino acids, proteins, nucleotides, RNA and DNA, hierarchy of cellular organisation, Principles of genetic Engineering, Recombinant DNA technology, mutation. (7)

UNIT II: The kinetics of enzyme catalyzed reactions - the enzyme substrate complex and enzyme action, simple enzyme kinetics with one and two substrates, determination of elementary step rate constants. Isolation and utilisation of Enzymes -production of crude enzyme extracts, enzyme purification, applications of hydrolytic enzymes, other enzyme applications, Enzyme production ñ intercellular and extra cellular enzymes. (8)

UNIT III: Metabolic pathways and energetic of the cell, concept of energy coupling, ATP and NAD, Photosynthesis, Carbon metabolism, EMP pathway, Tricarboxylic cycle and electron transport chain,

aerobic and anaerobic metabolic pathways, transport across cell membranes, Synthesis and regulation of biomolecules. (8)

SECTION - B

UNITIV: Typical growth characteristics of microbial cells, Factors affecting growth, Batch and Continuous cell growth, nutrient media, enrichment culture, culture production and preservation Immobilisation Technology ñ Techniques of immobilisation, Characteristics and applications, Reactors for immobilized enzyme systems. (8)

UNITV: Introduction to bio reactors, types, Continuously Stirred aerated tank bioreactors, Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power consumption. (7)

UNITVI: Fermentation-methods and applications, Downstream processing and product recovery in bio processes. (7)

TEXT BOOKS:

1. M.L.Shuler and F.Kargi, BioProcess Engineering : Basic concepts, 1st Edition, Prentice Hall, New Jersey, 1992
2. Mukesh Doble, Sathyanarayana N, Gummai, Biochemical Engineering, Prentice Hall, 2007

REFERENCE BOOKS:

1. Trevan, Boffey, Goulding and Stanbury, Biotechnology, Tata McGraw Hill Publishing Co., New Delhi, 1987
2. S.Aaiba, Biochemical Engineering, Academic Press, 1965
3. D.G. Rao, Introduction to Biochemical Engineering, Tata McGraw Hill, 2005
4. J.E.Bailey and D.F.Ollis, Biochemical Engineering Fundamentals, McGraw Hill, 1986

8CH04 PROFESSIONAL ELECTIVE - II (4) PETROLEUM REFINERY ENGINEERING SECTION - A

UNIT-I: Introduction ñ genesis, occurrence, exploration, drilling of crude oil. Composition and Evaluation of crude oil and testing of petroleum products. Refining of petroleum ñ Atmospheric and vacuum distillation. (8)

UNIT-II: Refining of petroleum ñ Atmospheric and vacuum distillation. Pretreatment of crude oil and transportation. (7)

UNIT-III: Cracking processes - Thermal cracking, Vis-breaking, Coking, Catalytic cracking (FCC), Hydro cracking, Rebuilding processes, bitumen blowing. (8)

SECTION - B

UNIT-IV: Treatment techniques for removal of sulphur compounds to improve performance, Storage and stability. Product treatment processes - various solvent treatment processes, Dewaxing, Clay treatment and Hydro fining. (8)

UNIT-V: Cracking of naphtha and gas for the production of ethylene, propylene isobutylene and butadiene. Production of acetylene from methane. (7)

UNIT-VI: Catalytic Reforming of petroleum feed stocks. Extraction of Aromatics. (7)

TEXT BOOKS:

1. B.K.Bhaskara Rao, "Modern Petroleum Refining Processes", 2nd Edn., Oxford and IBH Publishing Company, New Delhi, 1990
2. W.L.Nelson, "Petroleum Refinery Engineering", 4th Edn., McGraw Hill, New York, 1985

REFERENCE BOOKS:

1. Robert. A. Meyers, "Handbook of Petroleum Refining Processes", McGraw Hill, 1986
2. G.D.Hobson and W.Phol, "Modern Petroleum Technology", Applied Science Publishers, IV Edition, 1975

8CH04 PROFESSIONAL ELECTIVE -II (5) BIOFUELS

SECTION - A

UNIT-I: History, diesel engine, diesel fuel, alternative diesel fuels, Biodiesel, definition, sources, standards. (7)

UNIT-II: Use of straight vegetable oil, dilution with conventional diesel, blending with esters; Structure of triglycerides. (7)

UNIT-III: Transesterification of oils, alcohols and catalysts used, mechanism of reaction, reaction conditions, process, glycerine recovery, raw materials and glycerine use, fuel related properties of various fats, oils and their esters, comparison with petroleum diesel. (8)

SECTION - B

UNIT-IV: Combustion chemistry, lubricity, engine performance, engine problems and deposits using biodiesel in present engines. (7)

UNIT-V: Tailpipe emissions using vegetable oil fuel and esters, comparison with petroleum diesel. (8)

UNIT-VI: Health hazards on use of petroleum fuel and biodiesel, Safety and advantages of biodiesel. Storage conditions for biodiesel. (8)

TEXT BOOKS:

1. Biodiesel: A Realistic Fuel Alternative for Diesel Engines by Ayhan Demirbas
2. The Biodiesel Handbook by Knothe, Gerhard

8CH04 PROFESSIONAL ELECTIVE -II (6) INDUSTRIAL PIPING

SECTION - A

UNIT-I: Importance of piping in chemical industry. Classification of pipes: - Pipe codes and specification, Schedule numbers, BWG, NPS. (7)

UNIT-II: Material of construction of pipes. Pipe sizing: - Calculation of pipe diameter, thickness. Pipe fittings, advantages, calculation of frictional losses, and empirical correlations for flow of oil. Gasoline, hydrocarbons. (8)

UNIT-III: Criteria for selection of pipe joints, pipe joints for similar and dissimilar material, expansion effects and methods for reducing them. (7)

SECTION - B

UNIT-IV: Piping lay-out consideration, piping diagrams, types of pipe support, erection and maintenances of supporting, restraining and braing systems. Complex pipelines in series and in parallel. (8)

UNIT-V: Calculation of equivalent lengths. Pipeline storage capacity. Fundamental considerations in piping vibrations, types of vibrations, their prevention and control. Cryogenic piping. (8)

UNIT-VI: Single phase and two-phase flow. Piping for slurries. Insulation for piping systems. (7)

TEXT BOOKS:

1. Piping Design for Process Plants by H. F. Rase, John Wiley.
2. Process Piping Systems, D. J. Deutsch, Chemical Engineering Magazine, McGraw Hill

REFERENCE BOOK:

1. Industrial Piping, C.T. Littleton, McGraw Hill

8CH04 **PROFESSIONAL ELECTIVE -II**
(7) WINE MAKING
SECTION - A

- UNIT-I:** History, definition, wine and wine industry, Wine production of selected areas, grape varieties Geographic, geological, and climatic attributes regarding wine production and quality. Structure and composition of grapes: Grape structure, chemical composition of grapes, e.g. sugars, acids, an thocyanins, tannins, etc., analytical techniques, fruit ripeness. noble rot. (7)
- UNIT-II:** Processing of grapes: Grape reception, grape handling strategies, e.g. destalking, crushing, pressing and skin contact, must treatments, temperature control. Fermentation: Alcoholic fermentation, role of yeast, enzymes, temperature and fermentation Vessels, strategies for the extraction of colour, aroma, flavour and tannin Carbonic maceration, whole bunch fermentation and thermovinification, theory and practice of malolactic fermentation. (7)
- UNIT-III:** Maturation and blending: Maturation options, types of maturation vessel, inert storage, blending options, timing of bottling Stabilization, clarification, packing and labeling: Movement of wine in bulk, methods of stabilization and clarification, e.g. fitting, filtration, centrifugation, cold stabilization, etc., use of chemicals in wine making and wine handling - their function, action and application, international regulations governing the use of chemicals, packing into bottles and other containers, ingredient labeling, closures. (8)

SECTION - B

- UNIT-IV:** Production of sparkling wines: Production techniques for sparkling wines, grape selection and pressing, temperature control, selection and blending of base wines, the second fermentation, Maturation, finishing. (7)
- UNIT-V:** Production of fortified wines: Production techniques for fortified wines, selection of base wines, timing of fortification. practice and significance of blending and maturation, finishing. (8)
- UNIT-VI:** Quality assurance and quality control: Composition of wine and its faults, analysis of wine, its purpose, use and limitations, QA and QC systems and structures for wine and dry goods, practical issues of QA and QC, Effects of storage and transport on wine after packing. (8)

TEXT BOOK:

1. Exploring Wine, II Edition, by Koplan, Smith, & Weiss, Published by John Wiley & Sons, Inc. New York

8CH04 **PROFESSIONAL ELECTIVE - II**
(8) PETROCHEMICAL TECHNOLOGY
SECTION -A

- UNIT-I:** General Introduction - History, economics and future of petrochemicals, energy crisis and petrochemical industry, sources and classification of petrochemicals. (7)
- UNIT-II:** First generation petrochemicals - alkanes - C1, C2, C3, C4 petrochemicals, alkenes -C2, C3, C4, petrochemicals, alkynes - C2, C3, C4 petrochemicals, B-T-X aromatics, diene based petrochemicals. (7)
- UNIT-III:** Second generation petrochemicals - synthesis gas, methanol, formaldehyde chloromethanes, ethanol, acetaldehyde, acetic acid, acetic anhydride, isopropyl alcohol, ethylene oxide, propylene oxide, acetone, vinyl chloride, phenol, aniline and styrene. (8)

SECTION - B

- UNIT-IV:** Third generation petrochemicals - plastics, rubbers and fibres, olefinic polymers, polyethylene, polypropylene, polyisobutylene, diene polymers - polybutadiene, neoprene, polyisoprene, SBR, synthetic fibres. (7)
- UNIT-V:** Miscellaneous petrochemicals - petroleum proteins, synthetic detergents, resin and rubber chemicals, explosives - TNT and RDX. (8)
- UNIT-VI:** Various technological forecasting of the petroleum and petrochemicals. (8)

Text Books:

1. S.Maiti, óIntroduction to petrochemicalsô, Oxford and IBH publishing Co.,1992
2. H.Steines, óIntroduction to petrochemical Industryô, Pergamon, 1961

REFERENCE BOOKS:

1. G.D.Hobson and W.Pohl, óModern Petroleum Technologyô, Applied Science Publishers, IV Edition, 1975
2. Richard frank Goldsten and A.Lawrence Waddams, óThe Petroleum Chemical Industryô, E&FN Spon Ltd., 1967
3. G.T.Austin, óShreves Chemical Process Industriesô, McGraw Hill, V Edition, 1986

8CH04 PROFESSIONAL ELECTIVE - II
(9) ENERGY TECHNOLOGY & MANAGEMENT
SECTION - A

- UNIT-I:** Fuels: Classification, Properties, tests and analysis. Solid Fuels: Coal, origin, classification, storage and handling, carbonization, gasification and briquetting, gasification of biomass. (7)
- UNIT-II:** Liquid fuels: Petroleum based fuels, synthetic fuels, alcohol and blended fuels, storage and handling.
 Gaseous fuels: Water gas, carburetted water gas, producer gas, coal gas and natural gas. (7)
- UNIT-III:** Combustion - Air requirement for solid, liquid and gaseous fuels, combustion equipment Solar energy, Wind energy, Tidal energy. (8)

SECTION - B

- UNIT-IV:** Geothermal energy, Magneto hydrodynamics, Nuclear energy. Energy Management-Principles need, initiating and managing an energy management program. (7)
- UNIT-V:** Energy audit: Elements, and concepts, types of energy audits, energy audit with respect to industries like sugar, paper etc. (8)
- UNIT-VI:** Energy Conservation: Thermodynamics of energy conservation, cogeneration, waste heat recovery technologies. Industrial insulation, material selection, economical thickness. (8)

TEXT BOOKS:

1. S.Sarcar, "Fuels and combustion", Orient Longman, 1990
2. G.D.Rai, "Non conventional energy sources", Khanna Publishers, IV edition, New Delhi, 2004
3. S.P.Sharma and ChanderMohan, "Fuels and Combustion", Tata McGraw Hill, 2004
4. J.K.Harker and J.R.Backhurst, "Fuel and energy", Academic Press, 1981

REFERENCE BOOKS:

1. D.A.Raey, "Industrial Energy Conservation", Pergamon Press, 1980
2. J.D.Gilchrist, "Fuels, Furnaces and Refractories", Pergamon Press, 1977

8CH04 PROFESSIONAL ELECTIVE - II
(10) ENERGY & ENVIRONMENT
SECTION - A

- UNIT I:** INTRODUCTION TO ENERGY SOURCES: Global Energy, Environmental Resources, Energy necessity and energy crisis. Indian Energy Scenario: Energy Consumption, needs and crisis, energy sources and availability. (7)
- UNIT II:** RENEWABLE SOURCES OF ENERGY AND ENVIRONMENT: Biomass - introduction, energy plantation, bio-mass conversion technologies (wet and dry process), photosynthesis, agricultural waste derived energy, urban waste derived energy. BIOGAS: Generation, factors affecting bio-digestion, advantages of anaerobic digestion, classification of bio-gas plants. (7)
- UNIT III:** HYDROPOWER: Site selection for hydroelectric power plants, classification of hydroelectric power plants, submergence, ecological imbalance, catchment area treatment, advantages and disadvantages of hydroelectric power plants. Submergence, Ecological Imbalance, Catchment Area Treatment. (8)

