# संत गाडगे बाबा अमरावती विद्यापीठ
## SANT GADGE BABA AMRAVATI UNIVERSITY

**(Faculty of Engineering & Technology)**

## PROSPECTUS
### Prescribed for
### Four / Five Year Degree Course
### Bachelor of Engineering Sem-VII,VIII
### / Bachelor of Architecture Sem-VII-X
### (CREDIT GRADE SYSTEM)

**BRANCHES**

1) Civil Engineering
2) Mechanical Engineering
3) Electrical Engineering (Electronics & Power)
4) Electrical and Electronics Engineering
5) Electrical Engineering (Electrical & Power)
6) Electrical Engineering
7) Architecture
8) Information technology
10) Biomedical Engineering

2013

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# SANT GADGE BABA AMRAVATI UNIVERSITY

## SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

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

| | | |
|---|---|---|
| Ordinance No. 109 | : | Recording of a change of name of a University student in the records of the University. |
| Ordinance No. 5/2010 | : | 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 boradly 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 Honøble 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 pere 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 Enginering & 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 õSchemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Enginering & 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 Enginering | B |
| 3) Production Engineering | C |
| 4) Electrical Engineering (Electronics & Power) | D |
| 5) Electrical and Electronics Engineering | E |
| 6) Electrical Enginering (Electrical & Power) | F |
| 7) Electrical Enginering | 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

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

### SEMESTER- SEVENTH

Appendix - A

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | MAX. MARKS EXTERNAL | MAX. MARKS INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | | | | | | |
| 01 | 7CE01 | Theory of Stuctures-II | 3 | 1 | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 02 | 7CE02 | Geotechnical Engineering-II | 3 | 1 | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 03 | 7CE03 | Structural Design-II | 4 | - | - | 4 | 4 | 4 | 80 | 20 | 100 | 40 | - | - | - | - |
| 04 | 7CE04 | Environmental Engineering-I | 4 | - | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 05 | 7CE05 | Professional Elective-I | 4 | - | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| **PRACTICALS / DRAWING / DESIGN** | | | | | | | | | | | | | | | | |
| 06 | 7CE06 | Theory of Stuctures-II - Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 07 | 7CE07 | Geotechnical Engineering-II - Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 08 | 7CE08 | Structural Design-II - Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 09 | 7CE09 | Project & Seminar | - | - | 2 | 2 | 4 | - | - | - | - | - | - | 50 | 50 | 25 |
| | | **Total** | 18 | 2 | 8 | 28 | 27 | | | | 500 | | | | 200 | |
| | | | | | | | | | | | | **GRAND TOTAL : 700** | | | |

Professional Elective-I (i) Advanced Water Treatment (ii) Advanced Geotechnical Engineering (iii) Water Power Engineering (iv) Prestressed Concrete (v) Artificial Neural Network & Fuzzy Logic (vi) Advanced Concrete Technology (vii) Environmental Pollution & Rural Sanitation (viii) Advanced Earthquake Engineerig

### SEMESTER : EIGHTH

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | MAX. MARKS EXTERNAL | MAX. MARKS INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | | | | | | |
| 01 | 8CE01 | Water Resources Engineering-II | 3 | - | - | 3 | 3 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 02 | 8CE02 | Environmental Engineering-II | 3 | - | - | 3 | 3 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 03 | 8CE03 | Project Planning & Management | 3 | - | - | 3 | 3 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 04 | 8CE04 | Professional Elective-II | 4 | - | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| **PRACTICALS / DRAWING / DESIGN** | | | | | | | | | | | | | | | | |
| 05 | 8CE05 | Water Resources Engineering-II-Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 06 | 8CE06 | Environmental Engineering-II - Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 07 | 8CE07 | Project & Seminar | - | - | 6 | 6 | 12 | - | - | - | - | - | 75 | 75 | 150 | 75 |
| | | **Total** | 13 | | 10 | 23 | 27 | | | | 400 | | | | 250 | |
| | | | | | | | | | | | | **GRAND TOTAL : 650** | | | |

Professional Elective-II *(i) Advanced Design of Steel Structures (ii) Advanced Waste Water and Industrial Waste Treatment (iii) Finite Element Method (iv) Dam Engineering (v) Advanced Engineering Geology (vi) Matrix Computer Analysis of Structures (vii) Advanced Structural Analysis (viii) Rock Mechanics *(ix) Advanced Design of RCC Structures
* PAPER 4 HOURS DURATION.

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

**SEMESTER - SEVENTH**  Appendix - B

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hrs.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 7ME01 | Machine Design & Drawing-II | 3 | - | - | 3 | 3 | 4 | 80 | 20 | 100 | 40 | - | - | - | - |
| 02 | 7ME02 | Energy Conversion-II | 3 | 1 | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 03 | 7ME03 | Industrial Management and Costing | 3 | 1 | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 04 | 7ME04 | Automation Engineering | 3 | 1 | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 05 | 7ME05 | Professional Elective-I | 3 | 1 | - | 4 | 4 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 06 | 7ME06 | Project & Seminar | - | - | 2 | 2 | 4 | - | - | - | - | - | - | 50 | 50 | 25 |
| 07 | 7ME07 | Machine Design & Drawing-II-Lab. | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 08 | 7ME08 | Energy Conversion-II-Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 09 | 7ME09 | Automation Engineering-Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 10 | 7ME10 | Professional Elective-I - Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| | | Total | 15 | 4 | 10 | 29 | 27 | | | | 500 | | | | 250 | |

GRAND TOTAL : 750

Professional Elective-I (1) Non Conventional Energy System (2) Tool Engineering (3) Artificial Intelligence & Expert Systems (4) Mechatronics

**SEMESTER : EIGHTH**

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hrs.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 8ME01 | Elective-II | 3 | - | - | 3 | 3 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 02 | 8ME02 | Elective-III | 3 | - | - | 3 | 3 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 03 | 8ME03 | I.C. Engines | 3 | - | - | 3 | 3 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| 04 | 8ME04 | Opertaions Research Techniques | 3 | - | - | 3 | 3 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 05 | 8ME05 | Project & Seminar | - | - | 6 | 6 | 12 | - | - | - | - | - | 75 | 75 | 150 | 75 |
| 06 | 8ME06 | Professional Elective-III-Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 07 | 8ME07 | I.C. Engines-Lab | - | - | 2 | 2 | 1 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| 08 | 8ME08 | Opertaions Research Techniques-Lab | - | - | 2 | 2 | 2 | - | - | - | - | - | 25 | 25 | 50 | 25 |
| | | Total | 12 | - | 12 | 24 | 27 | | | | 400 | | | | 300 | |

GRAND TOTAL : 700

Professional Elective-II (1) Automobile Engineering (2) Production Planning & Control (3) Management Information Systems (4) Advanced Manufacturing Systems
Professional Elective-III 1) Refrigeration & Air Conditioning 2) Machine Tool Design 3) Finite Element Methods 4) Robotics

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

### SEMESTER - SEVENTH

**Appendix - C**

| Sr. No. | Subject Code | Subject | TEACHING SCHEME | | | | | EXAMINATION SCHEME | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOURS / WEEK | | | Total HOURS/WEEK | CREDITS | THEORY | | | | | PRACTICAL | | | |
| | | | Lecture | Tutorial | P/D | | | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | MAX. MARKS | | TOTAL | MIN. PASSING MARKS |
| | | | | | | | | | | | | | EXTERNAL | INTERNAL | | |
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 7EP01 | Control System II | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 7EP02 | Power System Operation & Control | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 7EP03 | Electrical Power - II | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 7EP04 | Switchgear & Protection | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 05 | 7EP05 | Professional Elective - I * | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 06 | 7EP06 | Project & Seminar | _ | _ | 2 | 2 | 4 | _ | _ | _ | _ | _ | 0 | 50 | 50 | 25 |
| 07 | 7EP07 | Electrical Power - II- Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 08 | 7EP08 | Switchgear & Protection- Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| | | TOTAL | 20 | _ | 6 | 26 | 26 | | | | 500 | | | | 150 | |

**TOTAL 650**

* Professional Elective - I 1] Process Control System  2] Computer organisation  3] Computer Methods in Power System Analysis  4] Artificial Intelligence

### SEMESTER - EIGHTH

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 8EP01 | Power System Stability | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 8EP02 | High Voltage Engineering | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 8EP03 | Digital Signal Processing | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 8EP04 | Professional Elective - II** | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 05 | 8EP05 | Project & Seminar | _ | _ | 6 | 6 | 12 | _ | _ | _ | _ | _ | 75 | 75 | 150 | 25 |
| 06 | 8EP06 | Digital Signal Processing- Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| | | TOTAL | 14 | 0 | 8 | 22 | 27 | | | | 400 | | | | 200 | |

**TOTAL 600**

** Professional Elective - II   1] Electric Drives & Control   2] Power Quality   3] Embedded Syatems   4] Generalised Machine Theory

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

### SEMESTER- SEVENTH

Appendix- D

| Sr. No. | Subject Code | Subject | TEACHING SCHEME | | | | | EXAMINATION SCHEME | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOURS / WEEK | | | Total HOURS/WEEK | CREDITS | THEORY | | | | | PRACTICAL | | | |
| | | | Lecture | Tutorial | P/D | | | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | MAX. MARKS | | TOTAL | MIN. PASSING MARKS |
| | | | | | | | | | | | | | EXTERNAL | INTERNAL | | |
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 7EX01 | Utilisation of Electrical Energy | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 7EX02 | Electronic Communication | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 7EX03 | Computer Organisation | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 7EX04 | Power Electronics - II | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 05 | 7EX05 | Professional Elective - I * | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 06 | 7EX06 | Project & Seminar | _ | _ | 2 | 2 | 4 | _ | _ | _ | _ | _ | _ | 50 | 50 | 25 |
| 07 | 7EX07 | Utilisation of Electrical Energy-Lab. | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 08 | 7EX08 | Computer Organisation-Lab. | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 09 | 7EX09 | Power Electronics - II-Lab. | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| | | TOTAL | 20 | _ | 8 | 28 | 27 | | | | 500 | | | | 200 | |

TOTAL 700

* Professional Elective - I    1] Process Control System    2] Power System Simulation    3] High Voltage Engineering    4] Wind Electrical Systems

### SEMESTER : EIGHTH

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 8EX01 | Power System Operation & Control | 3 | | | 3 | 3 | 3 | 80 | 20 | 100 | 40 | | | | |
| 02 | 8EX02 | Switchgear & Protection | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 8EX03 | Embedded Systems | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 8EX04 | Professional Elective - II** | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 05 | 8EX05 | Project & Seminar | _ | _ | 6 | 6 | 12 | _ | _ | _ | _ | _ | 75 | 75 | 150 | 25 |
| 06 | 8EX06 | Embedded Systems-Lab. | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| | | TOTAL | 14 | _ | 8 | 22 | 27 | | | | 400 | | | | 200 | |

TOTAL 600

** Professional Elective - II   1]Power System Management   2] Fuzzy Logic & Control   3] RPC & Facts Controller    4]  Power Quality

# FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
## BRANCH - ELECTRICAL ENGINEERING (ELECTRICAL & POWER) - SEMESTER PATTERN (CREDIT GRADE SYSTEM)

**Appendis - E**

## SEMESTER - SEVENTH

| Sr. No. | Subject Code | Subject | TEACHING SCHEME | | | | | EXAMINATION SCHEME | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOURS / WEEK | | | Total HOURS/WEEK | CREDITS | THEORY | | | | | PRACTICAL | | | |
| | | | Lecture | Tutorial | P/D | | | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | MAX. MARKS | | TOTAL | MIN. PASSING MARKS |
| | | | | | | | | | | | | | EXTERNAL | INTERNAL | | |
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 7EL01 | Control System II | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 7EL02 | Power System Operation & Control | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 7EL03 | Electrical Power - II | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 7EL04 | Switchgear & Protection | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 05 | 7EL05 | Professional Elective - I * | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 06 | 7EL06 | Project & Seminar | _ | _ | 2 | 2 | 4 | _ | _ | _ | _ | _ | 0 | 50 | 50 | 25 |
| 07 | 7EL07 | Electrical Power - II-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 08 | 7EL08 | Switchgear & Protection-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| | | TOTAL | 20 | _ | 6 | 26 | 26 | | | | 500 | | | | 150 | |
| | | | | | | | | | | | | | | TOTAL | 650 |

*Professional Elective - I  1] Process Control System  2] Wind Electric Systems  3] Computer Methods in Power System Analysis  4] Artificial Intelligence*

| | | | | | | | | Semester : Eighth | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 8EL01 | Power System Stability | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 8EL02 | High Voltage Engineering | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 8EL03 | Digital Signal Processing | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 8EL04 | Professional Elective - II** | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 05 | 8EL05 | Project & Seminar | _ | _ | 6 | 6 | 12 | _ | _ | _ | _ | _ | 75 | 75 | 150 | 25 |
| 06 | 8EL06 | Digital Signal Processing Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| | | TOTAL | 14 | _ | 8 | 22 | 27 | | | | 400 | | | | 200 | |
| | | | | | | | | | | | | | | TOTAL | 600 |

*\*\* Professional Elective - II  1]Electric Drives & Control  2] Power Quality  3] Power System Management  4] Generalised Machine Theory*

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

### SEMESTER - SEVENTH

**Appendix - F**

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | | | | | | |
| 01 | 7EE01 | Control System II | 4 | – | – | 4 | 4 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| 02 | 7EE02 | Power System Operation & Control | 4 | – | – | 4 | 4 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| 03 | 7EE03 | Electrical Power - II | 4 | – | – | 4 | 4 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| 04 | 7EE04 | Switchgear & Protection | 4 | – | – | 4 | 4 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| 05 | 7EE05 | Professional Elective - I * | 4 | – | – | 4 | 4 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| **PRACTICALS / DRAWING / DESIGN** | | | | | | | | | | | | | | | | |
| 06 | 7EE06 | Project & Seminar | – | – | 2 | 2 | 4 | – | – | – | – | – | 0 | 50 | 50 | 25 |
| 07 | 7EE07 | Electrical Power - II -Lab | – | – | 2 | 2 | 1 | – | – | – | – | – | 25 | 25 | 50 | 25 |
| 08 | 7EE08 | Switchgear & Protection -Lab | – | – | 2 | 2 | 1 | – | – | – | – | – | 25 | 25 | 50 | 25 |
| | | **TOTAL** | 20 | – | 6 | 26 | 26 | | | | 500 | | | | 150 | |
| | | | | | | | | | | | | | | **TOTAL** | **650** | |

*  *Professional Elective - I  1] Process Control System  2] Wind Electrical Systems  3] Computer Methods in Power System Analysis  4] Artificial Intelligence*

### Semester : Eighth

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | | | | | | |
| 01 | 8EE01 | Power System Stability | 3 | – | – | 3 | 3 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| 02 | 8EE02 | High Voltage Engineering | 4 | – | – | 4 | 4 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| 03 | 8EE03 | Digital Signal Processing | 4 | – | – | 4 | 4 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| 04 | 8EE04 | Professional Elective - II** | 3 | – | – | 3 | 3 | 3 | 80 | 20 | 100 | 40 | – | – | – | – |
| **PRACTICALS / DRAWING / DESIGN** | | | | | | | | | | | | | | | | |
| 05 | 8EE05 | Project & Seminar | – | – | 6 | 6 | 12 | – | – | – | – | – | 75 | 75 | 150 | 25 |
| 06 | 8EE06 | Digital Signal Processing -Lab | – | – | 2 | 2 | 1 | – | – | – | – | – | 25 | 25 | 50 | 25 |
| | | **TOTAL** | 14 | – | 8 | 22 | 27 | | | | 400 | | | | 200 | |
| | | | | | | | | | | | | | | **TOTAL** | **600** | |

** *Professional Elective - II   1] Electric Drives & Control   2] Power Quality   3] Power System Management    4] Generalised Machine Theory*

# FIVE YEAR DEGREE COURSE IN BRANCH OF ARCHITECTURE
## SEMESTER PATTERN (CREDIT GRADE SYSTEM)

### SEMESTER - SEVENTH

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESSMENT | TOTAL | MIN. PASSING MARKS | MAX. MARKS EXTERNAL | MAX. MARKS INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | | | | | | |
| 1 | 07AR01 | Advance Construction - I | 2 | _ | _ | 2 | 2 | 4 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 2 | 07AR02 | Environmental Services - I | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 3 | 07AR03 | Professional Practice | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 4 | 07AR04 | Urban Planning | 2 | _ | _ | 2 | 2 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 5 | 07AR05 | Architectural Structure - VI | 2 | 1 | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| **SESSIONAL / PRACTICAL** | | | | | | | | | | | | | | | | |
| 6 | 07AR06 | Architectural Design Studio - VII | _ | _ | 8 | 8 | 8 | _ | _ | _ | _ | _ | 100 | 100 | 200 | 100 |
| 7 | 07AR07 | Advance Construction Studio - I | _ | _ | 4 | 4 | 2 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 8 | 07AR08 | Urban Planning Studio | _ | _ | 4 | 4 | 2 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| | | **Total** | 12 | 1 | 16 | 29 | 25 | | | | **500** | | | | **300** | |
| | | | | | | | | | | | | | | **TOTAL** | **800** | |

Note: Consider one hour Lecture / Tutorial and P/D is equal to one credit for the subjects of Architectural Design and for all other subjects consider 1hour Lecture & Tutorial = 1credit & 2hour Practical /Design studio. = 1 credit .

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESSMENT | TOTAL | MIN. PASSING MARKS | MAX. MARKS EXTERNAL | MAX. MARKS INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Semester : Eighth** | | | | | | | | | | | | | | | | |
| **THEORY** | | | | | | | | | | | | | | | | |
| 1 | 08AR01 | Architectural Design - VIII | 2 | _ | _ | 2 | 2 | 24 | 200 | _ | 200 | 80 | _ | _ | _ | _ |
| 2 | 08AR02 | Advance Construction - II | 2 | _ | _ | 2 | 2 | 4 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 3 | 08AR03 | Environmental Services - II | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 4 | 08AR04 | Sustanaible Architecture | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 5 | 08AR05 | Landscape Design | 2 | _ | _ | 2 | 2 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 6 | 08AR06 | Professional Elective - I | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| **SESSIONAL / PRACTICAL** | | | | | | | | | | | | | | | | |
| 7 | 08AR07 | Architectural Design Studio - VIII | _ | _ | 6 | 6 | 6 | _ | _ | _ | _ | _ | 100 | 100 | 200 | 100 |
| 8 | 08AR08 | Advance Construction Studio - II | _ | _ | 4 | 4 | 2 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 9 | 08AR09 | Landscape Design Studio | _ | _ | 4 | 4 | 2 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| | | **TOTAL** | 15 | _ | 14 | 29 | 25 | | | | **700** | | | | **300** | |
| | | | | | | | | | | | | | | **TOTAL** | **1000** | |

Professional Elective-I 1) Housing  2) Environmental Planning  3) Construction Management

## SEMESTER : NINETH

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TEACHING SCHEME** | | | | | **EXAMINATION SCHEME** | | | | | | | | |
| | | | **HOURS / WEEK** | | | | | **THEORY** | | | | | **PRACTICAL** | | | |
| | | | | | | | | | | | | | **MAX. MARKS** | | | |
| **SESSIONAL / PRACTICAL** | | | | | | | | | | | | | | | | |
| 1 | 09AR01 | Practical Training | – | – | – | – | 26 | – | – | – | – | – | 150 | 150 | 300 | 150 |
| | | **Total** | – | – | – | – | 26 | – | – | – | – | – | – | – | 300 | – |
| Practical Training shall be for six month in architectural firms approved by the institutions | | | | | | | | | | | | | | | Total | 300 |

## SEMESTER: TENTH

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | | | | | | |
| 1 | 010AR01 | Professional Elective – II | 2 | 1 | – | 3 | 3 | 3 | 80 | 20 | 100 | 40 | - | - | - | - |
| **SESSIONAL / PRACTICAL** | | | | | | | | | | | | | | | | |
| 2 | 010AR02 | Architectural Project / Thesis | - | 6 | 12 | 18 | 18 | - | - | - | - | - | 200 | 100 | 300 | 150 |
| 3 | 010AR03 | Seminar | - | - | 6 | 6 | 13 | - | - | - | - | - | - | 100 | 100 | 50 |
| | | **Total** | 2 | 7 | 18 | 27 | 24 | | | | 100 | - | - | - | 400 | - |
| Professional Elective – II   1) Industrial Architecture   2) Climate Responsive Architecture   3) Vernacular Architecture | | | | | | | | | | | | | | | Total | 500 |

# FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
## BRANCH : INFORMATION TECHNOLOGY - SEMESTER PATTERN (CREDIT GRADE SYSTEM)

**Appendix - H**

### SEMESTER - SEVENTH

| | | | TEACHING SCHEME | | | | | EXAMINATION SCHEME | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOURS / WEEK | | | | | THEORY | | | | | PRACTICAL | | | |
| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | MAX. MARKS | | TOTAL | MIN. PASSING MARKS |
| | | | | | | | | | | | | | EXTERNAL | INTERNAL | | |
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 7IT01 | Digital Signal Processing | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 7IT02 | Object Oriented System Analysis & Design | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 7IT03 | Web Technology | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 7IT04 | Real Time Embedded Systems | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 05 | 7IT05 | Professional Elective I* | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 06 | 7IT06 | Digital Signal Processing-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 07 | 7IT07 | Web Technology-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 08 | 7IT08 | Real Time Embedded Systems-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 09 | 7IT09 | Project & Seminar | _ | _ | 2 | 2 | 4 | _ | _ | _ | _ | _ | _ | 50 | 50 | 25 |
| | | TOTAL | 20 | _ | 8 | 28 | 27 | | | | 500 | | | | 200 | |
| | | | | | | | | | | | | TOTAL | | 700 | |

Professional Elective I* (i) Distributed DBMS (ii) Modelling & Simulation (iii)Artificial Intelligence & Expert Systems (iv) Multimedia Technologies

### Semester :EIGHTH

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | | | | | | | | |
| 01 | 8IT01 | Digital & Wireless Communication | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 8IT02 | Network Administration & Security | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 8IT03 | Software Engineering | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 8IT04 | Professional Elective II* | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN | | | | | | | | | | | | | | | | |
| 05 | 8IT05 | Network Administration & Security-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 06 | 8IT06 | Software Engineering-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 07 | 8IT07 | Computer Lab-V (Content Management System) | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 08 | 8IT08 | Project & Seminar | _ | _ | 6 | 6 | 12 | _ | _ | _ | _ | _ | 75 | 75 | 150 | 75 |
| | | TOTAL | 12 | _ | 12 | 24 | 27 | | | | 400 | | | | 300 | |
| | | | | | | | | | | | | TOTAL | | 700 | |

Professional Elective II* (i) Data Warehousing & Data Mining (ii) Web-Commerce (iii) Cloud Computing (iv) Neural Networks & Fuzzy Logics

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

### SEMESTER - SEVENTH

Appendix - I

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY |
| 01 | 7BM01 | Bio Signal Processing | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 7BM02 | Artificial Organs and Rehabilitation Engineering | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 7BM03 | Medical Expert Systems | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 7BM04 | Hospital Engineering & Management | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 05 | 7BM05 | Professional Elective-I * | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN |
| 06 | 7BM06 | Bio Signal Processing-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 07 | 7BM07 | Medical Expert Systems-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 08 | 7BM08 | Hospital Engineering & Management-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 08 | 7BM09 | Project and Seminar | _ | _ | 2 | 2 | 4 | _ | _ | _ | _ | _ | _ | 50 | 50 | 25 |
| | | TOTAL | 20 | _ | 8 | 28 | 27 | | | | 500 | | | | 200 | |
| | | | | | | | | | | | | | | | TOTAL | 700 |

Professional Elective-I * (i) Tissue Engineering
(ii) Bio Informatics

### Semester : Eighth

| Sr. No. | Subject Code | Subject | Lecture | Tutorial | P/D | Total HOURS/WEEK | CREDITS | DURATION OF PAPER (Hr.) | MAX. MARKS THEORY PAPER | MAX. MARKS COLLEGE ASSESMENT | TOTAL | MIN. PASSING MARKS | EXTERNAL | INTERNAL | TOTAL | MIN. PASSING MARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY |
| 01 | 8BM01 | Professional Ethics & Values | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 02 | 8BM02 | Bio Medical Imaging Systems | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 03 | 8BM03 | Professional Elective-II* | 3 | _ | _ | 3 | 3 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| 04 | 8BM04 | Bio Medical Embedded System Design | 4 | _ | _ | 4 | 4 | 3 | 80 | 20 | 100 | 40 | _ | _ | _ | _ |
| PRACTICALS / DRAWING / DESIGN |
| 05 | 8BM05 | Bio Medical Imaging Systems-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 06 | 8BM06 | Bio Medical Embedded System Design-Lab | _ | _ | 2 | 2 | 1 | _ | _ | _ | _ | _ | 25 | 25 | 50 | 25 |
| 07 | 8BM07 | Project and Seminar | _ | _ | 6 | 6 | 12 | _ | _ | _ | _ | _ | 75 | 75 | 150 | 75 |
| | | TOTAL | 13 | _ | 10 | 23 | 27 | | | | 400 | | | | 250 | |
| | | | | | | | | | | | | | | | TOTAL | 650 |

Professional Elective - II i) Bio-Inspired Algorithm    ii) Biofluids & Dynamics

SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
CIVIL ENGINEERING
SEMESTER PATTERN (CREDIT GRADE SYSTEM)

**SEMESTER SEVEN**

**7CE01**          **THEORY OF STRUCTURES – II**

### SECTION - A

**Unit-I** :   1.   Moment distribution method, application to portal frames with sway. Multibay, multistoried, symmetrical frames subjected to symmetric loads only.
2.   Slope deflection method: Application to portal frames with side sway.

**Unit-II** :   1.   Kani's method: Continuous beams and single bay single storey portal frames with side sway.
2.   Multi- bay, multi storeyed frames subjected to symmetric loads.

**Unit-III** :   1.   Castigliano's second theorem, principle of least work, Analysis of redundant frames. (up to two degree redundancy).
2.   Analysis of redundant trusses (up to second degree of redundancy), lack of fit, temperature effect.

### SECTION - B

**Unit-IV** :   1.   Maxwell's reciprocal theorem, Betty's theorem, Muller - Breslau's principle, Influence line diagrams for continuous beams, upto two span only.
2.   Tension coefficient method & its applications to simple space trusses.

**Unit-V** :   1.   Flexibility method, static redundancy, flexibility coefficients, compatibility condition application to beams.
2.   Introduction to plastic analysis of steel structure, shape factor, plastic section modulus, Redistribution of moment, upper and lower bound theorems, collapse loads for beams, single bay, single storey portals.

**Unit-VI** :   Stiffness method, kinematic redundancy, stiffness coefficients, direct stiffness approach, application to continuous beams and single - bay, single - storey portal.

**BOOKS RECOMMENDED:**
1.   Junnarkar, S. B., Mechanics of Structure, Volume I and II
2.   Jain and Arya, Theory and Analysis of Structures

3.   Reddy. C. S., Basic Structural Analysis, Tata McGraw Hill
4.   Wang, C. K., Elementary Analysis of Structures
5.   Norris and Wilbur, Elementary Structural Analysis

**7CE02**          **GEOTECHNICAL ENGINEERING – II**

### SECTION – A

**Unit I :**   Exploratory Programme : Field exploration, objectives and methods of exploration planning of exploration programme soil boring , hand augers, percussion boring, rotary wash boring, collection of sample, split spoon sampler, area ratio, disturbed and undisturbed sample, SPT test, field vane shear test, geophysical methods, electrical resistivity and soil refraction methods. Soil log bore presentation and interpretation exploration data.