SECTION - B

- UNIT IV:** SOLAR ENERGY: Solar constants, solar radiation at earth surface, physical principles of conversion of solar radiation into heat. Concentrating collectors (focusing and non-focusing). (7)
- UNIT V:** TIDAL ENERGY: OTEC (Ocean Thermal Electric Conversion), methods of ocean thermal electric power generation, site selection. Energy from tides - basic principles of tidal power, components of tidal power plant.
 WIND ENERGY: Introduction, basic principles of wind energy conversion. Site selection considerations. Basic components of wind energy conversion system. Wind energy collectors. Natural gas - classification and comparison of different gas turbine power plants, Associated Environmental Effects. (8)
- UNIT VI:** NUCLEAR ENERGY: necessity, general components of nuclear reactors, different types of reactors, breeding reactors, location of nuclear power plants, disposal of nuclear wastes, Associated Environmental Effects.
 GEO-THERMAL ENERGY: introduction, nature of geothermal fields, geo-thermal sources, binary fluid geo-thermal power system and arrangement for hybrid plants. (8)

TEXT BOOKS:

1. Rai, G.D., "Non-conventional Energy Sources", Khanna Publications
2. Rao and Parulekar B.B., (1977), "Energy Technology" Non-conventional, Renewable and Conventional, 2nd Edition, Khanna Publishers

REFERENCE BOOKS:

1. Mathur, A.N., and Rathore, N.S., "Renewable Energy and Environment" Proceedings of the National Solar Energy, Himanshu Publications, Udaipur
2. Saha, H., Saha, S.K., and Mukherjee, M.K., (1990), "Integrated Renewable Energy for Rural Development", Proceedings of the National Solar Energy Convention, Calcutta, India,
3. Wilber, L.C., (1989), "Handbook of Energy Systems Engineering", Wiley and Sons
4. The Energy Research Institute (TERI), New Delhi, Publications
5. Ministry of Environment and Forests, Government of India, Annual Reports

8CH05 PROFESSIONAL ELECTIVE-III LAB

Minimum EIGHT experiments based on the syllabus are to be performed by the students.

8CH06 PROJECT & SEMINAR**SEMINAR:**

The Seminar Report submitted by the student at the end of VII Semester will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of VIII Semester.

PROJECT:

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of Chemical Technology. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks by way of oral presentations. The university examination, which carries a **total of 150 marks**, will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

**FOUR YEAR DEGREE COURSE IN
B.TECH POLYMER TECHNOLOGY
CREDIT & GRADE SYSTEM**

SEMESTER: SEVEN**7PP01**

**POLYMER PROCESSING - I
SECTION - A**

Unit-I&II: Injection moulding - Principle, process, Types of injection moulding m/c, Clamping unit, injection unit selection of injection moulding machines, materials used. M/c maintenance defects and remedies. Feed system in injection moulding, Quality in injection molding. Fundamental of injection moulding, typical injection moulding cycle, effect of materials, properties and process variables on product quality, Runners and hot runner moulding. Injection moulding of thermosets. Problems of calculation of optimum no. of cavities, Injection pressure, volumetric output, HP/KW required, Wall thickness, Shrinkage etc. Recent developments in injection molding such as Gas assist injection molding, two colour Injection moulding.

Unit III: Compression Moulding Principle, Process, types of process, materials used properties, of materials relevant to moulding process. Compression moulding cycle equipments and auxiliary equipments, Interrelation between flow properties of the polymers, process parameters as well as moulding design on product quality. Different types of compression moulds. Molding defects and remedies.

SECTION - B

Unit IV: Transfer Moulding: Principle, process description, Transfer moulding cycle. Types of process, materials used. Types of equipment comparison with compression Moulding, limitations, Defects and remedies.

Unit V: Lamination, casting, foaming of polymers, rotational molding and reaction injection moulding.

Unit VI: Recycling Tech: Types of recycling, size and material separation, Biodegradation, Incineration.

TEXT BOOKS:

- 1) Principles of Polymer Processing: Z. Tadmor and C.G. Gogos.
- 2) S.P.I. Hand Book of Plastic Engg, Foadoes

REFERENCE BOOKS:

- 1) Injection Molding, Theory and Practice: I.I. Rubin
- 2) Injection Molding Design, 11nd Edn.,: R.C. W.Pye.

- 3) Plastic Molding E0gg.: D. A. Dearie.
- 4) Injection Molding of Machine : Whelan
- 5) Reaction Injection molding (3033): Reichart.
- 6) Injection molding Hand Book (3881): Athalye.
- 7) Polymer Processing (5686): Mortan Jones.
- 8) Plastic Engg.: Crawford.
- 9) Basic Principles of Rotational molding: Bonins.
- 10) Molding of Thermosetting Plastics : Whealan.
- 11) Injection Molding Hand Book: Rosato.
- 12) Recycling of Plastics by Adab and Chandra.

7PP02 POLYMER REACTION ENGINEERING SECTION - A

- Unit I:** Classification of Polymerization reactions & reactors. Isothermal/ Non isothermal, constant volume/variable volume, single ideal reactor, Ideal batch and steady state flow Ideal reactors such as plug flow and constant flow stirred tank reactors. Material balance and energy balance across these ideal reactors. Performance/design equations for ideal reactors.
- Unit II:** Techniques of Polymerization: Bulk, Solution, Suspension, emulsion and Dispersion Polymerization, Their merits and demerits, gas phase olefin polymerization.
- Unit III:** Kinetics of emulsion polymerization, Smith Ewart theory for stage II Polymerization, Estimation of total number of Polymer particles, Kinetics of Dispersion Polymerization, Fitch Theory.

SECTION - B

- Unit IV:** Reaction Engineering of condensation polymerization -Kinetics of A-R-B type condensation polymerization, Average molecular weight in condensation Polymerization: Effect of stoichiometric ratio of functional group on degree of Polymerization, Molecular weight distribution in condensation Polymerization: equation for number average chain length and weight average chain length. Choice of reactor in condensation Polymerization regarding average molecular weight and molecular weight distribution. Control of molecular weight.
- Unit V:** Reaction engineering of radical Polymerization - Kinetic model of radical polymerization, Average molecular weight in radical polymerization. Determination of rate of Polymerization and rate constant by dilatometer, molecular weight distribution in radical Polymerization: equation for number average chain length and weight average chain length. Choice of reactor in radical Polymerization regarding average

molecular weight and molecular weight distribution. Control of molecular weight in radical Polymerization by different methods such as increase in the temperature of Polymerization, method of weak inhibition, use of chain transfer agents.

- Unit-VI:** Introduction of non-ideal reactor: Basic idea of R.T.D. studies. Constructional Features of large Polymerization reactors: For suspension technique: polymerization of Polystyrene and Polyvinyl chloride. Agitation, heating-cooling, cleaning arrangements in Large polymerization reactors.

TEXT BOOK:

- 1) Chemical Reaction Engineering: O Levenspiel.
- 2) Fundamental of Polymer Science & Engineering Anilkumar & S.K.Gupta.

REFERENCE BOOK:

1. Polymerization Reactors & Process: J.N.Henderson.
2. Polymerization Kinetics & Technology: Naj Platzer
3. Polymer Reaction Engineering (2318): Reicharl

7PP03 STRUCTURE PROPERTY RELATIONSHIP IN POLYMERS SECTION - A

- Unit I:** Classification of polymer - on the basis of structure, regularity, chemical constitution, configuration and conformation of chain. Freely jointed chain: - segment of chain, size & shape of macromolecular chain, random flight model, random flight end to end distance. Internal rotation in macromolecule: internal rotation in freely jointed chain, the forces affecting internal rotation - different types of intra molecular / inter molecular interactions. Flexibility of chain: thermodynamic and kinetic flexibility of chain, factors affecting flexibility, practical importance of chain flexibility.
- Unit II:** Super molecular structure: Molecular aggregation & stable state of assemblage, two phase structure in solid polymer, fringed micelle theory, structure of amorphous polymer, structural features of crystallizable polymers, degree of crystallinity and measurement of degree of crystallinity.
- Unit III:** Thermodynamics of crystallization and melting : Energetic of phase change, Glass transition temperature, equilibrium melting temperature, determination of equilibrium melting temperature, mechanism of crystallization, Kinetics of crystallization, Avrami's equation, experimental studies of kinetics of crystallization in polymers, general kinetic features of crystallization.

SECTION - B

Unit IV: Morphology of crystalline polymers:- Polymer single crystal, folding of chain, lamellae. Structure of polymer crystallized from melt - spherulite. Extended chain crystal, strain induced morphology - fibrillar crystals, defect structure of crystalline polymer. Morphological changes during orientation. Structure formation during processing.

Unit V: Polymer structure and physical properties:

- (a) The crystalline Melting Point: - Melting point of homologous series, effect of chain flexibility and other steric factors, side chain substitution, effect of copolymerization.
- (b) Mechanical Properties:- Effect of crystallinity, molecular weight, cross link density, and filler on mechanical strength of glassy and crystalline polymers. Mechanical strength and life time of polymer.
- (c) Electrical Properties:- Electrical properties of polymers such as dielectric break down strength, dielectric loss, permittivity. Effect of chemical constitution of polymer, stereo regularity and crystalline of polymer on electrical properties.

Unit VI: (a) Property requirement and polymer utilization for different applications such as Elastomers, Fibers, General purpose plastics, optical applications, electrical applications, Mechanical applications.

(b) Special applications of polymers and their structures: Liquid crystalline polymers, polymer sorbents and porous structure of polymer, ion exchange resins.

TEXT BOOKS:

- 1) Physical Chemistry of Polymers - A. Tager, MIR Pub., Moscow.
- 2) The Structure of Polymers - M.L. Miller, Reinhold Pub. Corporation, New York.

REFERENCE BOOKS:

1. Properties and Structure of Polymers - Arthur V. Tobolsky, John Wiley and Sons Inc. Pub.
2. Polymer Structure Properties and Applications - R.D. Deanin, Calmer Pub. Co., New York, 1972.
3. Properties of Polymers - D. W. Van Krevelin and P.J. Nofttyier, Elsevier S. Pub. Co., Amsterdam, 1976.
4. Polymer Materials Science - J. Schultz, Prentice Hall Inc., N. 1974.

PROFESSIONAL ELECTIVE – I**(1) POLYMER BLENDS AND COMPOSITES****SECTION - A**

Unit-I: Polymer Blends-Miscible and Immiscible type, compatibilization mechanism, compatibilizers used in polymer blends and their addition method, compatibility of polymer blends, criteria for compatibility, methods of blends preparation, such as mechanical graft, block and IPNS, Principle tests for polymer compatibility.

Unit-II: Transition behaviors to polyblends. Impact modification by Elastomer, types of impact modifiers, characteristics of impact modifiers, Effect of blend type and rubber content on impact strength of polymer blend. Bulk behavior of two phase polymer material. Toughening mechanism in Elastomer modified blend.

Unit-III: Preparation, properties, Uses and processing of commercial polyblends - Incompatible, semicompatible or compatible type eg. Rubber - rubber polyblends, synthetic paper polyblends, HIPS, Blends based on PPO, PE, PVC, ABS, EVA, EPDM and PU-acrylic, etc.

SECTION - B

Unit-IV: Polymer composite, classification of composites, Fundamentals of polymer composites systems such as matrix, Reinforcement/ fiber and Reinforcement-matrix interphase, their role in polymer composite. Types of composites - mechanical, Thermal, Viscoelastic properties of composites in relation to processing, Selection criteria for material and reinforcements, Criteria for Process Selection of composites, Section thickness, Compatibility criteria for reinforcement and matrix.

Unit-V: Reinforced plastics types, material for reinforcement(polyester fibers, glass fibers, aramide fibers etc), type of matrix (Thermosets) and additives. Processing techniques of reinforced plastics & application, (open & close molding, pultrusion, RTM, Filament Winding, Pressure injection.)

Unit-VI: Designing aspects in Composites like flat sheets, hollow and solid structure (drafts, flanges, corners etc.), Defects and faults in Composite (Possible causes and Remedies), Application of composites in different fields-Automobile, Aerospace, Marine, Land transportation. Electrical and Electronics, Construction and industry.

TEXT BOOKS:

- 1) FRP Technology, Weatherhead, Applied Science Publishers Ltd, London.

- 2) Polymer Blends and Alloys By MJ.Folkes and P.S. Hope Blackie Academic and Professional Publication.

REFERENCE BOOKS:

1. Polymer Blends D.R.Paul and S.Newman Academic Press. New York 1976.
2. Polymer Blends and Alloys-Byuttraki
3. Polymer Engg. Composites, M.O. W.R.Richardson applied science London 1976.
4. Polymer Blends and Alloys By MJ.Folkes and P.S. Hope Blackie Academic and Professional Publication.
5. Handbook of Fillers and Reinforcement for Plastics, H.S.Katz and J. V.Milweski, Van Nostrand Renhold Renhold Co.New York 1 978
6. 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.
7. Structural Design with Plastics, B.S.Benjamin, Van Nostrand Renhold Co. New York, 1982.
8. Polymer Composite by Margolies.