**Unit II :**   Bearing Capacity of Shallow foundation :- Different theories: Terzaghi's skempton's, Meyerhof's, BIS method for bearing capacity , determination bearing capacity of granular soils based on SPT value. concept of raft foundation and floating foundation.
In situ methods of evaluation of bearing capacity, plate load test, static cone penetrometer, pressure meter test contact pressure distribution diagram below the base of footing.

**Unit III** :   Earth pressure at rest, general & local Stages of plastic equilibrium, Rankine's and coulomb's theory of active and passive earth pressure on retaining wall. Influence of surcharge, water table, wall friction, Rebhann's and culmann's simple graphical methods Ground Improvement : methods of soil stabilization use of admixture (lime, cement, flyash) in stabilization) Mechanism of reinforced soil, use of Geo synthetics material as a reinforcement, vibroflotation, sand drain installation and preloading.

### SECTION – B

**Unit IV:**   Pile foundation : Classification of piles and their uses, static analysis, formula for determination of pile capacity for driven and bored pile in sandy and in clayey soil , dynamic pile formula Negative skin friction, factor affecting it, piles in groups and their capacity, group efficiency, factors affecting group efficiency, behavior of group of pile in sandy and in clayey soil, pile load test, effect of pile cap. Criteria for spacing and depth of piles. IS design criterion for undereamed Pile in clay and sands

**Unit V:**   Settlement Evaluation of soils settlement : immediate, primary and secondary settlement for footing resting on homogenous isotropic, cohesive and cohesion less soils related to single footing, combined footing, raft foundation etc, standard for requirement of settlement,

total as well as differential settlement, concept of differential settlement, factors and causes for differential settlement, service loads, proportioning of footing for uniform settlement computation of total and differential settlement of a single pile and group of piles in sandy and clayey soil.

**Unit VI :**
1. Well foundation : Component & their function, sinking of well, types of force system, and their computation, design criteria for various components of wells, tilting and shifting
2. Design of cantilever retaining wall and counterfort retaining Bearing capacity of well as per IS. Cofferdam purpose, various types their suitability

**BOOKS RECOMMENDED :**

1) Craig : Soil Mechanics.
2) Bowles J.E. : Foundation Design Analysis.
3) Hanson : Theoretical Soil Mechanics.
4) Peck and Hanson : Foundation Engineering.
5) Tomlinson : Foundation Engineering.
6) Leoner : Foundation Engineering.
7) Bramha : Foundation Engineering.
8) Prakash S. : Analysis and Design of Foundation and Retaining Structure.
9) Kasmalkar : Foundation Engineering.
10) Arora K.R. : Foundation Engineering.
11) Venkataramiah : Soil Mechanics and Foundation Engineering.
12) Rao G.V. : Engineering with Geosynthetics.

**7CE03**      **STRUCTURAL DESIGN – II**

**SECTION-A**

**(R.C.C. STRUCTURES BY LIMIT STATE METHOD)**

**Unit-I :**
1. Design of interior panel of flat slab by direct design method. (Problem on square panel only)
2. Design of cantilever retaining wall and Counterfort retaining wall.

**Unit II :**
1. Design of combined footing.
2. Complete design of simple, small structures like Canopies & Parking shed.

**SECTION - B**
**( PRESTRESSED CONCRETE )**

**Unit-III :**
1. Introduction to Prestressed concrete: Materials and their characteristics, types of prestressing, Methods and various prestressing systems, Losses of prestress

2. Analysis of beams for flexure, under working load for Rectangular and flanged sections.

**Unit-IV :**
1. Basic Design of rectangular sections for flexure by limit state method, Design of one way single span slabs.
2. Design of prestressed concrete circular water tanks by IS code method.
*Students may be shown video CD, slides, transparencies, and photograph of actual structures.*

**BOOKS RECOMMENDED:**

1. Jain, A. K., Reinforced Concrete (Limit State Design)
2. Jaikrishna and Jain, Plain and Reinforced Concrete, Volume I and II
3. Sinham S. N., Reinforced Concrete (Limit State Design)
4. Edward G. Nawy õPrestressed Concrete- A fundamental Approachö, Prentice Hall
5. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
6. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi)
7. Dr. Shah V.L. & Karve S.R.: Limit State Design.

**7CE04**      **ENVIRONMENTAL ENGINEERING–I**

**SECTION - A**

**Unit-I** : Quantity Estimation of water: Demand of water. Consumption for various purposes. Fire demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population, and design periods for water supply components.
Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection.
Intake works: Intakes, type, location, requirement & features.

**Unit-II** : Water quality: Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment works.

**Unit-III :** Aeration: Purpose, type of gravity, aerator & spray aerators. Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, coagulant, feeding and mixing devices. Flocculation, clarrifloculator. Design criteria for sedimentation tanks, surface loading, simple problems of design of sedimentation tanks.

## SECTION - B

**Unit-IV** : **Filtration :-** Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process. Control system, Negative head, operating difficulties, pressure filter; Simple design problems on rapid sand filters modifications of filters. (Dual media, multimedia, upflow, biflow, Diatomaceous earth).

**Unit V :** **Disinfection** :- Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination forms of chlorine. Use of bleaching powder - Simple problems. Introduction to tertiary treatments like Softening, Ion Exchange, Reverse Osmosis, Defloridation, Desalination.

**Unit-VI :** Distribution system: - Types of supply - Continuous, and intermittent, Types of system - Gravity; Pumping and combined gravity and pumping, Layouts of distributions system, Dead end, Grid iron, Circular system and Radial system. Maintenance of distribution system. Equalising storage, Type of storage reservoirs, capacity, Types of conduits, Relative merits, selection, joints, hydraulic design. Pipe laying and

**BOOKS RECOMMENDED:**
1. Steel E. W. , Water Supply and Sewerage, Mc-Graw Hill.
2. Kshirsagar S. R., Water Supply Engineering, Roorkee Pub house, Roorkee.
3. Birde G. S. , Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, Delhi.
4. Punmia B. C. water Supply Engineering.

**7CE05** **PROFESSIONAL ELECTIVE – I**
**(i) ADVANCED WATER TREATMENT**

### SECTION-A

**Unit - I :** Requirements of water treatment facilities different unit operations and unit processes.
Coordination of unit operations. Common attributes of water affected by conventional unit operations and processes.
Aeration: rate of gas absorption and desorption, objectives of aeration, gravity aerators and spray aerators, governing factors, design of aerators, removal of methane, $CO_2, H_2S$ taste, design and odour.

**Unit-II :** Objectives of flocculation, chemical coagulation, concept of surface charge, coagulating effects of electrolytes, zeta potential, coagulants and coagulant aids, factors affecting coagulation.

Perikinetic and orthokinetic flocculation - mixing and stirring devices, flash mixing flocculators, construction and operation of flocculators, problems on design of flocculators. Pebbled bed flocculator.

**Unit-III :** Sedimentation: objectives, theory of sedimentation discrete settling and hindered settling, settling of floucculant suspension. Ideal settling basin and its efficiency. Design, construction and operation of sedimentation tanks.
Inlet and outlet hydraulics, sludge, removal and disposal, tube and plate settlers. Problems on design of sedimentation tanks.

### SECTION-B

**Unit-IV :** Filtration: objectives, design, construction and operation of rapid and slow sand filters, filtering sand, grain size and size distribution, preparation of filter sand, hydraulics of filtration. Hydraulics of fluidized beds. Scour intensification, high rate, declined rate, upflow biflow, dual media, diatomaceous earth filters.

**Unit-V :** Disinfection : objectives, different disinfectants, chemical disinfection, theory, factors governing, and kinetics. Disinfection by Ozone. Disinfection by chlorine; free available and combined. available chlorine, break point chlorination, chemical technology and other uses of chlorine, manageable variables.

**Unit-VI :** Miscellaneous methods of treatment : Water softening: limesoda and zeolite process, split treatment problems on calculation of dose of lime and soda ash. Iron and Manganese Removal : Fluoridation and defluoridation. Desalination. Taste and Odour Removal.

**BOOKS RECOMMENDED :**

1) Fiar, Geyer & Okun : Water and Waste Water Engg., John Wiley & Sons.
2) Mark J. Hammer : Water and Waste Water Technology, John Wiley & Sons.
3) Steel E.W. & Ghee M.C. : Water Supply & Sewerage, McGraw Hill Co.

**7CE05** **PROFESSIONAL ELECTIVE – I**
**(ii) ADVANCED GEOTECHNICAL ENGINEERING**

### SECTION-A

**Unit - I :** Clay mineralogy : Introduction, atomic bonds, classification and nomenclature, structure of clay mineral, K lonite. Illite and Montmorillonite groups, physical properties, clay-water relations,

diffused double layer, thixotropy, base exchange capacity formation of different structure in soil deposites, electrical effects, electroosmosis, electrophoresis, stemming potential, zeta potential, clay mineral identification,DTA analysis, X ray diffraction method.

**Unit II -** Seepage : Flownet for anisotropic soil media, construction of flownet for hydraulic structure on non- homogenous soil, directional variation of permeability in aniosotropic medium. Numerical analysis of seepage in layered soil computation of seepage force, seepage through earthen dam resting on confined and unconfined medium entrance discharge and Transfer condition of line of seepage through earth dam.

**Unit-III :** Three dimensional consolidation. Equation, solution of 3dimensional consolidation equation, consolidation by vertical sand drain and its design aspect, free strain consolidation with no smear, effect of smear zone on radial consolidation. Calculation of the degree of consolidation with radial drains and solutions of problems based on this.

### SECTION – B

**Unit IV :** Expansive soils: orgin of soil, intensification of expansive soil, swelling potential, factors affecting the swelling, different systems of classification, concept of swelling pressure and its measurements in the laboratory, special constructional measures adopted for the construction on expansive soils, special foundations adopted for the construction in expansive soils, concept of cohesive non-swelling techniques and its effect on expansive soil.

**Unit V :** Soil stabilization concept of mechanical stabilization, physical and chemical stabilization with organic and inorganic material like line, cement, lime, fly ash and mechanisms, various factors affecting stabilization, determination of bearing capacity of stabilized soil, laboratory and field methods of stabilization, On various properties of soil.

**Unit VI :** Geotextile: types, specifications, functions and various applications in the field of Geotechnical engineering. Reinforced earth, mechanism of reinforced earth, various constructional methods and its effect towards altering, the properties of soil, field situations for application of this techniques. Theory of Arching, effect of arching, design of yield strip, computation of vertical stresses.

**BOOKS RECOMMENDED** :
1) Scoth R.F. : Principles of Soil Mechanics.
2) Das B.M. : Advanced Soil Mechanics.
3) Terzaghi : Theoretical Soil Mechanics.
4) International Conference on Expansive Soils.
5) International Conference on Geotextiles.
6) Soil Mechanics for Road Engineers, AMSO Series.

**7CE05      PROFESSIONAL ELECTIVE – I**
**( iii) WATER POWER ENGINEERING**

### SECTION - A

**Unit I :** Introduction, sources of energy, importance of water power, estimation of water power potential, primary and secondary power, load factor, pondage and pondage factor, load curve.
Type of hydropower plants:- low and high head, run of river, valley dam, diversion canal, high head diversion, pumped storage underground, general description, layout, topographical requirements of each of above.

**Unit-II :** Penstocks: general classification, design criteria, economical dia, anchorages and accessories.
Water hammer :- meaning, rigid and elastic water column theory, Allievi's charts.

**Unit-III :** Surge tanks: Necessity, types, function, location, effect of sudden load change, Hydraulic design of simple surge tanks, stability of surge tanks.

### SECTION – B

**Unit-IV :** Intakes: types, locations, requirements, trashrack and other components, control gates, emergency gates.

**Unit-V :** Hydel channel:- power canal and forebay, general principles of alignment and capacity, balancing tank.
Turbines:-types, hydraulic features, size, general description of components and layout, specific speed, choice, approximate costs.

**Unit-VI :** Power house:- types, general layout and approximate dimensions. Non conventional sources of energy: - tidal power, wind power, geothermal power, solar power, elementary principles and description, application of water power in drilling and blasting of rocks.

**BOOKS RECOMMENDED :**
1) Dandekar M.M. & Sharma : Water Power Engineering, Vikas Pub. House, Delhi.

2) Brown J.G., Blackie and Practice : Hydro Electric Engg., Vol. I, II & III, W. Sons, London.
3) Mosonyi E. : Water Power Development, Hungarian Academic Sciences, Budapest.
4) Deshmukh M.M. : Water Power Engineering.
5) Davin C. and Sorenson K.C. : Hand Book of Applied Hydraulics, McGraw Hill.

### 7CE05 PROFESSIONAL ELECTIVE – I
### (iv) PRESTRESSED CONCRETE

#### SECTION-A

**Unit I :** a) Analysis and design of beams - Rectangular, flanged and I sections, for Limit State of flexure, ultimate flexural strength, recommendations of I.S. codes.
b) Analysis and design of end blocks in post tensional members -primary and secondary distribution zones, Bursting and spalling tensions.

**Unit II :** a) Shear strength of prestressed concrete beams - mode of failure in beams, recommendations of I.S. code, ultimate shear strength of concrete, Design of shear reinforcement.
b) Deflection and bond in prestressed concrete.

**Unit III :** Analysis and design of continuous (upto two spans) and fixed beams. Elastic analysis, secondary moments, concordant cable, linear transformations.

#### SECTION – B

**Unit IV :** Analysis and design of prestressed concrete structures such as concrete pipes, poles, sleepers, water tanks etc.

**Unit V:** Analysis and design of portal frames, single storey and limited to two bays (fixed and hinged)

**Unit VI:** Design of prestressed concrete bridges (simply supported) for I.R.C. loadings or equivalent uniformly distributed loads.

**NOTE :** Candidates should use the latest I.S. Codes.

**BOOKS RECOMMENDED:**
1. Guyon Y. : Prestressed Concrete, Vol. I & II, John Wiley and Sons, New York.
2 Krishna Raju, N. : Prestressed Concrete, Tata McGraw Hill Pub. Company, New Delhi.
3 Lin, T. Y. : Prestressed Concrete, Tata McGraw Hill, New Delhi.
4. Dayaratnam, P. : Prestressed Concrete Structures, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.

### 7CE05 PROFESSIONAL ELECTIVE – I
### (v) ARTIFICIAL NEURAL NETWORK & FUZZY LOGIC

#### SECTION - A

**Unit I :** Artificial intelligence, introduction, classification of artificial intelligence, tools of artificial intelligence, applications of A. I. in Civil Engineering.

**Unit-II:** Expert systems, introduction, classification, tools, applications of expert system in Civil Engineering.

#### SECTION – B

**Unit-III :** Neural network, introduction, classification, tools, applications of neural network in Civil Engineering.

**Unit-IV :** Fuzzy logic, introduction, classification, tools, applications of expert system in Civil Engineering.

**BOOKS RECOMMENDED:**
1. Rolston D.W. :Principles of Artificial Intelligence and Expert System, McGraw Hill International Edition, 1988.
2. Waterman D.A. : A Guide to Expert Systems, Addision-Wesley Pub. Co., 1985.
3. Koestem C.N. and Maher : Expert System in Civil Engineering, ASCE, 1986.
4. ASCE's Journal of Computing in Civil Engineering.

### 7CE05 PROFESSIONAL ELECTIVE – I
### (vi) ADVANCED CONCRETE TECHNOLOGY

#### SECTION-A

**Unit-I:** Admixtures and construction chemicals: Introduction, admixtures, plasticizers (Water reducers), action of plasticizers, dispersion, retarding effect, superplasticizers (High range water reducers), site problems in the use of plasticizers, retarders, accelerators, air-entraining admixtures, pozzolanic or mineral admixtures, fly ash, silica fume, rice husk ash, metakaolin, ground granulated blast furnace slag (GGBFS), damp and water proofing admixtures, IS code provisions for admixtures.

**Unit-II:** Durability of concrete: Introduction, strength and durability relationship, volume change in concrete, significance of durability, impact of water cement ratio on durability, factors affecting durability, methods of predicting durability, IS code provisions for durability of concrete.

**Unit-III :** Deformation in concrete: Introduction, deformation of concrete in Indian climate, permeability, factors contributing cracks in concrete, sulphate attack, alkali aggregate reaction, corrosion of embedded steel, controlling measures.

### SECTION – B

**Unit-IV:** Special concrete and concreting techniques: Introduction to special concrete, Lightweight, aerated, no-fines, high density, fibre reinforced, polymer, prepacked, self-compacted (self leveled), and high volume fly ash (HVFA) concrete.
Introduction to special concreting techniques, Gunite or shotcrete, ferrocement, roller compacted concrete, and ready mix concrete casting and applications.

**Unit-V:** Repairs and rehabilitations: Introduction, need for repairs, crack width, interaction between permeability, volume change and cracking, polymer modified mortar, bond aid for plasters, guniting aid, silicon based water repellent materials, protective and decorative coatings, injection grout for cracks, coatings to embedded reinforcement, concrete repair systems, stages of repair works.

**Unit-VI:** Non-destructive testing of concrete: Introduction, rebound hammer, limitations, rebound number and strength of concrete, penetration technique, pullout test, resonant frequency, pulse velocity method, corrosion analyser, rebar locators.
Students must be shown video CD, slides, transparencies and photograph of actual structures.

**BOOKS RECOMMENDED:**

1. Lea, F. M.: The Chemistry of Cement and Concrete, Edward Arnold (Publishers) Ltd.
2. Neville, A. M. : Properties of Concrete, Pitman Publishing Company.
3. Neville, Brooks : Concrete Technology, ELBS
4. Orchard, D. F. : Concrete Technology, Applied Science Pub Ltd.
5. Shetty, M. S. : Concrete Technology, S. Chand
6. Varshney, R. S. : Concrete Technology, Oxford Pub. House.
7. Krishna Raju : Design of Concrete Mixes, McGraw Hill.
8. Shah and Kale : Reinforced Cement Concrete Design,
9. Sushil Kumar :Treasure of Reinforced Cement Concrete

**7CE05          PROFESSIONAL ELECTIVE – I**
**( vii) ENVIRONMENTAL  POLLUTION & RURAL SANITATION**

### SECTION - A

**Unit I :** General components of environment. Nature and scope of Environmental pollution, population growth, Degradation due to human activity. Episodes of Environmental pollution.

**Unit-II:** Water pollution-sources of water pollution, effects on water bodies, D.O. sag curve, pollution control measures, water pollution act
Noise pollution: sources of noise pollution, human tolerance levels, levels of exposure due to various sources, preventive and curative methods.

**Unit-III :** Report of field visit to municipal waste water treatment plant/ Industrial Effluent treatment plant.

### SECTION-B

**Unit-IV:** Land pollution: solids its effect on the environment, various methods of collection, treatment and disposal of solid waste, Hazardous waste and risk analysis.

**Unit V :** Environmental Impact assessment : Need for EIA, elements of EIA, Environmental attributes, Nature of Impact -Primary, Secondary, Tertiary, Short Term & Long terms, Local & Regional.

**Unit-VI:** 1) Rural Sanitation ó Collection & disposal of night soil, Sanitary Latrines.
2) Biogas plant - Capacity & Design.

**BOOKS RECOMMENDED :**

1) Mishra P.C. : Fundamentals of Air & Water Pollution.
2) Mohan I. : Environmental Pollution & Management, Ashish Pub. House, New Delhi-110026
3) Gilbert M. Masters : Introduction to Environmental Engg. & Science.

**7CE05          PROFESSIONAL ELECTIVE – I**
**(viii) ADVANCED EARTHQUAKE  ENGINEERING**

### SECTION-A

**Unit I :** Behaviour of structures in past earthquakes : lessons learnt with regards to weak / strong aspects of structural systems.
Ground motion characteristics : choice of ground motion for a major project site.

**Unit II:** Detailed study of IS : 1893 - 2002 : seismic analysis of buildings using codal previsions, design considerations.

**Unit III:** Introduction to seismic design : Considerations for bridges, dams, chimneys.

### SECTION-B

**Unit IV :** Vulnerability of buildings : use of Vulnerability Atlas and understanding techno legal issues with regard to buildings.

**Unit V :** Concepts in repair, restoration and seismic strengthening: retrofitting weakness in existing buildings, aging, weathering, development of cracks, material and equipment for repairs of masonry and concrete structures, study of IS : 13935.

**Unit VI :** Methodologies for repairs : for walls, roofs, slabs, columns and foundations of buildings in stone, brick or reinforced concrete.

**BOOKS RECOMMENDED :**

1) Anil K. Chopra : Dynamics of Structures, Prentice Hall of India Pvt. Ltd.
2) James L. Stratta : Manual of Seismic Design, Pearson Education.
3) Jaikrishna, Chandrashekhar, Brajesh Chandra : Element of Earthquake Engineering, Sarita Pub., Meerat.

**7CE06**        **THEORY OF STRUCTURES- II – Lab**

**PRACTICALS:**

The laboratory work will be based on the following experiments (Any five experiments):

1. Influence line diagram for continuous beams.
2. Horizontal reaction of two hinge arch.
3. Forces and displacements in redundant trusses and frames.
4. Minimum two exercise based on theoretical course work.
5. Verification of Betty theorem
6. Verification of Maxwell Reciprocal Theorem.
7. Basic exposure to software for analysis.
8. Computer aided design of structures

Software: Anyone of the following software STAAD, SAP, NASTRAN, ANSYS, BUILD MASTER, SCADDS & STRUDS and any other reputed software (Any TWO)

1. Analysis and design of minimum three storied building
2. Cantilever or counterfort retaining wall
3. Analysis and design of steel structure

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

**7CE07**        **GEOTECHNICAL ENGINEERING- II – Lab**
                **LIST OF EXPERIMENTS: (**Any six)

1. To determine the shear strength by conducting Field Vane shear test.
2. To identify the subsoil strata by conducting soil resistivity / seismic refractivity method
3. To determine the bearing capacity of soil by conducting standard penetration test
4. To determine the soil characteristic by conducting standard penetration test
5. To determine the soil properties by conducting the static cone penetration test.
6. Computation of bearing capacity by analytical approach to verity with field test
7. To determine the C- characteristic with respect to soil log bore presentation and interpretation of exploration
8. To examine the soil characteristic with respect to soil log bore presentation and interpretation of exploration

**Compulsory**: Introduction to Geotechnical Software, determination of bearing capacity , earth pressure etc. using this software.

**7CE08**        **STRUCTURAL DESIGN- II – Lab**

**PRACTICALS:**

1. Candidates are required to prepare at least two designs based on theoretical course detailed workings are necessary.
   A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

**7CE09**        **PROJECT & SEMINAR**

Seminar based on Project shall be delivered in Seventh Semester only. 50 marks shall be given through the internal evaluation done by three member committee one of them will be guide.

Seminar shall be delivered with POWER POINT presentation.

## SEMESTER: EIGHT
**8CE 01**      **WATER RESOURCES ENGINEERING - II**

### SECTION-A

**Unit-I** :   Reservoir Planning : Investigation, selection of site, control levels, Reservoir Sedimentation, Reservoir Capacity, Calculation of life Reservoir.

Dams : Different types and their suitability-factors governing the selection of types of dam for project

Earth Dams : Types of dams, causes of failure seepage and drainage arrangement, phreatic line, stability analysis, seepage control measures

**Unit II** :   Gravity Dams: Types of dams forces acting, modes of failure; principles of design of straight gravity dams, Elementary and practical profile, Galleries, Earthquake and its effect on dams.

**Unit-III:**   Diversion Head Works :- Selection of site and layout, components of diversion head works, design of weirs on permeable foundation, construction details of Kolhapur type weirs.

Spillways: Types of spillway, spillway capacity, Flood routing through spillways, types of crest gates. Energy dissipaters: meaning, objectives, location. Types hydraulic jump, jet diffusion and Bucket type,

### SECTION-B

**Unit-IV :**   Canal Irrigation: Types of canals, Parts of Canal irrigation system, Canal alignment, Design of unlined and lined Canals, Balancing depth, cross section of canal, propose and types of canal lining

**Unit-V :**   Canal Masonry Works: Types and only design principles and description of
1. Regulation works: Canal falls, Head Regulator, Cross regulator, Canal escapes and canal outlets.
2. Cross drainage works: Aqueduct, Syphon aqueducts, super passage, canal siphon, level crossing

**Unit-VI :**   Well Irrigation : open wells and tube wells, types of tube walls, duty of tube well water.

Water Management : Water management and distribution, co-operative water users organization, warabandi, conjunctive use of water. Water shed Management : Need of watershed management, importance of soil conservation measures, techniques ground water harvesting.

River Training Works : Need and types of river training works.

**BOOKS RECOMMENDED :**

1)    Dr. Modi P.N. : Irrigation, Water Resources & Water Power Engg.

2)    Punmia : Irrigation & Water Power Engg.

3)    Garg S.K. : Irrigation & Water Power Engg.

4)    Dahigaonkar J.G. : T.B. of Irrigation Engg., Wheeler & Co.

5)    Varshaney R.S. : Theory of Irrigation Structures, Vol. I & II, Nemchand, Roorkee.

6)    Birdie G.S., Das R.C. : Irrigation Engg., Dhanpatrai & Sons.

7)    Michael A. M. : Irrigation ( Theory & Practice)

**8CEO2**      **ENVIRONMENTAL ENGINEERING–II**

### SECTION–A

**Unit-I** :   Quantity of storm water, DWF, variation of sewage, flow systems of sewerage - separate combined and partially combined, layouts of sewerage system, capacity of sewers design of sewers Laying out of circular sewers-Boning rod and sight rail method, Testing & maintenance of sewers

**Unit-II** :   Waste water characteristic, sampling of sewage, physical chemical and biological examinations, B.O.D. and C.O.D.,B.O.D. equation, problems on B.O.D Pollution due to domestic and industrial waste. Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Flow diagram for conventional sewage treatment plant. Preliminary Treatment:- Screening, Grit chamber, detritus tank. Primary Treatment:- Sedimentation of sewage

**Unit-III** :   Biological treatment: Trickling filters, low rate & high rate tricking filters, construction details, Re- circulation Modification of trickling filters Activated sludge process - Process description, Methods of aeration, loading rates, Different modified forms of A.S.P.,MLSS & SVI,F/M.

### SECTION–B

**Unit-IV :**   Low cost waste treatments - Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal Septic tank, working and design, Disposal of septic tank effluent Disposal of sewage on land and in stream. Effluent standards for disposal on land, into stream and into sewers. MINAS. Self purification capacity of stream

**Unit-V :**   Characteristics of solid waste:- Physical, chemical, biological Analysis

Collection of solid waste:- Types of collection system and services, frequency of collection, methodology involved in setting up collection bins Disposal of solid wastes:- Different methods, sanitary land fill, composting, incineration

**Unit-VI :** Air pollution: Introduction to air pollution, various pollutants their sources and their effects on man and material, prevention or air pollution at sources, introduction to control devices electrostatic precipitator & cyclones only human tolerance level Introduction to EIA and Environmental Audit.

**BOOKS RECOMMENDED :**
1) Kshirsagar S.R. : Sewerage and Sewage Treatment, Roorkee Pub House, Roorkee.
2) Steel E.W. Steel : Water Supply & Sewerage, McGraw Hill Book Co.
3) Birdie G.S. : Water Supply and Sanitary Engineering, Dhanpat Rai & Sonøs.
4) Garg S.K. : Waste Water Engineering.
5) Dr. Bhide A.D., Sunderson B.B. : Solid Waste Management in Developing Countries.
6) Rao H.V.N. : Air Pollution.
7) Stern, Wohlers, Boobel, Lowry : Fundamentals of Air Pollution, Academic Press, 1973.