7FEPP04 PROFESSIONAL ELECTIVE –I (2) 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 -A

- 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 physical: physico chemicals: effect of moisture, vapor, oxygen & other gases

SECTION -B

- 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 unreacted chemicals, packaging material properties biological: sensitivity to micro organisms, packaging material properties physical chemical: absorption & diffusion of moisture and gases biological: 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),
2. Plastics in Packaging A.S. Athalye, Tata McGraw Hill, New Delhi, 1992
3. 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 ñ Materials, Processes And Applications By F. Hannay [Rapra Publications], 2002.

7PP05 PLANT DESIGN & PROJECT ENGINEERING

Objectives:

Learning fundamentals and applications of chemical engineering plant design, value engineering, optimization with emphasis on chemical engineering applications, fundamentals of engineering economics and the management decision making processes that are used in engineering problem solving. Understanding the concept of interest and equivalence, learning the methods of engineering economic analysis like present worth, rate of return, annual cash flow and benefit-cost ratio, depreciation, etc.

SECTION - A

UNIT I: Basic considerations in chemical engineering plant design, project identification, project identification, preliminary techno-economic feasibility, process selection, laboratory developments and its importance, pilot plant, scale-up methods, flow diagrams. Selection of process equipments: standard vs. Special equipments, materials of construction of process equipments, specification sheets. (7)

UNIT II: Plant Location: Objectives, levels of location problems, factors influencing location of a plant, locational analysis, selection criteria, significance, theories of plant location. Plant Layout: Meaning of plant layout, design importance and scope, essentials, types of layout, factors influencing layout, dynamics of plant layout, planning for plant design. (7)

UNIT III: Cost estimation: equipment costs, cost indices, William's point sixth rule, methods of estimation of fixed capital, product cost estimation. Interest formulae and their applications, time value of money, simple and compound interest, discrete, nominal and continuous rate of return and their relationships, issue and evaluation of bonds, concept of equivalence. (8)

SECTION - B

UNIT IV: Depreciation: Introduction, straight line method of depreciation, declining balance method of depreciation, sum of the years-digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation. (8)

UNIT V: Replacement and Maintenance analysis: Types of maintenance, types of replacement problem, determination of economic life of

an asset, Replacement of an asset with a new asset, capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely, practical factors in alternative and replacement investment.

(8)

UNIT VI: Inventory control, scheduling a project using CPM/PERT, project management, optimum conditions, optimum production rates in plant operations, optimum conditions in cyclic operations, design reports. (7)

TEXT BOOKS:

1. Max Peters, Plant design and economics for chemical engineers, McGraw Hill
2. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001

REFERENCE BOOKS:

1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002
2. Donald G. Newman, Jerome P. Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002

7PP06 POLYMER PROCESSING – I - Lab

LIST OF PRACTICALS

1. To study the working of intensive dry mixture during preparation of P V C compound.
2. To manufacture shoe sole compound using extruder.
3. To study the effect of processing parameters during preparation of Bottle cap by hand injection process.
4. Selection of injection moulding machine.
5. To manufacture Test sample using reciprocating screw injection moulding machine by various materials (LDPE, HDPE and P S)
6. Using heat Gun. (Shrink-Pack Techniques)
7. To study the rotational moulding machine and to prepare sample.
8. To manufacture two way electric plug using Transfer moulding machine.
9. To study the laboratory extruder.
10. Calculate the water absorption of filler percent in P V C sheet.
11. Production of articles by compression moulding and effect of process parameters on moulded articles.
12. To study the hydraulics and electric circuits of automatic injection molding m/c.

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.

7PP07 POLYMER REACTION ENGINEERING-Lab
LIST OF EXPERIMENTS

1. To study kinetics of reaction by differential/integral method of analysis.
2. To find activation energy and frequency factor.
3. Performance of batch reactor.
4. Performance of C.S.T.R.
5. Performance of tubular reactor.
6. Bulk Polymerisation technique.
7. Emulsion Polymerisation technique.
8. Suspension Polymerisation technique.
9. R.T.D. Studies in mixed vessel.
10. R.T.D. Studies in tubular flow.
11. To study kinetics of Polycondensation.
12. To study kinetics of Addition Polymerisation by dilatometer.

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.

7PP08 PROFESSIONAL ELECTIVE-I-Lab
(1) POLYMER BLENDS & COMPOSITES

1. To prepare HDPE/PP blend.
2. To determine mechanical and thermal properties of HDPE/PP blend.
3. To prepare Rubber polyblends.
4. To determine the mechanical and thermal properties of rubber polyblends.
5. To prepare fibre reinforced composite by hand lay-up technique.
6. To determine mechanical and thermal properties of reinforced polymer composite (above prepared).
7. To prepare chopped strands reinforced composite by hand-lay up process.
8. To determine the mechanical & thermal properties of the above prepared composite.
9. To prepare fibre reinforced polymer composite using vacuum RTM.
10. To determine mechanical properties of the polymer composite made using vacuum RTM.
11. To give the surface treatment to and natural fiber / reinforcement and note the results.
12. To use the above treated natural fibers/reinforcement in polymer composites and determine their mechanical properties.

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.

7PP08 (2) PACKAGING TECHNOLOGY

1. Identification of plastic material for packaging films.
2. To determine tensile strength of a given plastic film sample
3. To determine percentage elongation of given plastic film sample
4. To determine static & dynamic coefficient of friction of plastic film.
5. To determine dart Impact strength of plastic film with the help of dart Impact tester.
6. To determine dielectric strength of plastic film sample.
7. To determine shrinkage in film Using heat Gun. (Shrink-Pack Techniques)
8. To study the character-ties of shrink packaging.
9. To study the screen printing on plastic film.
10. To study characteristics of plastic films corresponding to the application.

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.

7PP09 INDUSTRIAL TRAINING

During the course of study from **III** to **VII** semester each student is expected to undertake a minimum of two industrial visits and undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of **VII** semester for **50 marks**.

7PP10 PROJECT & SEMINAR

SEMINAR:

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for **50 marks**. The Seminar Report will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of **VIII Semester**.

PROJECT:

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of

Polymer Technology. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for **75 marks** by way of oral presentations. The university examination, at the end of **VIII** semester carries **75 marks**, will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

SEMESTER:EIGHT

8PP01 POLYMER PROCESSING-II SECTION -A

Unit I & II : Extrusion & II Principles of extrusion, Design features of extruders such as type of drives, types of screws, L/D ratios, compression ratio, pitch, screen, breakers plate, barrels, heating and temperature controls. Mechanism of extrusion zones of extruder. M/c & equipments for the production of pipes, blown and cast film, tapes, wire coating etc. Behavior of various Polymers in extrusion, effect of material properties and process parameter on product quality, trouble shooting M/C maintenance. Twin screw extruder, co-extrusion and vented extruders.

Unit-III: Blow Molding: Principle, types of B.M., salient features of injection and extrusion B.M., Blow molding cycle, choice of material for blow molding. Comparison between extrusion and injection blow molding. Stretch blow molding, Principle and advantage. Wall thickness control, Parision programming and it's methods, Trouble shooting.

SECTION - B

Unit IV: Calendaring: Principle and process description, types of calender units 2, 3 and 4 rolled calendars, Design of calender roll, Heating and temp control, roll crown, roll crossing and roll bending, materials for calendaring, calendaring sheets and films, embossing, coating and lamination by calendar, comparison between calendaring and extrusion.

Unit-V: Finishing techniques solvent cementing, electroplating, Hot stamping, vacuum metalizing, Heat sealing, welding, scree printing, Lecuring.

Unit-VI: Vacuum Forming: Process description, Diff. Techniques of vacuum forming, equipments used in vacuum forming, advantages and limitations and comparison of vacuum forming with injection molding.

Spinning: Process fundamentals, melt spinning, solution and wet spinning of fibers, Drawing and orientation, effects of unfolding, crystallinity and orientation on quality of spinning fibers.

TEXT BOOKS:

- 1) SP1 H.B. of Plastics Engg. by Benger.
- 2) Extrusion of Plastics by E.G. Fisher, Newness Butterworth, London.

REFERENCE BOOKS:

1. Polymer Extrusion by Rouwendari, Hanser Publication.
2. Extrusion of Plastfcs by- Finner
3. Dies, for Plastics Extrusion by M.V.Joshi
4. H.B. of Blow Molding by Rosato. Hanser Publication.
5. Plastics Extrusion Technology by Hensen.
6. Extrusion of Plastics-Klockner Windsor Publication.
7. Twin Screw Extruders by Martell.
8. PVC Technology by Athalye.
9. Decorating Plastics by Margolis.
10. Fundamentals of Fibre Formation by A.Ziabecki
11. Thermoforming by Throne.
12. Blow Molding of Plastics - Fisher.

8PP02 POLYMER VISCOELASTICITY & RHEOLOGY SECTION - A

Unit-I: State of Aggregation and phase states of matter Molecular motion in Polymers, Transition relaxation processes in Polymers.

Unit-II: Glass Transition, mechanism of glass transition temperature Theories to determine the glass transition i.e. Dillatometric, Heat capacity, measurement, Thermo mechanical, Measurement of modulus of elasticity, effect of Tg on molecular mass, kinetic chain flexibility and chemical constituent, Importance of Tg and Tm, HDT.

Unit-III: Viscoelastic behavior, chain topology, branching & crosslinking of Polymer solution and melts stress-strain curves for Polymers, creep of Polymeric material, elastic deformation, irrecoverable follow deformation. Rubber like deformation, Time-temp superposition (WLF Equation) Models of viscoelastity such as Maxwell and kelvin model. Types of viscosity, stress relaxation.

SECTION-B

- Unit-IV:** Introduction and Basic concept of Rheology, classification of fluids, Newtonian and non Newtonian fluids, shear stress, shear strain and shear rate, shear modulus, bulk modulus, Zero shear viscosity, Dependence of viscosity with temp, shear stress, shear rate fluid through channel, characteristic parameter during shear deformation.
- Unit-V:** Methods to determine shear viscosity by capillary Rheometer, cone and plate viscometer. Cup and bob viscometer, Measurement of normal stresses. Theories of viscosities of dilute (Debye Bueche theory) and cone. Solutions (Grassley's entanglement theory), (Entanglement concern)
- Unit-VI:** Rheology of dilute and concentrated suspensions, effect of Rheology during Injection, moulding Extrusion: Film extrusion, sheet Extrusion and Blow moldings of polymers. Rheometer, Bubble inflation rheometer, compressional rheometers, stresses relaxation instruments. Torque rheometers, rotational & sliding surface rheometers and their use in determining process ability.

TEXT BOOKS:

- 1) Physical Chemistry of Polymers - Tager.
- 2) Flow Properties of Polymer Melt by J.A. Brydson.

REFERENCE BOOKS:

1. The Flow of Highpolymers, S. Middleman John Wiley and Sons, George St. 1968.
2. Rheometry K. Walters, Chapman and Hall London 1975
3. Rheology of Polymers :G.V.Vinogradov and A.Ya Malkin Mir Pub MOSCOW 1980.
4. J.J. Alkonis and W.J.Macknight - Introduction to Polymer Viscoelasticity - Wiley Inter Science, New York-1982.
5. Viscoelasticity of Polymers D.D.Ferry III Edn. John Wiley and Sons New York 1981.
6. Polymer Sc. and Tech. of Plastics and Rubber; D.Ghosh.
7. Melt Rheology and its Role in Plastics Processing : Dealy

8PP03**PROFESSIONAL ELECTIVE-II****(1) TESTING AND PRODUCT DESIGN FOR PLASTICS****SECTION-A**

- Unit-I:** Introduction - concepts of strength of Polymers, theoretical stress analysis, theory and types of fracture, comparison between metals and polymers, selection of polymer on strength & stiffness basis.

- Unit-II & III:** Principles tests for mechanical properties such as tension, shear, compression, flexural, hardness. Impact: pendulum, Izod, charpy, chip, Falling weight: Dart impact, high speed impact tester, abrasion creep:- tensile creep, flexural creep, stress relaxation. Electrical properties such as dielectric strength, dielectric constant, dissipation factor, arc resistance & electric resistance.

SECTION - B

- Unit-IV:** Testing of Polymers for thermal, optical, Environmental & Weathering Properties, Chemical Properties and other properties, such as nondestructive testing.
- Unit-V:** Importance of polymer material, material and process selection for designing of product, aspect of temperature, elasticity, flame resistance, impact strength, moisture, chemical wear, Permeability, weathering, odour and test.
- Unit-VI:** Processing parameter on structure, properties and quality of VI & VI the product. Aspect of parting line, wall thickness, Ribs and bosses, molded holes, insects, Threads, mold/dies, gates, runners, parting lines and their design aspects. Mould ability general considerations, and specific cases.

TEXT BOOKS:

- 1) Identification and Testing of Plastics by Athalye.
- 2) H.B. of Plastics Testing Technology by V.Shah.

REFERENCE BOOKS:

1. Product Design with Plastics by Dym.
2. Designing with Plastics by E.H.Renstein.
3. Plastics Product Design H.B.Part A and B by Miller.
4. Plastics Product Design by R.D.Beck.
5. Plastics Engg. by Croford.
6. Product Design and Testing of Polymeric Material by Che Reminisbroff.
7. H.B. of Plastic Test Methods Vol-I and II by Brown
8. Designing with Plastics and Composites by Rosato.
9. Quality Control and Testing Manual of Copet.
10. Plastics Product Design H.B.by Levy.
11. Mechanical Prop, and Polymers by Norbert M.Bikates.

8PP03**PROFESSIONAL ELECTIVE-II****(2) SURFACE COATING TECHNOLOGY**

Objective: Surface coatings and adhesives are an important area of material science where polymeric materials are findings increasing applications. This segment of industry caters to the needs on construction, automobile, ship building, aviation, electrical insulation industry where a large number

of materials such as paints, varnishes, enamels and lacquers are extensively used for functional as well as aesthetic reasons. In the first section, effort has been made to introduce the student to various aspects of manufacture, testing and applications of these materials. Second section deals with adhesives- manufacturing, testing and applications.

SECTION - A

Unit I: Introduction and Components of Surface Coatings - Introduction of coatings, Detail classification of various coatings methods (Roll, pre-metered, Air knife coating), Selection criteria for coating methods, surface tension, wet ability, contact angles and spreading, types of applicator rolls. Surface coating- definitions and general classifications, paints, varnishes and lacquers, mechanism of film formation, classification of oils, semi drying and non-drying oils, chemical properties of oils, introduction to pigments and dyes, organic and inorganic pigments. Role of various additives like-emulsifier, dispersing agents, anti-settling agent, biocides, antifoams, corrosion inhibitors, UV and light stabilizers, antioxidants etc. Solvents-properties of solvents, solvent (cutting) power, rate of evaporation, water as coating solvent, phenomenon of mixing, soaking, wetting ,grinding, dispersion and stabilization, Types of viscosity behavior, Surface Chemistry, Rheological phenomenon in coatings..

UNIT II: Natural Resins and Polymers- Natural resins- Rosin, shellac, natural bitumen, bituminous paints Synthetic Polymers-raw materials, chemistry, formulations, manufacturing processes, properties and some important aspects of following resins- alkyd resins, polyester, phenolic resins, epoxy resins, polyamide resins, polyurethanes, silicone resins, acrylic and vinyl resins, hydrocarbon resins.

UNIT III: Formulation, Manufacturing, Coating Properties and Evaluation- Typical formulations of various types of paints, general properties of paints, varnishes and lacquers, properties of raw materials used in coating formulations, adhesion and cohesion properties, factors affecting adhesion, wetting power. Physical and chemical and mechanical properties of paint films, Newtonian and non-newtonian flow behavior, factors affecting viscosity and influence on rheological behavior, test on liquid paints- density, dispersion, viscosity, consistency, application of films, spreading capacity, wet opacity, dry hiding, spreading time, drying time, wet and dry film thickness etc. Optical properties-color, gloss, haze & clarity, opacity, orange peel, transparency, hiding power, mechanical properties, electrical

resistance properties, environmental resistance and ageing properties of coatings.

SECTION - B

UNIT IV : Adhesive Formulations- Detail classification of Adhesives, Principle of adhesive formulation and production techniques, adhesive formulation for various industries viz. construction, packaging, textiles, automotive, abrasives and friction material shoes, electrical aerospace etc. Types of adhesives: Structural adhesives, epoxy, acrylic, phenolic, elastomeric modified adhesive, PU adhesives, natural such as starch, dextrin, cellulose ether, cellulose ester, pressure sensitive adhesives, hot melt adhesives, anerobic adhesives, temp based adhesives, solvent and emulsion based adhesives. Health and safety

UNITV: Theory and Mechanism of Adhesion- Theories of adhesion-mechanical interlocking, diffusion theory, electrostatic theory, adsorption, chemisorptions, surface energetic and wetting equilibrium, kinetics of wet bonding operations, Various bonding processesò Methods of Adhesive Application, Methods of Adhesive Bonding, Methods of Bond Curing, Compatibility of adherents and adhesives, Bond stresses, Service Conditions and service life. Advantages and disadvantages of using adhesive bonding over conventional joining techniques.

UNITVI: Testing of adhesive Bonding Surface Characterization, surface pretreatment and treatments for various substrates, techniques for evaluation of adhesives, Physical Testing of adhesives-assessment of durability and strength parameters (Fatigue, creep, flexural strength, peel strength, durability, fracture mechanics , Non-destructive testing), Joint Design- (Types of stresses, types of joints, selection criteria for joints), properties and testing of adhesives for tack, viscosity, cure time, etc.

TEXT BOOKS:

- 1) Surface coatings: Science and Technology, by Swaraj Paul, John Wiley and Sons, 1985
- 2) Adhesives Handbook, By Butterworths

REFERENCE BOOKS:

1. Coatings Technology Handbook, By Arthur A. Tracton, Third Edition.
2. Organic Coating Technology, Volume I, by Henry Fleming Payne, John Wiley & Sons, 1954.
3. Surface Coatings, Volume I, by OCCA Australia (Prepd.), Chapman and Hall, 1983.
4. Outlines of Paint Technology, III Ed. By W. M. Morgans, Edward Arnold, 1969

5. Organic Coatings: Science and Technology, Volume I, by Z. W. Wicks, F. N. Jones and S. P. Pappas, Wiley-Interscience, 2007.
6. Basics of Paint Technology, Part I & II, by V. C. Malshe & Meenal Sikchi, 2002.
7. Datta P.K. & Gray J.S. Surface Engineering Vol. I Fundamentals of coatings. Royal Society of London, 1993.
8. Datta P.K. & Gray J.S. Surface Engineering Vol. II Fundamentals of coatings. Royal Society of London, 1993.
9. Datta P.K. & Gray J.S. Surface Engineering Vol. III Fundamentals of coatings. Royal Society of London, 1993.
10. Skeist, Irving, Handbook of Adhesives, Van Nostrand, New York, 3rd edition, 1990.

8PP04 MOULD DESIGN FOR PLASTICS

SECTION-A

Unit-I: Choice of materials for mould making, different types of steels and steel alloy used in mould making, composition and its properties. Methods of heat treatment and advantages. Properties of aluminum, beryllium, copper and zinc used for moulds. Selection of materials for specific mould components, Different machine tools and methods used in mould making like grinding, milling, and die sinking machines, casting hobbing and polishing operation. Electrodischarge machining. Electrolytic depositing process.

Unit-II & III: Injection mould: Classification of Injection moulds. Design of runners, gates, vents and sprue. Design of Ejection systems. Different techniques of Ejection. Design of cooling systems, cooling of cavity and core, cooling channels, bubbler, baffle and helical channel. Hot runner moulds - Design consideration, its advantages and limitation. Mould economics - Determination of No. of cavities and cost estimate, Runnerless Moulds, Different types nozzles for mould. Parting line, cavity and core location, use of core and inserts, locating ring and sprue bushing. Moulds for articles with Drafts and Undercuts, Allowance for shrinkage and warpage problems. Design of BLOW MOULDS: Design of simple blow moulds, Die design for parison control.

SECTION-B

Unit IV: EXTRUSION DIE: Design aspects of the following extrusion dies - Pipe Die, sheet Die, Monofilament Die, Blown film and cast film die, Tape Die, Profile Die.

Unit-V: Compression Mould: Flash, positive, semi positive moulds.

Details of cavity block, punch plate, guidepins, pressure pads, cores etc. standard components of compression mould typical design.

Unit-VI: Transfer Mould: Design of integral pot and auxiliary ram types. Design of standard mould part like transfer pot, transfer plungers, sprue bush. Transfer pressure and clamping force.

TEXT BOOKS :

- 1) Plastics Product Design Handbook - Miller
- 2) Plastic Product Design-Beck R.D.

REFERENCE BOOKS :

1. Plastics Mould Engineering - Dubois J.H.
2. Injection Molds and Molding ñ Dym
3. Dies for Plastics Extrusion -M.V.Joshi
4. Injection Mold Design 4th Edn. ñ Pye
5. Mold Making H.B. ñ Stoeckhart
6. Design of Plastics Molds and Dies ñ Sors
7. Injection Mold Design, Design Manual for Thermoplastic Industry (1567)
8. Designing with Plastics and Composites - Rosato.

8PP05 POLYMER PROCESSING-II-Lab LIST OF PRACTICALS

1. Study and construction of single screw extruders.
2. Manufacturing of Pipes/Pellets.
3. Manufacturing of Blown film.
4. Manufacturing of woven sack
5. Manufacturing of strands. (Granules Reprocessing)
6. Manufacturing of extrusion blow molded articles.
7. Manufacturing of articles by vacuum forming
8. Study of calender unit
9. Screen Printing process for plastics
10. To prepare solvent cement for plastics
11. To calculate the mixing index of PVC
12. To study the character-ties of shrink packaging.

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.

8PP06 PROFESSIONAL ELECTIVE-II-Lab (1) TESTING AND PRODUCT DESIGN

1. Identification of different material used for different application
2. To determine percentage elongation at break of polymer sample
3. To determine tensile strength of a given plastic material.

4. To determine izod impact strength of a given plastic sample.
5. To determine dielectric strength of plastic.
6. To determine Rockwell hardness of a given plastic material by using hardness tester
7. To determine abrasion resistance value, of tire pile.
8. A case study on design and its design parameter for cold drink water
9. A case study on design and its design parameter of container
10. A case study on design and its design parameter of cosmetic container
11. To determine dart impact strength of plastic sheets.
12. To determine dart impact strength of plastic films.

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.

8PP06 (2)SURFACE COATING TECHNOLOGY

1. To find Tactility of PP.
2. To prepare adhesives based on Novlac.
3. To prepare Water soluble Adhesive.
4. To prepare Pressure Sensitive Adhesive by solution method.
5. To prepare Acrylic Adhesive.
6. To prepare Cellulosic Adhesive.
7. To prepare Multi-purpose adhesive by emulsion polymerization or rubber based adhesive.
8. To prepare Co-polymer of Epichlorohydrin with Novlac.
9. To prepare Starch Slime by using adhesive.
10. To prepare emulsion paints using vinyl acetate.
11. To give surface pre-treatment to various material surfaces (metal/plastic/wood) by various pre-treatment process and apply primers and note the results.
12. To prepare joints of various materials using the above prepared adhesives and check the durability (pot life/shelf life) and strength of joints.

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.

8PP07 MOULD DESIGN FOR PLASTICS - Lab (DRAWING)

Every student has to complete five sheets based on the following mould designs.

Compression Mould	1 sheet
Transfer Mould	1 sheet

Injection Mould	2 sheets.
Blow Mould	1 sheet
Extrusion Dies	2 Sheets.

8PP08 PROJECT & SEMINAR

SEMINAR:

The Seminar Report submitted by the student at the end of **VII Semester** will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of **VIII Semester**.

PROJECT:

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of **Polymer Technology**. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for **75 marks** by way of oral presentations. The university examination, which carries a total of **150 marks**, will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/ Guide.

**SYLLABUS PRESCRIBED
FOR BACHELOR OF TECHNOLOGY
(CHEMICAL TECHNOLOGY)
FOOD, PULP & PAPER, OIL & PAINT AND
PETROCHEMICAL TECHNOLOGY**

SEVENTH SEMESTER

7 CT01

MASS TRANSFER

SECTION A

- Unit I :** Diffusion - molecular diffusion in gases & liquids, diffusivities of gases & liquids, application of molecular diffusion, mass-transfer coefficients in laminar flow, Eddy diffusion, Mass-transfer in turbulent flow. Analogies of transfer Process.
Models of Mass-Transfer analogies. Theories of mass transfer.
Interphase mass transfer Diffusion between phases, two phase mass transfer coefficients, individual & overall coefficients:
Stagewise processes co-current & countercurrent processes.
Equipment : Tray towers, general characteristics of tray towers, efficiencies Wetted Wall towers, packed towers characteristics of packed towers. Mass transfer coefficients in packed towers.
Gas absorption: Equilibrium relationships, Material balance for co-current and counter current multistage equipment. Approach for dilute systems.
Calculation of HETP & HTU in continuous equipment for absorption and stripping, - Individuals & overall coefficients, Transfer units.
- Unit II :** Distillation : Various liquid equilibria for ideal & non ideal systems. Relative volatility, Azeotropes, Enthalpy concentration diagram, single flash vaporization. Partial condensation. Differential distillation for binary systems.
Fractionation McCabe - Thiele & Ponchon-Savarit methods for multistage operations. Reflux, Reflux ratio & optimum reflux ratio. Reboilers, Total and partial condensers. Tray efficiencies, azeotropic & extractive distillation. Introduction of multicomponent distillation.
- Unit III :** Extraction - Liquid Liquid Ternary liquid equilibria, Different co-ordinate systems. Classification of equipment.

Single Stage and Multistage Co-current & counter current extraction. Calculation of number of stages analytically and graphically continuous Extraction. N. T. U. and H. T. U.
Ion exchange & Membrane separation techniques.

- Unit-IV :** Leaching, Principles, Equilibrium calculation of single stage & multistage leaching- process equipment.
- Unit V :** Crystallization & Principles, Calculation of Yield, Heat effects, equipments.
- Unit VI :** Humidification, Fundamental concepts, General Theorems, Psychrometric chart, Dehumidification and drying theory and mechanism, drying rates, Design and performance and continuous and Batch Dryers, Industrial Dryers.