**8CE03        PROJECT PLANNING & MANAGEMENT**

### SECTION-A

**Unit-I :** Project, Project Stakeholders, Project life cycle - Conceptual Phase, Planning Phase, Execution Phase, Termination phase.
Conceptual Phase - Concept of feasibility study, Budgeting, Cash Flow, Risk assessment plan.
Project planning- Steps, work break down structure, Scheduling, Project Monitoring & Controlling- Concept of Tracking, Reviewing and Rescheduling.
Planning Tools: Basic concept of Gantt Chart, Bar Chart, Mile stone chart ,their advantage , limitations and overcoming measures ,

**Unit II :** Networking ó Activity ,Event, dummy Activity, Fulersonøs numbering rule, Geometrical consideration.
Critical Path Method: Concept, technique , Critical path , Numerical on Time and Floats computation , concept of Updating Network and its numerical for computation.

**Unit III :** PERT: Concept, technique, three time estimates, average time, Critical path, slack computation, S.D, Variance, Probability factor, , crash programe , normal and crash cost, normal and crash time, cost slope, Numerical on Probability computation, crashing .

### SECTION – B

**Unit –IV:** Concept of resource smoothening and leveling ,Cost Cuves, Numerical of it.

Introduction to MicroSoft Project Planner software .Various stages and process for Work Breakdown structure, planning, scheduling and resource allocation for project in MSP. One Compulsory assignment for planning, scheduling and resource allocation for  construction project using Microsoft Project Planner.

**Unit-V:** Management- Feyoløs Principal of Management, Functions of management, organization definition, type  line, line and staff, functional organization ,quality control, ISO.
Safety management ,construction hazards in multistage building, method of prevention of accident, injury rate, injury severity rate, injury index, National safety council, its role, recommendation, Material management , Objective ,Functions, Inventory, Need for inventory, ABC,EOQ analysis.

**Unit VI:** **Equipment Management :**
a) Power shovel: Construction, working, Output, factors affecting, cycle time , Problem n Output.
b) Dragline: Construction, working, output, factor affect ting output, cycle time ,Problem on output .
c) Concrete mixer, Tilting and non-tilting type construction working.

**BOOKS  RECOMMENDED:**
1) Peurifoy R.L. : Construction Planning, Equipment & Method.
2) Srinath L.S. : PERT & CPM.
3) Punmia & Khandelwal : PERT & CPM.
4) Khanna S.K. : Industrial Organization & Management.
5) Satyanarayan : Operations Reserach.

**8CE04        PROFESSIONAL ELECTIVE – II**
**( i ) ADVANCED DESIGN OF STEEL STRUCTURES**

### SECTION - A

**Unit-I :** (a) Design of foot bridge(N-Truss or Pratt)
(b) Analysis and design for transmission tower lines

**Unit-II :** (a) Design of self supporting steel chimney and its foundation.
(b) Design of through type truss bridge member for dead load and equivalent live load including top, bottom bracings and portal bracing.

### SECTION - B

**Unit-III:** Design of industrial buildings including gantry grider, gantry column, Design of knee braces.

**Unit-IV:** a) Design of north light trusses and lattic girder.
b) Design of elevated rectangular, square pressed steel tanks and staging

**BOOKS RECOMMENDED:**
1. Ramchandra, Design of Steel Structure, Volume – I and II
2. Arya, Ajmani, Design of Steel Structures
3. Duggal, Design of Steel Structures
4. N. Subrramanyam, Design of Steel Structures, Oxford University Press, 2008.

**8CE04 PROFESSIONAL ELECTIVE – II**
**(ii) ADVANCED WASTE WATER & INDUSTRIAL WASTE TREATMENT**

### SECTION - A

**Unit-I:**  1. Physical unit process: screening, mixing, flocculation, sedimentation, floatation.
2. Design of Grit Chambers and Screens.
3. Chemical Unit Processes: precipitation, gas transfer, adsorption

**Unit-II:** Biological Unit Process: fundamentals of biological treatment. Design of trickling filter & activated sludge process.

**Unit-III:** 1. Low cost waste water treatment: design of oxidation pond and aerated lagoon
2. Oxidation ditch. Design of Secondary Settling Tank.
3. Methods of disposal of industrial wastes. Equalization tank, Neutralization.

### SECTION – B

**Unit-IV:** General : Effect of discharge of industrial wastewaters on streams, land and environment. Importance and scope. Problems involved in treatment. Variation in quality and quantity of industrial wastewaters. Standards & Criteria
Indian standards for discharge of treated waste water on land, into municipal sewers and natural water courses.
Sampling of Waste Water : Representative sampling. Grab and composite samples.

**Unit-V:** General Approaches to Planning of Industrial Wastewater Treatment and disposal. Equalization and proportioning Neutralization.
Treating different effluent streams separately. Including/excluding domestic wastewater along wish the industrial waste. Treating industrial wastewater along with town waste.

**Unit-VI:** Process flow diagram, characteristics and treatment of various industrial wastes.
Industrial wastes of pulp and paper, textiles, tannery, food, canning, sugar mills, distillery, dairy, Pharmaceutical, Electroplating etc. Case study of any one industry.

**BOOKS RECOMMENDED:**
1) Matcalf and Eddy : Waste Water Treatment, Disposal and Reuse, McGraw Hill Pub. Co., New Delhi.
2) Rao and Datta : Waste Water Treatment, Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi.

**8CE04 PROFESSIONAL ELECTIVE – II**
**(iii) FINITE ELEMENT METHOD**

### SECTION - A

**Unit- I:** Continuum structures, discretisation, finite elements, nodes, variational principle, minimum potential theorem, relation to Rayleigh-Ritz method.

**Unit-II:** Interpolation, Lagrangian, Hermition shape functions, natural coordinates, area and volume coordinates, coordinate and derivative transformations.

**Unit-III:** 2-D plane stress and plane strain analysis, constant strain triangle, rectangle. 3D analysis, tetrahedron & parallelepiped elements.

### SECTION - B

**Unit-IV:** Isoparametric elements, plane stress, plane strain and solids, numerical integration.

**Unit-V:** Beam straight with C and C continuity, numerical integration to cater for membranes, bending and torsion combination.

**Unit-VI:** Programming aspects, geometry, connectivity, code numbers alternate data types, half band data preparation, flow charts, typical subroutine for assembly, shape functions, soluti6n of equations, stiffness matrix.

**BOOKS RECOMMENDED:**
1. Desai, C. S., Abel, Introduction to Finite Element Method
2. Cook, Concept and application of Finite Element Method
3. Patwardhan, N. R. Illustrated Finite Element Method
4. Krishnamurthi, C. S., Finite Element Analysis – Theory and Programmingn

**8CE04**          **PROFESSIONAL ELECTIVE – II**
**(iv) DAM ENGINEERING**
**SECTION - A**

**Unit- I :** Introduction to Dam Engineering : Different classification for dams, relative advantages and disadvantages of various dam selection or types of dam, Investigation of dam sites, Engineering surveys, geological investigation, subsurface exploration programme, economic height of dam, Construction machinary, material, money, inventory.

**Unit-II :** Rockfill dam : Introduction, general characteristics, materials and testing of rockfill material, foundation of rockfill dam, design, rockfill placement, examples.

**Unit-III :** Arch dam :- components, types, methods for design.
Buttress dam : components, types, forces acting, Buttress spacing, Master curve for economic spacing, preliminary design Solid Gravity dams : Analysis & Design of gravity dam.

**SECTION – B**

**Unit-IV:** Spillways: choice of types, crest gates, hydraulic design, comparison, approach and tail channel, J.H.C. & tail water rating curve Energy Dissipaters: types, components, design of hydraulic jump type, basins, ski-bucket type, roller bucket.

**Unit- V:** Head Regulators : requirements, types, foundation treatment including uplift consideration, Bank connection, energy dissipation, hydraulic design of opening and barrel, ventilation, types of gates.
Approach Channel, case study for one on rock foundation and one on permeable foundation.
Model Studies: scales design principles, materials, scale effects for model of dams spillways.

**Unit-VI :** Instrumentation : In earth dam and solid gravity dams, piezo meters, settlement, gauges, (surface monuments, base plate, cross arm) strain meters joint meters, thermometers, stress meters, pore pressure cells, plumb-bob Seismograph. Water level gauges (description, object, location, working, installation of each, design not expected)
Special problems: increasing height of masonry and concrete dams, strengthening, repairs and maintenance, leakage, evaporation controls. evaporation controls.

**BOOKS RECOMMENDED :**
1) Sharma H.D : Concrete Dams, Metropolitan Book Co, Delhi.
2) Varshney R.S. : Concrete Dam, Ox IBH, Mumbai.
3) Sherard et al : Earth and Rockfill Dam, John Wiley, New York.
4) USBR : Design of Small Dams.
5) USBR : Design of Large Dams.
6) Peurifoy R.L. : Construction, Planning and Equipments, McGraw Hill Book Co.
7) Satyanarayanan : Construction, Planning & Equipment, Standard Pub.
8) USBR : Design of Gravity Dam.

**8CE04**          **PROFESSIONAL ELECTIVE – II**
**( v ) ADVANCED ENGINEERING GEOLOGY**

**SECTION - A**

**Unit I :**   A)   Geology & engineering characters of Basalts & other rock formations : study of rock formations of Maharashtra older than Deccantrap from Civil engineering point of view, field characters of basalt flows and older formations which are significant from dam foundation, tunnelling work, watershed development including percolation tanks and construction material.

      (B)   Geology of dam & reservoirs : bearing capacity & water tightness of different types of rocks occruing in Maharashtra from construction of gravity dam with important case histories of different dam sites in Maharashtra whose geological problems were encountered and remedial measures were adopted. Set of geological conditions which lead to tail channel erosion with case histories of different dam sites.

      (C)   Geology of tunnel alignment : geological factors responsible for overbreaks & percolation of water, various geological structures which affects the tunnelling works. Case histories of tunnels & hydro-electric projects, roads, railways & canals driven through different types of Basalts & other rocks occur in Maharashtra.

**Unit II:**   (A)   Seismological studies : factors to be to safeguard gravity dams. Detailed studies of active & dead faults. Type & design aspect of the dam to be constructed in seismic zone with cace histories.

      (B)   Percolation tanks : importance of geological studies for the selection of sites for percolation tanks, geological studies of watershed development projects in Maharashtra including Raleganshindi & Vidarbha region.

(C) Ground water studies : water bearing characters of different types of Basalts. Soil & water preservation techniques of civil engineering significance and under ground bandhara. Exploration of tubewells n alluvium and sandy ó alluvium substrata for drinking water oses procedures and need thereof. Deciding acquifers for tubewell exploration & development of tubewells conducting yield tests of tubewell.

**Unit III:** (A) eology of soil formation : geological factors which govern the engineering characters of soils. Soil derived from different types of rocks which can be used for casing & hearting of earthen dams. Nature of river alluvium in Maharashtra. Problem water logging & its remedial measures.

(B) Construction material : properties of different types of rocks that can be used as rubble for masonry, road metal, railway ballast, concrete aggregates etc. Problem of alkali aggregate reaction. Scaricity of sand in Deccan trap region, suitability of compact & gdaloidal basalt as a substitute of sand after crushing.

(C) Geology of cut-off trench : geological logging and mapping of cut off trench of irrigation projects. Applicability of grouting in irrigation projects & different grouting techniques.

### SECTION - B

**Unit IV :** (A) Drilling and logging : different methods of drilling. Precautions to be taken during drilling, preservation of cores. Recording of drilling data. Geological logging of the drill & its interpretation. Methods of water intake tests.

(B) Aerial photo interpretation : interpretation of aerial photos from the point of view of rock types, geological structures, selection of dam sites and alignment of roads, railways & ghat interpretation of lineaments for groundwater.

(C) Town planning : role of geology in town planning. Important case histories of the old town planning.

**Unit V:** **Geophysical** principle of electrical resistivity survey, its utility in determining the depth of overburden, foundation grade rocks, gullies & other geological structures by having case histories of dams & tunnels, significance of electrical resistivity survey in ground water studies, brief introductory ideas regarding seismic, magnetic and gravity surveys and their applications in various fields.

**Unit VI:** (A) Rock Mechanics : Engineering properties of rocks, general properties, strength of rocks, elasticity of rocks. Residual stresses in rock masses, classification system in rock engineering - Terzaghiøs load classification, Lauffer-Pacher classification. Rock quality gnation (RQD), rock structure rating (RSR), concept of Wickham et.al (1972)

(B) Environmental Geology : role of geology in environmental engineering, geo-environmental : soils as resources, wind erosion, erosion by moving water, predicting & controlling erosion, soil erosion & land use decisions, problem soils. Reactivation of pre faults, earthquakes in Peninsular India, intensity & magnitude, assessment, Himalayan earthquakes, landslides - characterisation, landslide analysis, dimensions of landslide hazard, landslide potential, case histories, subsidence, response to subsidence prediction, costs of subsidence, case histories.

### BOOKS RECOMMENDED :

1) P.W.D. Hand Book, Chapter No. 6.
2) Geological Survey of India - Engineering Geology Case Histories, Parts I & II.
3) Auden J.B. : Indian Society of Engineering Geology, Commemoration Volume.
4) Wahlstrom E.E. : Tunnelling in Rocks.
5) Wahlstrom E.E. : Dams, Dam Foundations and Reservoir Sites.
6) Goodman R.E. : Introduction to Rock Mechanics.
7) Bieniawski Z.T. : Rock Mechanics Design in Minning and Tunnelling.
8) Lama R.D. & Vutukuri V.S. : Hand Book of Mechanical Properties.
9) Gupte R.B. : A Text Book of Engineernig Geology, Pune Griha Prakashan.
10) Miller : Principles of Remote Sensing.
11) Pandey S.N. : Text Book of Photo Geology.
12) Lundgren L. : Environmental Geology, Prentice Hall Pvt. Ltd.
13) Patwardhan A.M. : The Dynamic Earth System, Prentice Hall Pvt. Ltd.

### 8CE04    PROFESSIONAL ELECTIVE – II
### (vi) MATRIX COMPUTER ANALYSIS OF STRUCTURES

### SECTION - A

**Unit- I :** Solution of simultaneous algebraic equations, Gaussian elimination method, Half-band matrices, computer programme.