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED:

1. Unit operations in Chemical Engg. 3 Ed. W.L. McCabe & J. C. Smith, McGraw Hill & Kogakusha, Latest Edition.
2. Mass-Transfer RE. Treybal 3 ed. McGraw Hill, Latest Edition.
3. Mass-Transfer 3-ed. T.K. Sherwood, R. Pigford; C.R. McGraw Hill, Latest Edition.
4. Mass-Transfer Operation: RE. Treybal.
5. Design of equilibrium stage Process: B.D. Smith
6. Chemical Engineering, Vol II : Coulson Richardson.

**7 CT02 CHEMICAL REACTION ENGINEERING-I
(KINETICS)
SECTION - A**

- Unit-I :** Classification of chemical reactions. Variables affecting the rates of reaction. Kinetics & Thermodynamics. Thermodynamics of chemical reactions. Classification of reactors. Order of reaction & rate constant.
- Unit-II :** Rates of Homogeneous reactions. Fundamentals of rate equation. Rate equations from proposed mechanism. Analysis of simple & complex rate equation. Evaluation of rate equation from laboratory data.
- Unit-III :** Interpretation of rate data, Scaleup Design. Constant volume batch reactor. Variable volume Batch reactor. Temperature and reaction rate.

SECTION - B

- Unit-IV :** Single ideal reactors. Ideal Batch Reactor. space time and space velocity, steady state mixed flow reactors, steady state plug flow reactor, Holding-time & space time for flow system.
- Unit-V :** Design for single reactions

Size comparison of single reactors Batch reactor, Mixed verses plug flow reactors Variation of reactant rates. General Graphical comparison. Autocatalytic reactions.

Unit-VI : Design for multiple reactor system. Reactions in parallel & in series, series-parallel reactions. Batch recycle reactor, Flow-recycle reactor. Temperature & pressure effects in single and multiple reactions. Optimum temperature profile.

Practicals : based on above syllabus.

BOOKSRECOMMENDED:

- 1) Chemical Reaction Engg. : Octane Levenspiel, Wiley Eastern Ltd
- 2) Chemical Engg. Kinetics: Smith J.M., Mc Graw Hill:
- 3) Reaction Kinetics for Chemical Engineers: Waas. McGraw Hill.
- 4) Elements of Chemical Reaction Engg: Scott H., Fogler, Prentice Hall India.
- 5) Principles of Reaction Engg : S.D.Dawande, Central Techno., Pub., Nagpur.
- 6) Chemical Reaction Engineering : Gavhane K.A., Nirali Pub.
- 7) Chemical Kinetics and Dynamics : Stein feld, Allied Pub. Ltd., Chennai.
- 8) An Introduction to Chemical Engg. Kinetics and Reactor Design : Hill C.G., Jr., John Wiley.

SPECIAL TECHNOLOGY PAPER-IV

7 OT03

OIL & PAINT TECHNOLOGY (TECHNOLOGY OF SOAPS, DETERGENTS, ESSENTIAL OILS AND GLYCERINE)

Surfactants : Concepts of surface activity. structure of surfactant molecules, Hydrophil - Lipophil balance. Methods for measurement surface activity, mechanism of detergency.

Type of Surfactants : Anionic, Cationic, nonionic and amphoteric. Biodegradation of surfactants. Application of Surfactants.

Soaps: Raw materials for soap. industry classification and selection of raw materials. Properties of soap and soap solutions. Phase separation in soap boiling. Plants and process employed in soap manufacture. Various types of soaps and cleaning preparation. Analysis of soaps.

Detergents: Classification. raw materials. plants and process employed in manufacture of detergents, analysis of detergents. L.S.I.methods of testing of soaps and detergents.

Essential oils : Classification and chemical constituents of essential oils. Methods of extraction. Analysis of essential oils. Natural and synthetic perfumery. materials for industrial uses.

Glycerine : Manufacture of Glycerine from natural sources, sweet waters, properties spent lyes. Synthetic glycerine.: Properties. analysis and utilization of glycerine.

Recent advances in the field

BOOKSRECOMMENDED:

1. Soap: Their Chemistry and Technology: J.G.Khane.
2. Soap Manufacture: J.Davidson. Interscience Publishers. New York. Latest Edition.
3. Sulphated Oils and Allied Products: D.Burton and G.F.Robertshaw. Chemical Publishing Co., New York, Latest Edition.
4. Surface active agents and Detergents : A.M.Schwartz. J.W.Perry and J.Berch, Interscience Publishers, New York. Latest Edition.
5. Industrial oil and fat products: A.P.Bailley, Interscience Publishers. New York. Latest Edition.
6. Technology of Laundry Soap Manufacture: Small Business Publications, New Delhi
7. House Hold & Industrial Surfactants : Small Business Publications, New Delhi.
8. The Technology of synthetic Detergent : Small Business. Publications, New Delhi.
9. Textiles Chemicals & Auxiliaries : H.C.Speed and E. W.K.Schwartz, Reinhold Publications, New York, Latest Edition.
10. The Manufacture of Glycerol : G.Martin
11. The Modern Soap Detergent Industries: G.Martin
12. Textile Auxiliaries: Shenoy

OIL & PAINT TECHNOLOGY PRACTICAL-III

Producing fats and fat based products, Mechanical expression of Oil from Oil seeds, Refining and hydrogenation of Oils. Evaluation of Bleaching Earths. Activated carbon and charcoal. Preparation of soaps and detergents. Preparation of various types of detergents. Refining of commercial waxes. Preparation and evaluation of wax formulations. Preparation of metallic soaps. preparation of boiled oil. blown oils and stand oils and their evaluation. Preparation of ester gum. monoglycerides. sulphated and sulphonated oils, varnishes, lime and zinc harden resin and product evaluation. Fat splitting and separation of fatty acids. Preparation of paints and its analysis for watability. drying lime. gloss and shade matching. Preparation of cosmetics. Analysis of pigment. Oil absorption. hiding power etc.

SPECIAL TECHNOLOGY PAPER-IV

THEORY

7 FT03

FOOD TECHNOLOGY-IV

(FOOD PROCESSING (I))

Unit Operation in Food Processing: Equipment for various operations like clearing, sorting, grading, size reduction and separation, mixing, filtration, expression, centrifugation, crystallisation etc. Application of heat in concentration, chilling and refrigeration. Thermal processing of foods, preliminary operations, methods of heat sterilisation and process time calculations. Food irradiation. Plant hygiene and water supply.

Process Technology of Cereals, Legumes and Oil Seeds: Post-harvest storage and handling. Insect infection and its control. Mycotoxins in cereals, Oilseeds and their products. Milling of cereals and legumes. By-products of milling industry Oil extraction, refining and hydrogenation. Manufacture of margarine, salad Oils, cooking oils, shortening agents, lecithin CMS etc. Processing of Oil seeds for food uses.

Process Technology of Baking and Baked Products: Selection of raw materials, Rheology of dough and dough testing methods. Changes during fermentation of dough. Manufacture of bread, Biscuits, crackers, cookies, cakes and other bakery products. Manufacture of breakfast cereals, puffed cereals, fortified and enriched products. Extrusion cooked products. Quality control.

Process Technology of Tea & Coffee: Composition and Processing. Flavour and aroma, Methods of evaluation of quality. Process technology of Cocoa, Chocolate, Candy and Confectionary Products.

Raw materials, use of additives, tech. of processing of cocoa, Manufacture of chocolate candies and confectionary products. Quality control and standards.

Special Foods: Weaning and baby foods, processed protein and cereal foods textured proteins, synthetic foods, space foods. I.M.Foods, Simulated milk products, Pro-cooked and instantised foods. Quality food management.

Recent advances in the field.

BOOKS RECOMMENDED:

1. Fundamentals of Food Processing Operations by Jonslyn, M.A. and Heid, J.L., Published by AVI Publishing Co., Inc Westport, Connecticut, Latest Edition.
2. Food Processing Operations, Vols.1,2 and 3 by Jonslyn, M.A. and Heid, J.L., Publ. by A VI Publ. Co., INC, Westport Connecticut, Latest Edition.

3. The Freezing Preservation of Foods, Vols., 1,2,3 & 4 Edited by Eople, MJ. and Tressler, D.K., Published by AVI Publ. Co., INC, Westport Connecticut, Latest Edition.
4. The Fundamentals of Food Engineering by Charu, S.E., Published by AVI Publ. Co., INC, Westport Connecticut, Latest Edition.
5. Grain storage part of System. Edited by Sinha, R.N. and Muir WE., Published by AVI Publ. Co., Inc, Westport Connecticut, Latest Edition.
6. Technology of cereals with Special reference to Wheat by Kent, N .L., Publishing by Pergamon Press, Oxford, Latest Edition.
7. Cereal Technology by Matz, Samuel, A., Published by the AVI Publishing Co., INC, Westport Connecticut, Latest Edition.
8. Coffee Processing Technology, Vols.1 and 2 by Sivetz M., Published by AVI Publ.Co., INC, Westport Connecticut, Latest Edition.
9. Food Dehydration, Vols, I and 2 by Copley, MJ. and Van Arsdel, WB., Published by the AVI Publ. Co., INC, Westport Connecticut, Latest Edition.
10. Modern Methods of Cocoa and Chocolate manufacture by Waters, H. W., Published by J. & A. Churchill, 40, Glouceter Place, Portman Square, Latest Edition.
11. Wheat Chemistry and Technology, Edited by Pomeranz, Y., Published by the American Association of Cereal Chemists, Incorporated St. Paul, Minnesota, Latest Edition.
12. Modern Cereal Chemistry by Kent Jenos. D. W. Amos, A.J., Published by Foods Trade Press Ltd., 7, Garrick Street, W.C. London, Latest Edition.
13. Snack Food Technology by Matz, S.A., Published by AVI Publ.Co., INC, Westport Connecticut. Latest Edition.
14. Bailey Industrial. Oil and Fat Products, Edited by Deniel Swern, Published by Interscience Publishers, A division of John Wiley and Sons, New York, Latest Edition.
15. Bakery Materials and Methods by Daniel, A.R., Published by Mac, Laren & Sons, Ltd., London, Latest Edition.
16. The Manufacture of Biscuits, Cakes and Wafers by Fritsch, J. and Groschirre, Published by Sir. Issac Pitman and Sons Ltd., London, Latest Edition.
17. Sargar Confectionary and Chocolate Manufacture by E. B. Jackson and Less, R., Published by Leonard Hills Books, 24, Market Square, Aylesbury, Books.

**FOOD TECHNOLOGY-III
PRACTICAL-III
FOOD ANALYSIS**

Chemical and Instrumental Methods for the analysis of foods and their constituents like fruits, bakery foods, honey, tea, coffee, vinegar, glucose, syrup. Spices and condiments, confectionary products and dairy products. Analysis of cereals and cereal products. Determination of maltose No., sedimentation value etc. Identification and determination of food additives, poisonous and toxic materials. Estimation of Arsenic and lead in processed foods.

BOOKS RECOMMENDED:

1. Modern foods Analysis by Hart, F.L. and Fisher, M.J., Published by Springer Verlag, Berlin, Heidelberg, New York, Latest Edition.
2. Official Methods of Analysis of the Association of Official Analytical Chemists, Edited by William Horwitz, Published by Association of Official Analytical Chemists, P.O.Box, 540, Benjamin Franklin Station, Washington, D.C. 20044, Latest Edition.
3. The Chemical Analysis of Foods and Food Products by Jacobs, M.R., Published by D. Van Nostrand Company, INC, Princeton New Jersey, New York Latest Edition.
4. Food Analysis by Less, R., Published by Leonard Hill Books 450 Road, London, W2, LEG Latest Edition.
5. The Chemical Analysis of Foods, by Pearson, D., Published by IEA, Churchill, 104, Clouester Place, London, Sixth Edition, Latest Edition.
6. Manual of Analysis of Fruit and Vegetable Products by Ranganna, S., Published by Tata McGraw Hill Publishing Co., Ltd., New Delhi. Latest Edition.

SPECIAL TECHNOLOGY-IV

**7 PC 03 PETROCHEMICAL TECHNOLOGY -IV
THEORY**

- Reactor Design in Petrochemical Processes
- Unit I : Design aspects of pipe still heaters. Radiant and convection sections. calculation of heat flux. radius and number of pipes. band allowance.
Capacity. number of plates. shell thickness. reflux ratio. pressure. temp. and composition calculations.
- Unit II : Capacity. role of FCCD stocks. desired product pattern. process variables. raw material of visbreaker. coker and catalytic cracker. Deactivation in catalytic cracking, types, mechanism and kinetics.

- Unit III : Details of loading capacities of different reactors in series for catalytic reforming. catalyst properties and composition. space time variation. variation of rates and extents of diff. reactions in diff. reforming, hydrocracking and isomerization reactors. problems associated with pressure and corrosion.
- Unit IV : Trickel bed reactors for HDS, mass. transfer effects. various reactions. role of pressure characteristics of fluidised bed reactors, parameters. Kunni Leva model, role of emission phase. wake. diameter of bubble. application of FBR for acrylonitrile production.
- Unit V : Packed bed reactors, multitubed reactors. phthalic anhydride production in multi tubular bed reactor. Details of slurry bed reactor, heat and mass transfer. effects in slurry reactors. problems of catalyst and product separation.
- Unit VI : Reactor design aspects for production of PP, PE, Styrene. Problems of agitation. viscosity rise, mass transfer and heat transfer, power requirement.
Reactor design for alkylator. cooling systems. agitation and product separation.
Recent development in the field.

Practicals : Based upon the Theory

BOOKS RECOMMENDED (FOR REFERENCES):

1. J.M.Smith : Chemical Engineering Kinetics. 2nd Edn.. McGraw Hill. Latest Edition. .
2. Octave Levenspiel : Chemical Reaction Engineering, Wiley Eastern. Latest Edition. .
3. C. G.Hill. Jr. : An Introduction to Chemical Engineering and Kinetics and Reactor Design. John Wiley; Latest Edition.
4. J.J.Carbery : Chemical and Catalytic Reaction Engineering. McGraw Hill. Latest Edition.
5. A. R. Cooper and G. V. Jeffreys: Chemical Kinetics and Reactor Design Oliver and Boyd. Edinburgh. Latest Edition.
6. J.M.Coulson. J.F.Richardson & D.G.Peacock: Chemical Engineering. Vol III, ELBS, Latest Edition.
7. K.B.Denbig & I.C.Turner: Chemical Reactor Theory. 2nd Edition, Cambridge University Press, Latest Edition.
8. O.A.Houghen and K.M.Watson: Chemical Process Principles. Part-III Kinetics and Catalyst: John Wiley - Latest Edition.

SPECIAL TECHNOLOGY-IV**7 PT03 PULP AND PAPER TECHNOLOGY-IV
(STOCK PREPARATION)**

Introduction. beating. refining. factors affecting bealing. equipments used in stock preparation such as peaters.,refiners, pulpers etc. consistency regulators, stock proportioners, chest and agitators. pums stock preparation systems for main grades of paper. board and tissue.

Internal Sizing of Paper : Introduction. application of internal sized papers, chemistry of internal sizing, wettability and contact angle materials used for internal sizing. size requirements for different pulps, factors detrimental to internal sizing.

Filling and loading: Definations. influence of loading. on physical properties of paper. adverse effects of fillers. properties of fillers. preparation of fillers. theories of fillers retention.

Colouring of Paper : Colour measuring instrument. shades of colour, colouring materials. dyes and pigments and fluoroscent brightening agents. dyeing of paper, colour selection and dye fonnula.

Special Additives: Introduction wet end adhesives. use of starches, gums, and synthetic resins in paper making, wet strength, papers, chemistry of wet strength process, mechanism of wet strength, retention of resins, curring of wet strength resin, Water and water reuse.

Recent development in the field.

BOOKS RECOMMENDED:

1. Pulp and Paper: Science and Technology Vol- II by C.E.Libby
2. Pulp and Paper Manufacture, 2nd Edn., Vol.-II by Mac Donald McGraw Hill
3. Pulp & Paper: Chemistry and Chemical Technology Erd, Edn. Vol-III by James Casey.
4. óHand Book of Pulp and Paper Technologyô by K.N.Britt

PULPAND PAPER TECHNOLOGY - PRACTICAL- III

Analysis of Paper-Moisture content, ash content, cold water and hot water extractibles, determination of copper number, Determination of rosin size, Alpha Cellulose content etc.

**7 CT04 PROFESSIONAL ELECTIVE -I
(1)CORROSION ENGINEERING**

Corrosion, direct, two stage attack, electrochemical attack, Environment conditioning. Higher corrosion resistance through proper selection of material, Isolation of corrosion, prone materials from destructive environment, Technologies of anodisation. enamelling, rubber lining, glass lining, refractory lining, painting and other surface protective measures. Corrosion Engineering in special applications such as material transport,

pumping, filtration, condensation, boiling, rivetting welding. high temperature environments, electrochemical environmental etc. Cost factor in competitive corrosion prevention/inhibition techniques.

BOOKSRECOMMENDED;

1. Uhilig, H.H.ôCorrosion and Corrosion Controlô, John Wiley and Sons Latest Edition.
2. Bullar G. and Ison HC. KCorrosion and its Prevention in Watersô, Leonard Hill-London Latest Edition.
3. Maslov, P, ôChemical Materials for Constructionô Structures Publishing Co. Latest Edition.
4. Fontane, M.G. and Greehnee. N.D. ôCorrosion Engineeringô Mc Graw Hill Latest Edition.
5. Payne, H.F., ôOrganic Coatings Technologyô John Wiley and Sons.
6. Rajgopalan, K.S.Corrosion and its Preventionô, Chemical Engineering Education Development Centre, I.I.T. Madras

**7CT04 PROFESSIONAL ELECTIVE -I
(2)POLYMER SCIENCE AND TECHNOLOGY****SECTION -A**

UNIT-I: Introduction - Definitions and concepts, polymerisation reactions, polymer structure, functionality and degradation, Characterisation of polymers. (7)

UNIT-II: Different types of polymers - natural and modified natural products, synthetic polymers, addition and condensation products and their preparations. (7)

UNIT-III: Methods of polymerisation - mass, solution, emulsion and suspension polymerisation processes, reactions and equipments used. (7)

SECTION - B

UNIT-IV: Polymer processing - Moulding, cold and hot compression moulding, injection and jet type moulding, extruding, calendaring and skiving. (8)

UNIT-V: Polymer processing - sheet forming, atmospheric and fluid pressure forming, lamination and impregnating. (8)

UNITVI: Polymer processing - coating, expanding, casting, embedding, spinning and finishing. (8)

TEXT BOOKS:

1. Fred.W.Billmeyer, ôText Book of Polymer Scienceô, John Wiley and sons, 1980.

2. V.R.Gowarikar, óPolymer Scienceô, New Age International, Second Edition, 2006

REFERENCE BOOKS:

1. David J. Williams, óPolymer Science and Engineeringô, Prentice Hall, 1971
2. Stanley Middleman, óFundamentals of Polymer Processingô, McGraw Hill, 1977
3. Herman S. Kaufman and Joseph J Falcetta, óIntroduction to Polymer Science and Technologyô, John Wiley and sons, 1977
4. Rakesh K.Gupta and Anil Kumar, óFundamentals of Polymersô, International edition, 1998

7 CT04

PROFESSIONAL ELECTIVE -I

(3) MAN MADE FIBER TECHNOLOGY

- 1) Classification of fibres: Types of natural fibers. man made fiber, synthetic fibers count, denier text, staple fibers, filament fiber, physical properties of fiber.
- 2) Degree of polymerization, cellulose and its properties, molecular weight, preparation and properties of cellulose acetate and rayon viscose and cuprammonium.
- 3) Preparation and properties of polyester, terylene, nylon and polyamide.
- 4) Preparation and properties of synthetic fiber carbo chain type. Polyvinyl, polypropylene and polyacrylonitrile.
- 5) Introduction to yarn spinning and testing of man made fiber.
- 6) Introduction to fabric forming by weaving process related to man made fiber.

BOOKS RECOMMENDED:

1. Textile Fibre by Mancrill
2. Textile Fibre by Murthy
3. Textile Fibre and their use by Hess
4. Physical Property of Textile Fibre by Norton & Hearle

7 CT04

PROFESSIONAL ELECTIVE -I

(4) INDUSTRIAL WASTE TREATMENT

SECTION - A

- Unit-I : Environment, pollution, pollutant, Zero pollution, production waste, consumption waste, by product waste salvageable waste, types of pollution causes by wastes, greenhouse effect, Acid rains, Causes of acid rains, effects. Chlorofluorocarbon, application of CFCs in industry, role of CFCs in depletion atmospheric ozone. Other effects of air

pollution. Agencies working on pollution control, their constitution, ageing of lakes and reservoirs, thermal stratification of lakes and reservoirs. example of wasteless processing.

- Unit-II : Legislations of Environment protection, Indian standards for drinking water, effluent discharge, Indian Standard Codes for disposal of Wastes, Micro-organisms present in water, water borne diseases, determination of the dissolved solids, suspended solids, turbidity, pH, conductivity, DO, BOD by direct method & dilution method, COD sampling methods, Sampling procedures and precaution.

- Unit-III : General Treatment: Screening and grease removal, Neutralization, Proportioning, Chemical Coagulation, Sedimentation, filtration.

Biological Treatment: Kinetics of Biological growth, various suspended and attached growth processes for the treatment of industrial effluent.

Advanced Waste Water Treatment : Ion exchange, Activated carbon adsorption, Electro dialysis, Reverse Osmosis. Disinfection of Water: Sterilization and methods for disinfection.

Sludge Disposal: Various alternatives for Sludge disposal.

SECTION-B

- Unit-IV : Solid waste management, land pollution, composting, land filling, incineration, types of hazardous waste, treatment of hazardous waste, sources of radioactive wastes, treatment of radioactive waste. effects of radiations. Rewashable and recyclable solid waste, recycling in chemical industries.

- Unit-V : Removal of particulated matter, comparative study of method employed e.g. cyclones, bag filters, precipitators, scrubbers, collectors etc., Pollutions control for fly ash, combustion and gasification plants. Various process for reducing SOx, NOx emissions.

- Unit-VI : Waste management for industries like Food Industry Dairy Industry, Sugar Mill, Fertilizer, Pulp and Paper. Sulphonic acid, Cement, Tanneries.

Case studies and corrective measures taken in industry to prevent environmental hazards.

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED:

- 1) Dr.S.P.Mahajan : Environmental Pollution Control
- 2) Matcaff and Eddy : Waste Water Treatment
- 3) Rao & Datta : Waste Water Treatment
- 3) V. V. Kafarov : Wasteless Chemical Processing

7 OT05 SPECIAL TECHNOLOGY PAPER-V
OIL & PAINT TECHNOLOGY
(TECHNOLOGY OF SURFACE COATINGS)

Convertible and non-convertible coatings: Chemical nature of coatings and their properties. Natural synthetic resin.

Chemistry of drying, Semi-drying and non-drying oils, chemistry and mechanism of heat and drying. Manufacture of synthetic drying oils, Processes and Plants employed in refining of drying oils.

Their manufacture and properties. Vents, diluents and thinners: Definition types of solvents and their properties.

Chemistry and tech.of resins: Natural and synthetic resins.

Pigment and extenders: Pigmentary properties and evaluation of pigments. General outlines of the methods of the manufacture of pigments. Properties and uses of important pigments. Organic pigments and colours.

Formulation of paints: Printing inks, leaques, varnishes and linoleum. Methods of manufacture of paints, printing inks, and leaques, I.S.1. methods for evaluation of paints and printing inks.

Recent development in the field.

BOOKS RECOMMENDED:

1. Outline of Paint Tech. - H.Hea
2. Organic Coating Tech. - H.R.Payne
3. Introduction to Drying Oil Tech. - A.R.Mills
4. Paint and Varnish Manufacture - H. W. Chatfields
5. Treatise on Coatings - Myas and Long.
6. Printing Inks - C.Ellis, Rainhold PbL., New York, Latest Edition.
7. Nitrocellulose Ester Leaques - F.Zimmer
8. Paint Film Defects - M.Hers
9. Paint and Varnishes - A.S.Khanna
10. O.C.C.I. Paint Technology Manual (5 Volumes)
11. Tech.of Writting and Printing Inks, Small Business Publ.

7 FT05 SPECIAL TECHNOLOGY PAPER-V
FOOD TECHNOLOGY-V
(FOOD PROCESSING-II)
THEORY

Process Technology of Fruits and Vegetables - Pre and Post harvest changes in fruits and Vegetables, Storage, handing, and canning of fruits and Vegetables and their products. Technology of fruits and Vegetables Juices, purees, concentrates, jams, jellies, marmalades, preserves fruit butters, candied fruits, pickles etc.

Process Technology of Meat and Poultry : Live stock and poultry preparations, slaughter, cutting dressing and grading, Various cuts of meat. Post-mortem changes. Preservation and packing of meat, poultry and their products.

Quality control in processed meat and poultry products, Microbiological standards. By products of meat and poultry processing industries. Process technology of eggs and their products.

Process Technology of Fish and other Aquatic Foods: Sources, methods of fishing, handling and storage processing of fish and fish products. By products of fish processing. Fish oils, Standards of fish and fish products. Processing of other aquatic foods like crabs, frogs, molluscs etc.

Process Technology of Milk and Milk products: Composition of milk, processing, storage and distribution of milk, manufacture of cream, butter, ghee, evaporated, condensed and skimmed milk, whole and skimmed milk powder and other fermented milk products. Manufacture of cheese. Preparation of Indian milk products like Khoa Channa, curd and their products, Standards for milk products.

Process Technology of Beverages: Carbonated Beverages. Fruit Juices, and R.T.S. beverages. Alcoholic Beverages. Quality control.

Packaging: Functions of packaging materials, Rigid and flexible packages, Metallic, glass and plastic containers. Laminated packaging. Requirement of packaging for specific products. Testing of packaging materials. Biodegradable packaging. Quality Attributes of Foods and their Evaluation. Flavour, aroma and texture of foods. Food additives. Spices and condiments. Contamination in foods.