**Unit-II :** Finite difference method, application to plate deflection problems for fixed and simply support conditions.

**Unit-III :** Flexibility method, static redundancy, flexibility coefficients, compatibility conditions, application to continuous beams, single-bay single story portals, pin joined plane trusses.

### SECTION-B

**Unit-IV:** Stiffness method, kinematic redundancy, equilibrium equations, member stiffness matrix and structure stiffness matrix, assembly procedure, application to continuous beams, pin jointed plane truss, numerical examples upto three unknowns.

**Unit- V :** Stiffness matrix of plane frame member with axial deformation (6x6), Grid member (6x6), transformation of forces and displacements, member and global coordinate system.

**Unit-VI :** Data and program organization for stiffness method, various coding systems, member-joint and joint-coordinate relations, member-displacement relations, code number approach, methods of introducing boundary conditions for restrained displacements.

**BOOKS RECOMMENDED:**

1. Gere, Weaver, Analysis of framed structures
2. Rubinstein, M. F., Matrix computer analysis of structures
3. Matrin, M. C., Introduction to matrix methods of structural analysis

**8CE04        PROFESSIONAL  ELECTIVE – II**
**( vii ) ADVANCED  STRUCTURAL  ANALYSIS**

### SECTION – A

**Unit – I:**  1.  Approximate methods of analysis of multi-bay multi-storey Frames by ó (a) Cantilever  method, (b) Portal method & (c) Factor method.
     2.  Shear centre for thin walled beam section.

**Unit – II :** 1.  Infinite & semi-infinite beams resting on elastic foundations.
     2.  Analysis of beams circular in plan.

**Unit –III:** 1.  Cantilever moment distribution method, application to rigid jointed plane frames.
     2.  Vierndeel girders - analysis for vertical sway cases only.

### SECTION - B

**Unit–IV :** 1.  Finite difference method, application to beam deflection problems
     2.  Minimum potential principle, Rayleigh & Rayligh-Ritz approach to continuous problems, application to simply

supported and cantilever beams using power series and trigonometric series.

**Unit – V:** Introduction to theory of elasticity - (treatment in Cartesian co-ordinates), state of stress at a point, stress óequilibrium equations, strain-components, stress -strain relations, generalized Hookeøs law,  strain plane stress and plane conditions, stress and compatibility for 2D.

**Unit–VI:**  1.  Analysis of columns loaded laterally.
     2.  Structural response to earthquake, analysis of multistoried frames by I.S. code provisions.

**BOOKS RECOMMENDED:**

1. Norris, Wilbur, Elementary Structural Analysis
2. Timoshenko & Goodier, Theory of Elasticity
3. Jaikrishna, Chandrashekharan, Element of Earthquake Engineering, Sarita Publication, Meerut (U.P.)
4. Vazirani & Ratwani : Advanced Theory of Structures.
5. Ross C.T.F.: Advanced Stress Analysis.

**8CE04        PROFESSIONAL  ELECTIVE – II**
**( viii ) ROCK  MECHANICS**

### SECTION - A

**Unit I :** Introduction, properties and testing. Introduction to Rock Mechanics and its field applications, identification of common rocks, physical & mechanical characteristics of rock material. Field & Laboratory testing of rocks. Classification of rock masses for engineering purpose.

**Unit II:** Rock excavation : Blasting - objectives, blasting materials, blasting methods, open cut blasting. control blasting operation, precautions. Drilling, braking & cutting. Machines used for rock excavation.

**Unit III:** Rock reinforcement & Grouting : Rock bolting ó bolting methods & materials.
High capacity of rock anchors - types of rock anchors, anchor grouting, civil engineering applications. Bolted & anchor supports. Rock grouting - objectives, types of treatment, grouting material, grouting methods, quality control & monitoring of grouting.

### SECTION-B

**Unit IV:** Rock strength & deformability : modes of rock failure, stress-strain behaviour in compression, Mohr- Coloumb failure criteria, Griffths crack theory, empirical criteria for failure, effect of size

on strength. Plane of weakness in rocks, joint orientation & roughness. Deformability of rocks - elastic & non- elastic behaviour, influence of time on rock deformation, viscous behaviour & creep.

**Unit V :** Rock foundation & slope stability : rock foundation ó allowable bearing pressures, stress & deflection in rock under footing, failure mechanisms, subsiding & swelling rocks, base heave & remedies, foundation anchoring. Rock slopes - modes of failure, factors affecting, analysis of slopes.

**Unit VI :** Underground opening : types of boring machine, cutting tools, muck handling. Opening in competant rock, horizontally layered rocks & rock with inclined layers, plastic behavior around tunnels, time dependent behaviour of tunnels, underground opening in blocky rocks - Block theory. Review of design methods of tunnels - Empirical & semi-empirical methods. Support & stabilisation.

**BOOKS RECOMMENDED :**

1) Goodman R.E. : Introduction to Rock Mecanics.
2) Franklin J.A., Dusseault M.B. : Rock Engineering.
3) Franklin J.A., Dusseault M.B. : Rock Engineering Applications.
4) Stagg K.G., Zienkiewicz O.C. : Rock Mechanics in Engineering Practice.

**8CE04      PROFESSIONAL  ELECTIVE – II**
**( ix ) ADVANCED DESIGN  OF R. C. C.  STRUCTURES**

**SECTION - A**

[BY LIMIT STATE METHOD]

**Unit-I :**    1)    Design of Portal frame up to two bay two storied symmetrical frame for symmetrical loading.
        2)    Design of circular slab for uniformly distributed load only, Introduction to grid floor slab.

**Unit-II :**    1)    Design of a footbridge and simply supported slab deck bridge for I.R.C.class A loading.
        2)    Design of RCC girder (T beam) bridge for I.R.C.class A loading.

**SECTION – B**

**Unit-III :**    1)    Structural response to earth quake, Analysis of multistoried frame by seismic coefficient method.
        2)    Design of square bunkers using Rankine theory. Design of Silos.

**Unit-IV :**    1)    Design of R.C.C. Intze tanks.
        2)    Design of staging for Intze tanks with raft foundation.

**BOOKS RECOMMENDED :**

1.    Suhil Kumar, Treasure of R. C. C. Design
2.    Jain, A. K., Reinforced Concrete (Limit State Method)
3.    Shah, Karve, Design of R. C. C. Structures
4.    N. Krishna Raju, Advanced R. C. C. Design
5.    Rajgopalan, K., Storage Structures.

**8CE 05      WATER  RESOURCES  ENGINEERING – II – Lab**

**TERM WORK :** Five problems from the following to be worked out by the students whenever necessary scale drawing on half empirical size must be drawn : Practical examination shall consist of viva ó voce.

1.    Fixing control levels of Reservoir from given data.
2.    Cross section, plan, L-section of Earth dam showing all components; details of drainage of downstream casing.
3.    Design and Drawing of elementary and practical profile of gravity dam.
4.    Design and drawing of diversion weir on permeable foundation.
5.    Design and Drawing of ogee spillway with energy dissipaters.
6.    Computer Aided design of unlined and lined canal.
7.    Drawing of any Four canal structure (No design)
8.    Field visit

**8CE06          ENVIRONMENTAL  ENGINEERING – II - Lab**
1)    Analysis of waste water (any four) ó BOD (for domestics waste), COD (for industrial   waste), Solids (Volatile), SVI,  Nitrogen, Chlorides
2)    Air sampling & Analysis of SPM.
3)    Physical characteristic of solid waste
4)    Sketches of sewers appurtenances ó Manholes ó different types storm water inlets, overflows, inverted siphons, automatic flushing tanks, ventilation in sewers.
5)    Report of Field visit to Municipal wastewater treatment plant/Industrial Effluent treatment

**8CE07          PROJECT  &  SEMINAR**
        Complete Project Report in a group of Maximum 9 students shall be submitted.
        Out of 75 internal marks, 25 marks shall be given through the internal viva by three member committee one of them will be guide.

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**SYLLABUS PRESCRIBED FOR**
**BACHELOR OF ENGINEERING**
**MECHANICAL ENGINEERING**
**SEMESTER PATTERN (CREDIT GRADE SYSTEM)**

**SEMESTER : SEVEN**

**7ME01          MACHINE DESIGN AND DRAWING – II**

**Unit I :** a)   Design of Shaft: Material, Design on the basis of strength considering shaft subjected to
- Twisting moment only
- Bending moment only
- Combine twisting and bending moment
- Design on the basis of rigidity.
b)   **Design of Key** – types, strength of key
c)   **Design of Coupling** – types, requirments of good couplings, design of sleeve coupling, clamp or compression coupling, rigit flange coupling, flexible flange coupling.
d)   **Design of fly-wheel :** Puction, coefficients of fluctuation of speed and energy, energy stored in fly wheel, constrution, stresses in fly wheel arms and rim, Design of fly wheel based on T-M diagram, fly wheel for Otto cycle engines and punching machines.                    (12 Hrs)

**Unit II:** a)   **Antifriction Bearings** : Types of bearing, construction, desingations, standard load ratings by AFBMA for static and dynamic loads, life of bearings, selection of bearings, lubrication, mounting and enclosure,
b)   **Journal bearings :** lubrication of bearings, stable lubrication, Thick film lubrication, pressure distribution , minimum film thikckness, relations of variables-viscocity, coefficient of friction, speed, pressure, length and diameter, bearing modules, viscocity-Temperature chart, sommerfeld number, selection of lubricant, design procedure and numericals.
c)   **Design of belts :-**
Flat belts – types, material and construction of belt, type of drives, slip, creep, Design of belt.
V-Belts- Consruction and types, design of V Belts.
d)   **Wire Rope-** Selection, Construction, classifiction, designations, stresses in wire rope, selection of wire rope for given loads.

**Unit III :-** Design of Gear Classification, law of gearing, forms and system of teeth, interferemce. beam strengthof teech, dynamic tooth load, wear tooth lead, tooth failure.
a)   Spur gear  - Design of gear
b)   Helical gear – Classification face width, formative teeth number, strength of gear Design of gear
c)   Bevel gear – Classification, pitch angles, strength of gear, Design of gear
d)   Worm gear – Types, efficiency of gear, Design of gear.

**Unit IV :** a)   Design of I.C. Engine parts : Design of Cylinder, Pistion, Piston rings, Piston pin, connecting rod and crank .
b)   Design and drawing of Governor (Parts and Assembly) Types of Governors, Design procedure and problems, Hartnelløs Governor (including design of Spring, spindle, lever and bails).

**BOOKS RECOMMENDED :**
**TEXT BOOKS -**
1)   Machine Design fundamentals- Mechaincal designer workbook, J.E. Shigley, published by Mc graw Hill .
2)   Machine Design, R.S.Khurmi and Gupta J.K. published by Eurasia Publishers- New Delhi.
3)   Machine Drawing, N.D.Bhat,Charotar Publication

**REFERENCE BOOKS :**
1)   Machine Design, Maleev nd Hartman, published by C.B.S. Publication New Delhi.
2)   Machine Component Design, Willian Orhwein, published by Jaico Publishing House- N.Delhi
3)   Machine Elements in Mechanical M.F. Spotts
4)   Machine Design, Black P.H. Published by Mc Graw Hill,
5)   CAD CAM Conepts & applications, Chenna Kesava, PHI Publications
6)   Design Data Book by- P.S.G. Koimbatore
7)   Design Data Book by Mahadevan
(Use of any data book from the above will be permitted during the examination).

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**7ME02          ENERGY CONVERSION – II**

**SECTION – A**

**UNIT I:**   Reciprocating, Air Compressions :- Industrial uses of compressed air , Methods of compression and efficiencies of compression, Methods of reducing losses during compression

single and multistaging of compressions, clerance volume and its effect on work done and volumetric efficiency, condition for minimum work in tow stage compression, intercooling and its effects, Overall, isothermal and adiabatic efficiencies, IHP, BHP, requirements and after cooler.                    (7 Hours)

**UNIT II**: Rotary Compressors :- Comparison between reciprocating and rotary compressors, difference between fans, blowers and compressors, general equations for rotary machines, Vane, Roots blower, construction, working and velocity diagrams of centrifugal and axial flow compressors, performance characteristics of blowers and compressors.        (8 Hours)

**UNIT III**: Definitions, classifications of refrigeration systems : Air refrigeration, Bell-column cycle, reversed cannot cycle, revered Brytion cycle, vapour compression refrigeration, vapour asorption refrigeration based on solar and waste gear recovery. Analysis of simple saturated vapour compression cycle, representation on T-s, Ph diagrams, Problem on simple saturation cycle, Need for CFC free refrigerants.
**Air conditioning :**- Definitions, classification and applications. Phychromatic properties, phychrometriccharts.      ( 8 Hours)

## SECTION – B

**UNIT IV**: Classification of gas turbines, construction and working Gas turbine ideal and actual cycles constant volume, constant pressure, (Open and Closed) cycle analysis, Inter coolong, Regeneration and reheating application, optimum and maximum pressure ratios,work rations, Performance characteristics. Fields of application of gas turbine power plant,Introduction to Jet Propulsion, Ram jet, turbo jet. (No numerical treatment for Jet Propulsion).                    ( 8 Hours)

**UNIT V**: NUCLEAR POWER:- Fussion, fission, Chain reaction, conversion and breeding in nuclear fission, components of water, gas cooled, liquidized metal cooled thermal reactors.

**UNIT VI**: Introduction to renewable energy, Wind Energy, solar, fuel cell, bio-gas, MHD, basic requirmenets, Advantages, Disadvantages and applications.                    (7 Hours)

**RECOMMENDED BOOKS:-**
**TEXT BOOKS:**
1.    Steam and gas turbines R, Yadav; Central Publication Allahabad.
2.    Thernal Engineering, Domkundwar, Kothandarawar, Dhanpat Rai & Co.
3.    Power Plant Engineering; R.K.Rajput; Laxmi publication

4.    Solar Energy by S.P.Sukhatme; Tata Mcgraw-HIll in New Delhi

**REFERENCE BOOKS :**
1.    Thermal engineering by Mahesh M.Rathore; Tata Mcgraw-Hill in New Delhi
2.    Gas Turbines Theory- By Cohen and C.F.Rogers, P.H.I.H. Saravanamuttoo Heritage Publishers,
3.    Gas Turbines and Rotary compressors, Khajuria and Dubey, Dhanpat Rai & Co.
4.    Thermal Engineerinng : R.K.Rajput, Laxmi Publication.
5.    Renewable Energy; Godbfrey Boyle, Oxford University Press.