Food Adulteration and Food Laws: PFA and FPO rules, ISI and Agmark standards.

Recent development in the field.

BOOKS RECOMMENDED:

1. Preservation of Fruits and Vegetables by Girdharilal and Siddappa,

- G.S. Published by Indian Council and Agricultural Research, New Delhi, Latest Edition.
2. Fruits and Vegetable Juice Processing Technology Edited by Treassler, D.K. and Jonslyn, M.A., Published by the AVI Publishing Co., Inc. Westport, Connecticut, Latest Edition.
3. Practical Canning by Lock A., Published by Foods Trade Press Ltd., 7 Garrick Street, W.C.2, London Latest Edition.
4. The Meat Hand book by Levie A, Published by the AVI Publishing Co., Inc. Westport, Connecticut, Latest Edition.
5. The Science of Meat and Meat Product, Edited by Price, J.F. and Schweigert, B..S. Published by W.H. Freeman and Company, San Francisco, Latest Edition.
6. Poultry Products. Technology by Mountney, G.J., Published by the A VI Publishing Co., Inc. Westport, Connecticut, Latest Edition.
7. Fishery By-products Technology by Brody, J., Published by the A VI Publishing Co., Inc. Westport, Connecticut, Latest Edition.
8. Fish and Food Vols. 1,11,11I & IV Edited by Brog traom. G, Published by Academic Press, New York and London, Latest Edition.
9. Processed Cheese Manufacture by Dr. Meyer A.. Published by Food Trade Press, London, Latest Edition.
10. Drying of Milk and Milk Products by Hall. C. W. and Hendrick, T.I., Published by the AVI Publishing Co., Inc. Westport, Connecticut, Latest Edition.
- 11.. Modern Dairy Products by Lampert, I.M., Published by Eurasia Publishing House, (P) (Ltd.), Ram Nagar, New Delhi - 110055, Latest Edition.
12. By products from Milk by Webb, B.H. and Whittier, E.O., Published by the A VI Publishing Co., Inc. Westport, Connecticut, Latest Edition.
13. The Chemistry and Testing of Dairy Products by New Lander, J.H. and Atherton, H. V., Published by Olsen Publishing Co., Milwaukee Wisconsin, Latest Edition.
14. Food Adultration by Jacob, T., Published by the Mac-Millan & Co. of India, Ltd., Latest Edition.
15. The Spice Handbook of Parry, J. W., Published by Chemical Publishing Co., New York, Latest Edition.
16. Meat Technology by Gerrard F., Published by Deonord Hill, London Latest Edition.
17. Radiation Technology by Desrosier, N. W., Published by the AVI, Publishing Co., INC, (1960)

18. Symposium: Processing Agricultural and Municipal Wastes, Edited by Inglett, C.E., Published by the AVI Publishing Co., Inc., Latest Edition.
19. Introduction of Waste Water Treatment Processes by Ramalho, R.S., Published by Academic Press, New York, Latest Edition.
20. Processed Plant Protein Food Stuffs, Edited by Aultschul, A.M., Published by Academic Press, London, Latest Edition.
21. Chemistry of Food Packaging by Swalam, C.M., Published by American Chemical Society, Washington D.C., Latest Edition.
22. Packaging by Newbaner, R.G., Published by Van Nostrand, Reinhold Co., New York, Latest Edition.

7 PC 05 SPECIAL TECHNOLOGY PAPER-V
PETROCHEMICAL TECHNOLOGY-V
PETROCHEMICAL INDUSIRY
THEORY

A state of the art account typically of the following with emphasis in increasing order of depth, wherever possible on 1) routes possible, 2) Stochiometry reaction, mechanism and flow sheet, 3) history, economics and future trends, 4) qualitative discussion of physico-chemical and chemical engineering principles involved and engineering problems encountered in the more favoured route.

Defination of a petrochemical; source materials for manufacture of chemicals from hydrocarbons individual compounds and mixtures; Manufacture of major olefin building block -ethylene, propylene, butadiene etc. Manufactures of BTX aromatics, naphthalene etc.

Production of acetylene, synthesis gas, hydrogen, sulphur, carbon black, Oxosynthesis.

Production of specific Hydrocarbon derivatives by hydrogenation, oxidation, hydration, alkylation, halogenation, sulphonation etc. As illustrated by benzene from cyclohexane; ethylene oxide, vinyl chlorides, acrylonitrile, phenol, DMT caprolatum, etc. Comparison of routes starting from paraffins, olefine, acetylene etc. Wherever possible.

Polymerisation - polyethylen, polypropylene, piktestersm bikibsm, acrylic fibres, synthetic rubbers etc.

Safety aspects, pollution control, energy saving etc. in a petrochemical plants, The petrochemical Industry in India.

Recent development in the field

BOOKS RECOMMENDED :

1. R.N.Shreve, J.A. Brink: Chemical Process Industries, 4th edition Mc Graw Hill, Kogakusha 1977, Chapter-38, Page 687.
2. J.A.Kent : Riegal's Handbook of Industrial Chemistry, 7th edn., Van. Nostrand Reinhold Co., 1974, Chapter 14, Page 402.

REFERENCE BOOKS :

1. Books 4 and 9 recommended under *Special Tech-III*, Petrochemical Technology
2. S.A.Miller : Acetylene, Vols. I & II, Ernest Benn. Latest Edition.
3. S.A.Miller : Ethylene and its industrial Derivatives, Ernest Benn., Latest Edition.
4. E.G.Nancock: Propylene and its Derivatives, Ernest, Bean, Latest Edition.
5. E.G.Nancock: Benzene and its Derivatives, Ernest Bean, Latest Edition.
6. S.B.Chandlia : Oxidation of Hydrocarbons, Sevak Publication, Latest Edition.
7. T.Dumas, W.Bulani : Oxidation of Petrochemicals, Chemistry and Technology, Applied Science, Latest Edition.
8. R.Long : Production of Polymer and Plastic Intermediates from Petroleum, Butterworths, Latest Edition.
9. Articles in Hydrocarbon Processing, Chemical Engineer, Oil & Gas Journal Etc. as recommended furthering the academic session.

7 PT05 SPECIAL TECHNOLOGY - V
PULP & PAPER TECHNOLOGY
THEORY

1. Paper and paper board Manufacture : Introduction auxiliary equipments, Centric leaners, Sand traps, centrifugal separators and various screens.
2. Paper making machines : Fourdrinier machine, history and development of fourdrinier, modern fourdrinier machine approach flow system, head box slice, types of slices, drainage and formation on fourdrinier machine.
3. Fourdrinier design and construction, miscellaneous equipments, twinwire formation of paper, Informer, various types of former.
4. Cylinder mold machine: Introduction, History of cylinder machine, Vat, stock entries, and preliminary press, rolls and ripples, cylinder machine felts.
5. Pick-up and press section: Section picks-up, pressing theory, felts press section arrangements, suction rolls, crown ling and open draw.

6. Dryer section: Function of dryer section, theories of drying, cylinder drying. air drying, radiant drying, auxiliary equipment, operations and control, performance calculations. cost and economics. Recent development in the field.

BOOKS RECOMMENDED :

1. Pulp and Paper Manufacture, 2nd edn., Vol.II, by B.Mac. Donald, Mc Graw-Hill.
2. Pulp and Paper, Science and Technology Vol-II, by C.E.Libby.
3. Handbook of Pulp and Paper Technology, by K. W.Britt.

SEMESTER-EIGHTH

8 OT01 SPECIAL TECHNOLOGY PAPER-VI
OIL & PAINT TECHNOLOGY

Technology of Waxes, Cosmetics and other Fat Based Products.

Waxes : Natural sources classification, Chemical composition, Extraction refining and processing of waxes, their modification and formulation. Synthetic waxes, properties, utilization, testing and evaluation of waxes.

Cosmetics. : Classification, manufacture and evaluation of cosmetic, preparation such as shampoos, shaving creams, lotions, toiletries and perfumery materials.

Other Fat based Products: Manufacture and utilization of nitrogen, phosphorous and sulphur containing compounds. Core oils, cutting oils, lubricants greases, plasticizers and products obtained by inter-esterification hydrogenation, oxidation and pyrolysis.

Fatty acids: Theory and practice of fat splitting and purification of products, Separation of fats and fatty acids and their applications in foods, pharmaceuticals, textile, plastics, leather and other industries.

Recent development in the field.

BOOKS RECOMMENDED :

- 1) The Chemistry and Technology of Waxes - A.H. Warth
- 2) Industrial Waxes - H.Benet (2 Volumes)
- 3) Fatty Acids and their Industrial Applications - E.S.Pattison
- 4) Industrial Oil and Fat Products - A.E.Bailey
- 5) Industrial Chemistry of Fats and Waxes - T.P.Hilditch.
- 6) Cosmetics Science and Tech. - W.Saggarrin
- 7) Perfumes, Cosmetics and Soaps - W.A.Poucher (Vol.-I, II, III)
- 8) Chemistry and Biochemistry of Natural Waxes - P.E.Kolattukudy.
- 9) Basics of Paint Technology, Part-I, V.C.Malshe, Meenal Sikchi, VICT, Mumbai.

8OT 05 OIL & PAINT TECHNOLOGY - IV - LAB

Analysis of butter, ghee, margarine, vanaspati, soap stock, sulphonated and oil spent lyes. Commercial fatty acids and glycerine. Evaluations of detergents. Analysis of fatty material by column thinlayer and gas liquid chromatography techniques. Analysis of mixture of oils and fats. Analysis of bye products and wastes. Preparation and, analysis of some industrially important fatty acids. Derivatives. Analysis of printing inks.

BOOKS RECOMMENDED FOR PRACTICALS:

- 1) Technical hand book of Oils, Fats and Waxes - P.J. Frayar and F.E. Weston (2 Volumes)
- 2) Analysis of Fats and Oils - V.C. Mehlenbacher.
- 3) Lab. handbook of Oils and Fat Analysis - D. V. Cock & c. Van Rede.
- 4) Analysis and Characterization of Oils, Fats and Fat Products : H.A. Boekennoogen.
- 5) Oils, Fat and Fatty Acids - Their Practical Exams: K.A. Williams
- 6) Synthetic Detergents, - A. Davidson
- 7) I.S.I. Method of Analysis of -
 - i) Oils and Fats No. - IS-548-1964.
 - ii) Soaps IS-286-195 I
 - iii) Oil Seeds and Oil Cakes -IS-I 714-1970, IS-4 I 15-1967
 - iv) Surface Active Agents - IS-5785-1970
 - v) Printing Inks - IS-693 1-1972
 - vi) Paints, Varnishes, and Pigments - IS-I 17-1964.
- 8) B.S.I. Methods of Analysis of Oils and Fats
- 9) Official and Tentative Methods of the American Oil Chemists Society, A.C.C.S. Publication.
- 10) Waxes - Natural and Synthetic - H. Bennet.
- 11) An Introduction to Drying Oil Technology- A.R. Mills
- 12) Thin layer Chromatography - Babbitt.
- 13) Bleaching Earths - M.K.H. Siddiqui
- 14) O.C.C.I. Paint Tech. manuals, Vol. V, the Testing of Paint
- 15) Cosmetics Science and Technology - W. Sassauin.

8 FT01 SPECIAL TECHNOLOGY PAPER-VI
FOOD TECHNOLOGY-VI
THFORY

Biochemical Engineering and Fermentation Technology : Metabolic pathways of micro organisms. Parameters for growth energy, carbon and nitrogen. Sources requirements and biomass, estimation, surface, submerged and solid state cultures. Kinetics of growth and structured growth models. Measurement of dissolved oxygen, mass transfer coefficient. Effect

of aeration and agitation, Kinetics of substrate utilisation. Product yield and biomass production, batch, plugflow and chemostat cultures, Scale up in fermenter design.

Types of fermenters. Designing and operation of fermentation equipment. Methods of aeration, agitation and sterilisation. Control of contamination in fermentors. Antifoam devices, auxiliary equipment an instrumentation, Product recovery.

Fermentation technology of alcohol, alcoholic beverages, vitamins, antibiotics, vinegar, organic acids, solvents. SCP, enzymes and other miscellaneous products. Specific metabolic transformation Hydrocarbon fermentations. Cultivation of algae, mushrooms and the starter culture.

Immobilised enzymes, methods of immobilisation, properties an applications of immobilized enzymes. Reactor design for immobilised enzyme Systems. Waste treatment, New special in fermentation technology.

Recent development in the field.

BOOKS RECOMMENDED:

1. Biochemical Engineering Fundamentals by Bailey, lame, E., Published by McGraw Hill Book Co., Latest Edition.
2. Advances in Biochemical Engineering. Vols. 1 to 6 Edited by Bhose, T.K. and Ficchter, A, Published by Springer Vorlag, Berlin, LLcid elberg NewYork, Latest Edition.
3. Biochemical and Biochemical Engineering, Science Vols. 1 to 2 Edited by Blakebrough, Published by Academic Press, London and New York, Latest Edition.
4. Industrial Fermentation, Vols. 1 & 2 By Under Kofler, L.A., Published by Chemical Publishing Co., INC, 212, Fifth Avenue, New York, Latest Edition.
5. Immobilized Enzymes, Antigens, Antibodies and Peptides, Vols. 1 & 2, 3 & 4 Edited by Weetal, H.H., Published by Marcel Decker, INC New York, Latest Edition.
6. Industrial Microbiology by Presscot and Dunn, Published by Me Graw Hill Book Co., INC, New York, Latest Edition.
7. Industrial Microbiology by Cas ida, L.E., Published by John Wiley and Sons, INC, New York, Latest Edition.

8 FT 05 FOOD TECHNOLOGY - VI- LAB (FOOD PROCESSING)

Preparation of fruit juices, squash, jam, jellies, concentrates, pickles etc. Canning of fruits and vegetable and their evaluation. Processing of meat, fish and dairy products. Dehydration of fruits and vegetables and their evaluation. Preparation of bakery products like bread, biscuits, cakes, crackers etc. Preparation and evaluation of confectionery products like hard and soft boiled candies, fruit candies, chikki, etc. Preparation of beverages.

Evaluation of Michaelis - menten constant. Determination of BOD, COD and dissolved oxygen by chemical and instrumental methods; potting of Do Sag profiles, Determination of K_L .

Production, recovery and control tests of the fermentation products like alcohols, organic acids, enzymes and antibiotics.

BOOKS RECOMMENDED :

1. Practical Baking by Sultan, W.J., The AVI Publishing Co., INC, Latest Edition.
2. Manufacture of Confectionary by an Industrialists, Industry Publishers Ltd., 22, R.G.Kar Road, Sham bazar, Calcutta.
3. The Chemical Analysis of Foods by Pemson, J.& A. Churchill Ltd., 404 Gloucester Place, London, W.L., Latest Edition.
4. Canned Foods by Baumgartner, L. & A. Churchill Ltd., 104, Gloucester place, Portman Square Latest Edition.
5. Preservation of Fruits and Vegetables by Girdharilal and Siddapa. Indian Council and Agricultural Research, New Delhi, Latest Edition.
6. Practical Canning by Lock, A., Food Trade Press Ltd.,
7. Garrick Street, W.C.2, London, Latest Edition.
7. Introduction to Waste Water Treatment Processes by Ramalho, R.S. Published by Academic Press, New York, Latest Edition.

8 PC 01 SPECIAL TECHNOLOGY PAPER-VI PETROCHEMICAL TECHNOLOGY - VI PETROCHEMICAL PROCESS ANALYSIS THEORY

Mathematical treatment, numerical problems etc. illustrating the physio-chemical and chemical engineering, principles, Process equipment design etc. pertaining to topics in the petroleum chemicals industry Petrochemical Technology- V (Theory) as exemplified by, the following.

Concept of equilibrium approach, criterion, kinetic severity, function safe conversion, etc., in liquid hydrocarbon mixture steam, cracking; calculation of number of tubes for propane cracking under operational conditions; parametric sensitivity in vapour phase catalytic reforming the simple smith model and the complete rare model; assessment of rate determining steps in oxosynthesis (liquid phase process) Naiglor, Natta catalysed Polymerisation of ethylene : calculations pertaining to dynamic sorption capacity Enso type Processes, Hypersorption : thermal problems in polymer storage etc.

Recent development in the field.

8 PC 05 PETROCHEMICAL TECHNOLOGY - VI-LAB REFINERY ENGINEERING

TBP distillation of petroleum fraction and construction of property midpercent, residue yield, distillate yield curves, Verification of ASTM, TBP, Correlations. Comparison of characteristics of bubble, packed column and mixer settler for extraction of acids from petroleum fractions into water, dilute alkali etc. Quantitative study of break through phenomena in adsorption of aromatics by silicagel.

8 PT01 SPECIAL TECHNOLOGY PAPER-VI PULP AND PAPER TECHNOLOGY (PROPERTIES AND TESTING OF PAPERS AND POLLUTION CONTROL)

1. Finishing of paper and board: Calendering, reeling and wrapping, winders. winding, super calendering, embossing.
 2. Surface treatment of paper and board: Definitions, objectives, general approaches, typical surface treatment processes. adhesives, by products.
 3. Insulating boards, hard boards, forming machines, dryers, fabrication and finishing.
 4. Wastewater treatment and air pollution control
 5. Analysis and testing: Introduction, test facilities. equipment. analysis and testing of pulp wood, wood pulps, paper and converted products.
 6. Energy conservation and capacity utilization in pulp and industry, hand made papers and speciality papers.
- Recent development in the field.

BOOKS RECOMMENDED :

1. Pulp and Paper Manufacture, 2nd edn. Vol-II. by B.Mac.Donald, McGraw Hill

2. Pulp and Paper, Science and Technology Vol-II, by C.E.Libby
3. Handbook of Pulp and Paper Technology. by K. W.Britt.

8 PT04 PULP AND PAPER TECHNOLOGY-VI- LAB

Processing of raw material, analysis of raw material and paper manufacturing, hand made paper manufacturing. Testing of Paper.

8 CT02 CHEMICAL REACTION ENGINEERING-II (REACTOR DESIGN)

SECTION - A

- Unit I** : Residence time distribution. Models for non-ideal flow.
- Unit II** : Mixing concept and models: Rate equation for Heterogeneous reactions, fluid particle reactions. Determination of rate controlling step. Application to Design.
- Unit III** : Fluid-Fluid reaction: The rate equation for different cases and application to design. 8 design.

SECTION - B

- Unit IV** : Heterogeneous processes, catalysis and adsorption/determination of surface area, void volume. Pore volume distribution catalyst preparation, promoters and inhibition catalyst reactivation.
- Unit V** : Rate equation for third solid catalytic reactions. Internal External transport process in Heterogeneous Reactions.
- Unit VI** : Design of Heterogeneous catalytic reactors, fixed bed reactors, isothermal & adiabatic fixed bed reactor, non-isothermal & non-adiabatic fixed bed reactor. fluidized bed, Drickler bed, slurry reactor.

BOOKS RECOMMENDED:

1. Chemical Reaction Engineering, Octave Levenspiel, Wiley Eastern Ltd.
2. Chemical Engineering Kinetics, Smith J.M., Mc Graw Hill.
3. Elements of Chemical Reaction Engineering - H.Scott Fogler, Prentice Hall.
4. Chemical Reactor Analysis & Design, Gilbert F Froment & Kenneth B Bischoff, John Wiley & Sons.
5. Chemical Reactor Design, Vol I & II, M W.Rase.

8 CT03 PLANT DESIGN & PROJECT ENGINEERING SECTION-A

INTRODUCTION - Basic Considerations in Chemical Engg. plant design.

- Unit I** : Project identification, Preliminary techno economic feasibility, Process design aspects selection of process, factors affecting process selection. importance of laboratory development pilot plant, scale up methods. safety factors, Types of flow diagrams.
- Unit II** : Detection of process equipments - standard vs. special equipment, materials of construction for process equipments. selection criteria. specification sheets.
- Unit III** : Process auxiliaries - piping design. layout. supports for valves, process control & instrumentation control system design.
Process utilities - process water, Boiler feed water, water treatment, waste treatment & disposal, oils heating systems. Chilling plant. compressed air & vacuum. Plant location & layout-Factors affecting both planning of layout. principles of plant layout, Use of scale methods.

SECTION - B

- Unit IV** : Cost estimation - factors involved in project cost estimation. Total capital investment, fixed capital & working capital. methods of estimation of investment.
Estimation of equipment cost production factors.
Estimation of total product cost - factors involved in estimating. Depreciation - types of methods of determination depreciation. evaluation of depreciation methods.
- Unit V** : Profitability, alternative investments & replacements, methods for profitability evaluation. practical factors in alternative & replacement investment.
- Unit VI** : Economic considerations in process & equipment design, inventory control, Scheduling a project using CPM/PERT methods, project management. Option design, general production rates in plant operation.
Optimum conditions, optimum production rates in plant operation, optimum conditions in cyclic operation.

BOOKS RECOMMENDED:

1. Plant Design & Economics for Chemical Engineering By M.S. Peters & K.D.Timmerhaus, McGraw Hill (Japan), 2nd Edition, Latest Edition.
2. Chemical Engg. Plant Design: F. C. Vibbrandt & C.E.Dryden, McGraw Hill (New York), Latest Edition.

**PROFESSIONAL ELECTIVE-II
(1) BIOCHEMICAL ENGINEERING**

Scope and possibilities. characteristics and classification of biological matter, kinetics of microbial growth. balance equations for batch and cultures, kinetics of enzyme catalysed reactions. Analysis of mixed microbial populations. Design and analysis of biological reactors. Production, isolation and utilisation of enzymes. Transport phenomena in biological systems.

BOOKS RECOMMENDED:

1. Aiba, A.E. Humphrey, N.F. Mills: Biochemical Engineering, Academic Press, New York. Latest Edition.
2. J.E. Bailey, D.F. Oltes : Biochemical Engineering Fundamentals, Mc Graw Hill, Latest Edition.
3. B.A. Tinkson : Biochemical Reactors, Pion Ltd. London, Latest Edition.

**PROFESSIONAL ELECTIVE-II
(2) PETROLEUM PROCESSING ENGINEERING**

Introduction to petroleum industry. World petroleum resources, petroleum industry in India. Origin, exploration, drilling and production of petroleum crudes, Transportation of crudes and Products. Crude pretreatment- Composition and classification of crudes. Methods of evaluation; ASTM, TBP and EFV distillation. Properties and specifications of petroleum products such as LPG, gasoline, naphtha kerosene, Diesel, oils, lubricating oils, waxes and the like.

Separation processes:

Design and operation of topping and vacuum distillation units. Tubes still furnaces Solvent extraction processes for lube oil base stocks and for aromatics from naphtha and kerosene streams, solvent dewaxing Conversion Processes.

Thermal cracking, visbreaking and cooking processes. catalytic Cracking reforming, hydroprocessing alkylation, polymerisation and isomerisation, Safety and pollution considerations in refineries.

BOOKS RECOMMENDED:

1. Nelson, W.L. : Petroleum Refinery Engineering, Mc Graw Hill.
2. Hobson G.D., Phil, W. : Modern Petroleum Technology, Halsted Press, Division of Wiley Eastern.
3. Guthrie V.B.: Petroleum Products Handbook, McGraw Hill.
4. Kobew K.A., McKetta, J.J. : Advances in Petroleum Chemistry and Refining, Interscience.

**PROFESSIONAL ELECTIVE-II
(3) FUEL TECHNOLOGY**

SECTION -A

- Unit I Comparison of various sources of energy. Alternatives to non-renewal sources. Characteristics and distribution, production and total deposits of coal and petroleum in India. Classification of Fuels Classification of Coal. Formation of Coal (coking process).
- Unit II Analysis of coal. Proximate and ultimate analysis. Significance of analysis. Rank of coal relation with moisture, ash, volatile matter. Reporting of coal analysis. Significance, composition of ash and mineral matter. Properties and testing of coal, Calorific value (Gross and net), Bomb calorimeter, Boy's gas calorimeter, weathering index, swelling index, caking index. Grindability Index, specific gravity. Theoretical computations of calorific value.
- Unit III Testing of oils, viscosity, flash point, pour point, aniline point, carbon residue, Diesel index, octane and cetane number moisture content. Preparation of raw of mine coal. Washing of coal, washability curves. methods of coal washing, coal washeries in India, Gravity separation, float and sink test Efficiency of coal washing.

SECTION - B

- Unit-IV Carbonisation. Physical and chemical changes, high and low temperature carbonisation. Modern developments in design of coke ovens. Recovery of by products, Tar distillation, Blending of coals. Fuel economy in steel plants. Properties of metallurgical coke. Straight run distillation of crude oil. Thermal transfer and catalytic cracking. Polymerisation alkylation and isomerisation.
- Unit-V General principles of combustion. Combustion of grates, mechanical stokers, combustion of pulverised coal, Suspended bed and fluidised bed combustion. Problems in combustion based on mass and heat transfer with chemical reaction..
- Unit-VI Gasification of coal. First and second generation gasifiers. Design of gasifier. Fixed and fluidised bed suspended gasifiers. Koppa Totrek, Lurgi Winkler Hygas process. Orsat gas analysis, Producer gas and sewage gas. Synthesis gas and its uses. Under ground gasification of coal.

BOOKS RECOMMENDED:

1. Fuels and Combustion : Samir Sarkar
2. Fules Fumaces and Refractories : O.P.Gupta
3. An Introduction to Study of Fuel : J C Marrae.
4. Fuels: J Francis
5. Fuels and Furnaces : Brame and King
6. Fuels : Huslam & Russel

8 CT06**PROJECT AND SEMINAR**

Each student is required to prepare and submit either a typed review of about 6000 words 011 the recent literature OR a typedlhand written account of a critical study of a recent mathematical treatment pertaining to topics of current interest. in the branch of special technology choosen or related topics. The review/account press to be presented as a lecture by the student to be followed by discussion.

PROJECT WORK

A student or a group of students, not exceeding three, is required to prepare and submit typed reports of a quantitative study including material energy balances. process equipment design etc. of any modem processing unit or units in the brance, of special technology choosen. The study may be based on calculations made using literature data.

OR a student or the group has to carry out experiemental investigation of a research problem of interest in the branch of special technology chQosen under the guidance of a teacher in the special technology branch chosen and submit typed reports.