**7ME03        INDUSTRIAL MANAGEMENT & COSTING**

**UNIT I**: Concept, Principles and Techniques of Management; Evolution of management thoughts, functions of management, organization structure & relationship.

**UNIT II**: Marketing and Management  : Marketing stretegy market research, buying, motives, types of market, new product development, Product life cycle, Sales Organization, advertising, methods of selling, consumer behaviour.

**UNIT III**: a)    Functions of personnel management, Human resource planning, Recruitment, training and development , workers participation in management, joint culsultation, collective bargaining.
b)    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.

## SECTION - B

**UNIT IV**  : Objectives, functions, principle factors of estimating and estimating procedure, Estimation of weights & materials, Estimation of machining time, estimation of fabrication cost, forging cost, foundry cost.

**UNIT V**: a)    Introduction to costing and costing Techniques: Definitions, objectives, elements of costs, components of cost, job costing, simple process costing, normal and subnormal losses in process, waste, scrap.        (8 Hours)

**UNIT VI**: a)    Financing of business :- Basis of business finance, need of finance, Kinds of capital, sources of fixed & working capital.
b)    Financial statements :- Profit and loss statement, balance sheet

    c)   Depreciation Analysis :- Causes and significance, meethods of calculation of deprecdiation.     (7 Hrs)

**TEXT BOOKS :**
1. Management-principles, processes and practicals, Anil Bhat, Aryakumar; Oxford University Press
2. Management Accounting; Paresh Shah; Oxford University Press
3. Estimating and costing; TTTI Madras.

**REFERENCE BOOKS :**
1. Essentials of Management; Koontz, Harold; Mcgraw-Hill Education(India)
2. Cost Accounting; Jawahar Lal; Tata Mcgraw Hill Publishing
3. Cost Accounting by Bhar.

**7ME04     AUTOMATION ENGINEERING**
**SECTION - A**

**UNIT I :** Automation &Types, Aucomation for mass manufacturing and assembly, Automation of continuous processing systems, Detroit type automation, Automated flow lines. Methods of work part transport, transfer mechanisms, control function . General terminology and anaylsis of automated flow line,partial automation, assembly, systems and Line balancing.

**UNIT II :** NC/CNC :- Basic concept, N.C. controls- point to point , straight-cut and continuous path control, machine control units, closed system, NC machine components, tooling, CNC & DNCs, Manual part programming formats, programming languages,- APT,ADAPT, EXAPT etc. NC/CNC Programming- Various Programming codes, Manual part programming for drilling, Milling and turning operations, Examples of APT, Sensors and adaptive control in machining, Applications and economics of CNC.
    (12 Hrs.)

**UNIT III :** ROBOTICS :- Introduction to cybernetics, Evolution of industrial robots, Robots anatomy, Arm geometry, drive system and end efforts, sensors, Evolution of geometrical configurations for robots Programming techniques of Robots.
Applicaion of Robots in manufacturing, casting, welding, painting, m/c loading, handling, heat treatment, assemly, inspection, etc. Technicql Specifications of a Robot, Robot economics.  (9 Hrs)

**SECTION - B**

**UNIT IV : GROUP TECHNOLOGY AND PROCESS PLANNING :**
    Introduction-Part families, part classification and coding systems, Group technology machine cells, advantage of group technology

The planning function, retrieval type process planning system, Generative process planning systems Benefits of CAPP, Expert systems and expert system approach to CAPP.     (09 Hrs)

**UNIT V :** FMS : Introduction, schematic of FMS, FMs cells, Componenets of FMS, Relation of Group Technology, with FMS, Planning, Simulation and analysis of FMS, Applications of FMS.
Material handling : Automated storage and Retrieval system (ASRS), aomagted Guided Vehicle (AGV)etc.     (08 Hrs)

**UNIT VI :** Computer INtegrated Manufacturing; Introduction, Sequence of functins in CIM,elements of CIM system, CIM Wheel, structure of CIM database system. Guidelines for CIM development, benefits of CIM shop floor control and process monitoring. Automated inspection and testing : Introduction to automated inspection, Advantages over traditional method. On-line & off-line inspection, CMM construction, types & working.  (09 Hrs)

**TEXT BOOKS :**
1. Production system, Automation and CIM, Mikhal Groover, Pearson Publications.
2. CNC Machines; M.Adithan & B.S.Pabla; New Age International.

**REFERENCE BOOKS :**
1. Robotics; Yarem Koren, Mcgraw Hill.
2. Computer aided Manufacturing; P.N.Rao, N.K.Tiwari and & T.K.Kundra; Tata Mcgraw Hill.
3. Machine Tool Design; N.K.Mehta, Tata Mcgraw Hill.
4. Computer Control of Manufacturing; Yarem Koren, Tata Mcgraw Hill.
5. CAD/CAM/CIM ; Radhakrishnan & Subramanium; New age International.

**PROFESSIONAL ELECTIVE – I**

**7ME05    (1) NON-CONVENTIONAL ENERGY SYSTEMS**
**SECTION – A**

**Unit I :- Introduction** :- Renewable & Non-renewable resourses. Solar Radiaton- Solar Constant basic earth-sun angles spectrum distribution of extra terrestrial radiations and its variation, Solar time, Direction of beam radiation, comportation of radiation inclined surfaces, solar charts, measurements of diffiuse & global & direct radiations, duration of sunshine hours,computation of radiation data, Alteration of solar radiation by the atmosphere.

**Unit II :** Radiation transmission through covers :- Reflection and absorption of radiation, optical properties of cover systems in trnsmittance effects of surface layers on transmittance,

transmittance absorptace product. Solar Energy collections;- Heat transfer for solar energy utilization, flat plate eollections such as liquid & air collector, collector overall heat transfer coefficient, temperature distribution between the tubes & the collector effiencney factor useful heat gain , heat removal and flow factor, Testing of collectors &    effects of various parameters on the performance. INtroduction to various systems of concentrating collectors

**Unit III:** Solar energy Utilisation :- Application of solar energy in heating, cooling, pumping, power production, distillation, drying,solar cookers, solar pond, solar fuanaces, Solar Energy Storage:- Methods of storage such as sensible, latent heat & thermochemical storage,selection of method of storage, properties of storage materials and different arrangements of storages. (No alphabetical treatment)

## SECTION - B

**Unit IV:** Energy from Ocean : Tidal Power :- Types of tidal plants such as single and two basin plants, power developed and operation of tidal power plant.  Occean thrmal energy conversion system. Ocean temp. profile, OTE Power plant development, controlled flassh evaporation, indirect vapour cycle, Salinity differences conversion of salinity grandient resources, cosmotic pump, dylitic battery, etc.
Wind power :- Wind speed data, power in the wind, wind power development, types of wind miles, application for pumping and power generation. (8 Hours)

**Unit V:** Biomass Energy Resourses; Mechanism of green plant photosynthesis, effiency of conversion, solar energy plantation, Biogas- Types of Biogas plants, factors affecting production rates, Pyrolysis, Gasifess Types & Classification of vegetable oils a a liquid fuel and their properties, esterification process, formation of Biodiesel, Biodiesel & its properties, suitable species for Biodiesel formation and its cultivation, byproduct formation during esterification, Biodiesel economics. (8 Hours)

**Unit VI :** Directy Energy Conversion :- Photo voltage cells: Principle, concept of energy conversion, conversion efficiency, powr output and performance, sotrage, FuelCells : Principles types of fuel cells, convrsion efficiency, Geothermal energy resources, power genration methods like vapour dominated, water dominated, flash steam, binary fluid and total flow concept of power generation. (7 Hours)

**TEXT BOOKS** :-
1. Solar Energy, S.P.Sukhatme,TMH
2. Non-Conventional Energy Sources,G.D.Rai,Khanna Publications

**REFERENCE BOOKS :-**
1. Treatise on Solar Energy : H.P. Garg; John Wiley & Sons
2. Renewable Energy Conversion, Trnsmission and Storage, Bent Siresen; Elsevier Publication
3. Renewalle Energy; GodfreyBoyle, Oxford University Press, Mumbai.

**7ME05**  **PROFESSIONAL  ELECTIVE – I**
 **(2)  TOOL  ENGINEERING**

### SECTION – A

**Unit I :** Theory of metal cutting : Chip formation, shear angle, shear strain-velocity relatios, undeformed chig thickness, Force relations, Merchant circle, energy consideration in metal cutting, Tool wear tool life, tool life criterion, mach inability, tool materials, properties & types, Newly invented tool material and their types, cutting fluids. (08 Hours)

**Unit II :** Single point cutting tools-classification and nomenclature, various systems of nomenclature,single point cutting tool design, recommended speed, feed and tool angles determination, clamping arrangements and form tools. Twist drills & Reamers ó Geometry types, cutting forces, Numerical on Power & torque. (09 Hours)

**Unit III :** i)  Broaches ó Geometric  elements  of  broach  teeth, classification of broaches, design of  broaches, cutting forces.
ii)  Miling cutters- Geometry elements of broach teeth, classificatio of broaches, design of broaches, cutting forces.
iii)  Thread cutting tools:- Geometry of taps and dies.
iv)   Gear cutting tools :- Geometry of gear shaper cutter, gear hobs. (09 Hours)

### SECTION - B

**Unit IV :** Jigs & Fixtures : Design economics, principles of locations, types of locations,prevention of jamming, problmes of chip & dust in location, use of dowle, Reducant location, Principles of clamping, types of clamps, power clamping, Tool guiding & tool setting, types of drill bushes, types of drill jigs & their designs, Turning, Milling, Grinding,  Broaching and Assembly fixtures, Indexing devices in jigs & fixtures . (10 Hours)

**Unit V :** Press tools, Classification of presses,Theory of sheet metal cutting, clearance, cutting force calculations, Methods of reducing cutting forces, centre of pressure & its significance, classification of press working operations, Theory of bending, spring back action in metals, drawing fundamentals, calculation of drawing & bending forces, planning for cupping operation, stock layout. (09 Hours)

**Unit VI :** Design of press working tools, Types of die construction, function & nomenclature of die components Cutting Dies-Blanking & Punching, Forming Dies-Forming, Drawing and Bending etc. Design of Compount, Combination and progressive dies. Miscellaneous dies- Horn die, cam-action die, rubber & bulding die, sub-press die. (9 Hours)

**TEXT BOOKS :**
1. Fundamentals of Tool Design, -A.Kumar (Dhanpatrai & Sons)
2. A text book of Production Engineering -P.C.sharma (S.Chand Publication)

**REFERENCE BOOKS :**
1. Tool Design - Cyril Donaldson (Tata Mcgram Hill)
2. Jigs & Fixtures - P.H.Joshi (Tata Mcgram Hill)
3. Metal Cutting Theory & Cutting Tool Design- Arshinov (Mir Publications)
4. Tool Design - ASTME (ASTME)
5. Fundamentals ofMetal Cutting & M/c Tools - Juneja (Age Internatinoal) .

**PROFESSINAL ELECTIVE - I**
**7ME05 (3) ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS**
**SECTION – A**

**Unit-I :** **Introduction toArtificial Intelligence (AI) –** Overview of AI, definition and importance of knowledge based systems, representation of knowledge, knowledge organization, knowledge manipulation, acquisition of knowledge. (6 Hours)

**Unit II:** Introduction to Expert Systems - Features of expert systems, knowledge enginering, basis expert system terminology, human experts and artificial experts, algorithmic nd heuristic methods, difference between conventional programms and expert systems, Architecture of expert systems. (8)

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

**SECTION – B**

**Unit IV :** **Expert system Tools –** Types of tools for expert system building, system building aids, support facilities, debugging aids, I/O faciliteis, explantation 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 ó Development phased in expert system building, development constraints, reliability, maintainibitlity, examples of expert systems, diffiulties in development of exprt systems (7)

**Unit VI:** Fuzzy Engineerig- Fuzzy logic, fuzzy expert systems, fuzzy setts, membership functions, fuzzy rules for approximate reasoning, fuzzy inference generation, deffufication, development of rules matrix, applications of fuzzy expert systems for design of industrial controllers,

**RECOMMENDED BOOKS :**
**TEXT BOOKS :**
1. A guide to Expert Systems by Donald a.Waterman, Pearson
2. INtroduction to Artificial intelligence & Expert Systems by Dan W.Peterson, PHI
3. Fuzzy Logic by John Yen, Reza Langari, Pearson

**REFERENCE BOOKS :**
1) Expert Systems ó Theory & Practice, By Ermine, Jean Louis,PHI
2) Expert systems in Engineering , By D.T.Pham.JFS Pub.
3) Expert system application bySumit Vadera,Sigma press
4) Artificial Intelligence by Winston P.H.,Pearson

**7ME05 PROFESSIONAL ELECTIVE – I**
**(4) MECHATRONCS**
**SECTION - A**

**Unit I :** **Introduction to Mechatronics –**
Definition, Block diagram & Example, Basics of Sensors, Position & Speed Sensors, Proximity Sensors & Switches, LVDT, Digital optical encoder, Temperature Sensors Actuators-Functions, Electromagtic Principles, Solenoids and Relays, working of DC motors and stepper motors, hydralic and pneumatic actuators, (6 Hrs.)

**Unit II:** Data Acquisition: Analog signal processing using operational amplifier- Indroduction, types of amplifiers, sample and hold circuts, introduction to data acaquisiton, sampling thermo, Quantizing theory, Analog to digital conversion, Analog to digital convertor, Digital to analog conversion, Multiplexer. (6)

**Unit III: Mechatronic Systems** – control architecture Introduction, Control architecture, Analog circuuits, digital circuits, Design of logic networks, sequntial logic, flip-flops, application of flip-flops, micro-controlrs, Programmable logic controller.          (6 Hrs)

### SECTION - B

**Unit IV: Control Valves –**
Study of different control components and pneumatic & Hydraulic system- Construction, worling and function of Directional control valve, Flow control valves, Pressure relief valve, pressure reducing valve, sequence valve with symbols.

**Unit V : Pneumatic System –**
Design and analysis of pneumatic circuits, Synchronizing, Power chucking operations, controlling the rate of speed of piston, circuit to move with piece around a corner, circuit to move a work piece at a constant speed .          (6 Hrs)

**Unit VI : Hydraulic System –**
Design nd analysis of Hydraulic systems-Sequencing, pneumohydralic, regeneration circuit, circuit to control tool movement on lathers, grinders, etc.

**TEXT BOOKS :**
1. Introduction to Mechatronics and Measurement systems- 2/e by Aciatore and M.B.Histant, Tata Mcgraw Hill edition.
2. Pneumatics and Hydrautics by H.L.Stewart.

**REFERENCE BOOKS :**
1) Introduction to Mechatronics by Appus Kuttan K.K.- Oxford Univesity Press.
2) Mechatronics ó A multidisciplinary approach 4/e by W.Bolton-Pearson Publication,
3) Automation, Production systms and CIM by M.PGroover- Pearson Publication.

**7ME 06          PROJECT & SEMINAR**

**7MEO7          MACHINE DESIGN AND DRAWING- II – LAB.**

**List of Exercises for Term Work :**
1) Sheet 1 : Design of shaft
2) Sheet 2 : Design of coupling or any one type of gears.
3) Sheet 3 : Design of I.C. Engine Part (any one based on sysllabus)
4) Sheet 4 : Preparation of detail drawing of simple machine assembly (Pedestal bearing, Plumer block, simple eccentric, stuffing box, Cross head, Tail stock, Tool post, C-clamp, Screw jack, Boiler sfety valve ó Any1 of these)
5) Sheet 5 : Preparation of assembly drawing of simple machine assembly (Any 1 machine from Practical 4)

**Note :-** Any one from the above list should be done using Computer Programming/software.

**7MEO8          ENERGY CONVERSION II – LAB.**
**List of Experiments :**
Any six of the following :-
1. Trial on reciprocating compressor.
2. Trial on centrifugal blower.
3. Studies of domestic refrigerator.
4. COP calculation of vapour compression system.
5. Study of room air conditioner.
6. Study of gas turbine with the help of models.
7. Study of Pyrheliometer and measurement of dirct radiation.
8. Study of testing of a flat plate controler
9. Study of Solar still and trial on it.
10. Study of a photovoltac system.
Practical Examination shall consist of viva voce based on above term work.

**7MEO9          AUTOMATION ENGINERING – LAB.**

**PRACTICALS :-**
**At least six practicals will be based on the following topics.**
1. Preparation of Manual part program for Point-to-Point control. Ex; Drilling Operation.
2. Preparation of Manufal part program for two-axis CNC turning operatio.
3. studyof working & Progrmming of XY plotter.
4. Programming Examples on APT.
5. Study of performance of Robots.
6. Simullation of CNC Machining.
7. Case study of CAPP.
8. Case study on GT.
9. Performance on NC and CNC m/c.
10. Study of computer aided quantity control (CAQC).

**PRACTICAL EXAMINATION :-**
Practical Examination shall consist of viva voce based on above term work and syllabus.

**7ME10          PROFESSIONAL ELECTIVE – I**
          **(1) NON-CONVENTIONAL ENERGY SYSTEMS – LAB.**

**List of practicals :**
**Any six practicals will be based on the following topics :-**
1. Study of Pyrhlimeter and measurement of direct radiatoin.
2. Study of pyranometer and measurement of global and difuse radiation.
3. Study of sunshine recorder and measurement of sunshine hours.
4. Study and testing of a flat plate recorder.

5. Study of various concentrating collectors..
6. Study of a solar absorption of refregerating system.
7. Study of a solar dryer.
8. Study of wind mill and trial on it.
9. Study of a bio-gas plant.
10. Study of sterling cycle engine and a trial on it.
11. Study of a Solar Still and trial on it.
12. Study of a gasifier and trial on it.
13. Study of a Photovoltaic system & trial on it.

**Practical Examination :**
Practical Examination shall consist of viva voce based on the term ówork and syllabus.

**7ME10         PROFESSIONAL ELECTIVE – I**
**                TOOL ENGINEERING – LAB.**

**TERM WORK :** ANY EIGHT OF THE FOLLOWING .
1. Design & drawing of single point cutting tool.
2. Design & drawing of form tools.
3. Design & drawing of drill.
4. Design & drawing of broach.
5. Design & drawing of milling cutter.
6. Study of geometry of reamer.
7. Study of gear cutting tools.
8. Measurement of forces inOrthogonal cutting by Dynamometer.
9. Study of Geometry of taps and dies.
10. Design & Drawing of press tools.
11. Design & drawing of jigs.
12. Design & drawing of fixtures.

**Practical Examination :**
Practical Examination shall consist of viva voce based on the term ówork and syllabus.

**7ME10         PROFESSIONAL ELECTIVE – I**
**      (1) ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS - LAB**

**Practical :** The students are expected to perform five practicals based on the above syllabus.

**7ME10          PROFESSIONAL ELECTIVE – I**
**         (2) MECHATRONICS – LAB.**

**PRACTICALS :** At least six practicals will be based on the above syllabus**.**
**Practical Examination :**
Practical Examination shall consist of viva voce based on the term ówork and syllabus.

**SEMESTER : EIGHTH**
**8ME 01         PROFESSIONAL ELECTIVE – II**
**           (1) AUTOMOBILE ENGINEERNIG**
**SECTION – A**

**Unit I :-** Classification ofautomobiles, chasis types, Power Unit-Functions and locations power for propulsion, engine mounting, engine parts- types, construction and functions, Multiple cylinder engines, General considerations of engine balancing, firing order..

(7 Hrs)

**Unit II :** Fuel feed systems - fuel fees systems for petrol engines. Fuel pumps, fuel filtrs, Air filters, Basic principles of MPFI and CRDI.Multipoint fuel injection Systems (MPFI) Common Rail Diesel Injection Systems (CRDI) Controlling system : purpose, types of cooling systems, liquid cooling system-water jacket ports, water pump and radiators, by pass rectractulator system, temeprature indicator, antifreeze, mixtures, troubles and remedies of cooling system.

**Unit III:** The electrical system, Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive, over running clutch, solenoid switch and shitf, Ignition system;- Battery coil ignition system, Ignition timing and its effect on engine performance, Ignition advance mechanisms, Electronic Ignition system.

**SECTION – B**

**Unit IV :** Transmission system : Layout, types of clutches, single plate friction clutch and multiple clutch, clutch adjustments, clutch troubles an remedies, Gear Boxes :- Sliding mesh, constant mesh and synchromesh gear box, function of over drive, trouble shooting and remedies, torque convertor, automatic transmisson, Propelier shaft, hotckiss drive, torque tube drive, differential.

(8 Hrs)

**Unit V:** Breaking system:- Mechanical, hydraulic brakes, power brakes, and vaccum brakes Fault finding and maintance of brakes, Steering system :- Fuction, types of linkages. steering gears, steering gear ratio, wheel balancing, wheel alighment castor, king pin inclination, toe-in & toe-out & their effect, introduction to powe steering.

**Unit VI :** Suspensions:- Rigid axle and independent syspension system, shock absorbers. Auto lubrication :- Types of lubrication, their tests and ratings, multi-viscocity oils, chasis lubrication, Engine lubrication :- types of lubricaing system, full premier system, dry sump system, oil pump, oil filters system- by pass system, full

flow system, oil breather, crankcase ventimeter, Engine lubrication troubles and remedies.

**TEXT BOOKS :**

1. Automobile Engineering- Vol.I & II, Kirpal Singh, Standard Publishers Distributors

2. Automobile Engineering ó R.K.Rajput; Laxmi publications, New Delhi.

**REFERENCE BOOKS :**

1. Automotive Mechanics; Crouse & Anglin, TMH.

2. Automotive Mechanics ; J Heitner; East West Press

3. Automotive Mechanics ; S.Srinivisan; TMH.

**8ME01        PROFESSIONAL  ELECTIVE – II**
**(2) PRODUCTION  PLANNING  AND  CONTROL**

**SECTION – A**

**Unit I  :-  INTRODUCTION**

Objectives and Advantages of PPC, Production procedure, functions of PPC, production consumptions cycle, centralised & decentralised PPC, Pre-requisite of PPC.

**Unit II  :- PRODUCTION FORCASTING :-**

Introduction, definition and importance of forecasts, Qualitative model: Delphi techniques, Quantitative models :- Simple moving average, weighted moving average, simple experimental smoothing.

Forecasing error and selection of forecasting model. Types of forecaste: Constant,linear cycle forecaster,Verification and conrolling, The moving range chart, Average MR, out of control conditions.

**UNIT III: PRODUCTION PLANNING** : -  The production order, Procedure for formulating Production order, masier Program, 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, Rate of return, Economic Batch size.

**SECTION – B**

**Unit IV : MACHINE OUTPUT :**

Machine output, multi machine supervision by one operator, Machine interforcence, Ashcroft lalbles, average number of consecutive servicing task, the Ashcraft Number.

**Unit V:   ANALYTICAL STRUCTURE OF INVENTORY :** - Definition of inventory, Types of inventory and the classification, structure of inventory problems and its analysis, the relevent cost, objectives of carrying inventories, selective inventory analysis. Static Model :- General characteristic, incremental analysis, opportunity cost, cost of risk, decision criteria under uncertaincy.

**Unit VI:   A)   DYNAMIC MODEL :- CERTAINITY CASE ;-** General characteristic, optimum lot size model win constant demand, quntity discounts.
Risk Case :- General characteritics, P-system and Q-system.

**B)** Material Requirment planning (MRP) :- Introduction to MRP, Manufacturing Resource Planning (MRP-IT), just in time (JIT), comparasion of MRP, MRP-II, Enterprenureship Resource Planning (ERP)          (8 Hrs.)

**TEXT BOOKS :**
1. Elements of Production Planning and Control by Simuel Eilon ó Universal Publishing Corporation ltd.Mumbai
2. Production Control ó John E.Biegal- Prentice Hall of India.
3. Inventory control, Theory & Practice- Start & Miller

**REFERENCE BOOKS :**
1. Production Planning and control and Management:- K.C.Jain & L.N.Agrawal.
2. Production & Operation Mgmt.;- E.E.Adam, Jr.R.J.Ether, Prentics Hall of India.
3. Industrial Engineering and Production Management- M.Mahajan-Dhanpat Rai.

**8ME01        PROFESSIONAL  ELECTIVE – II**
**(3 ) MANAGEMENT INFORMATION SYSTEM**

**SECTION - A**

**Unit I  :  Basis of MIS :**

What is a system, what is information and data, necessity of prompt, accurate & relevent information for effective decision making, decision tables, Types of information, organisational structure and types of information within them, Fact gathering techniques.          (8 Hrs.)

**Unit II  :  System of Anaylsis & Design** :

Phases of system development procedure, project request form system proposal, cost/benefit analysis functional specifications, detailed system descriptio, system acceptance criteria, audit and control requirments, structured system development, data flow diagram, context analysis diagram, exploding a process,

structured analysis, structured design,structure charts, coding schemes, input form design, system protection .        (8 Hrs.)

**Unit III :** A)    **Development of MIS**

Long Range plans of MIS, Class of Information, information requirment, implementation of MIS, Management of Quality in the MIS, Orgaisation for the development of MIS,Factors of success & failure of MIS.

B)    **Choice of Information Technology** :

Nature of IT decision, Strategic decision, Configuration decision, Evaluation, IT implementation plan.    (8 Hrs.)

### SECTION – B

**Unit IV :  Introduction of MIS :**

Priliminaries of Information System Technology Data base Management System **:** Concepets, Models, design, Performance monitoring & Turning, Security in the database environment MIS & RDBMS. DBMS Software ORACLE            (8 Hrs)

**Unit V  :  a)    Decision Support Systems (DSS) :**

Concept & Philosophy AI, Knowledge based expert system, MIS & Role of DSS.

**b)    Enterprise Management System (EMS) :**

Introduction to ERP, basic feature, benefits, selection and implementation EMS & MIS.

c)    Business preoces Re-inenginering (BPR) ; Introduction, Business process,Processl Models of Organisation and value stream model of organization, MIS& BPR.    (8 Hrs)

**Unit VI ; Application of MIS**

A)    Application in Manufacturing Sector:- Personal Management, Materials Management, Marketing Management.

B)    Application in Service Sector like Hospitals, Airlines, Hotels, Banks, Insurance. (8 Hrs)

**TEXT BOOKS :**

1)    Management Information System - W.S.Jawadekar (TMH, 2010)

2)    Information Systems for operation & Mgmt.-Voichdan, Homer.

3) Management Information Systems - Ross.

**8ME01            PROFESSIONAL  ELECTIVE – II**

**(4 ) ADVANCED  MANUFACTURING  SYSTEMS**

### SECTION – A

**Unit I :**    Total Quality Management(TQM) : Understanding quality, commitment & ledership Customer satisfaction involment

Performance measures- Case Study IMplementation of TQm Case Study                            (10)

**Unit II :**    Total Producive Maintanance (TPM) Introduction outline of TPM Concepts of õKobetsu-Kaizenö, õJishu-Hozenö Planned Maintenance Systems Operation & Maintenance skill upgrade training initial control, õHInshitu-Hozenö concept.    (10)

**Unit III :**    Business Process Re-Engineering (BPR) : Introduction, Reengg.Rethinking The new world of work who will Re-Engineer? Succeeding at Re-Engg.-case study.            (10)

### SECTION – B

**Unit IV :**    Value Engineering (VE) Introduction Value Orientation The variouis phases ofVE like orientation phase INformation phase, function phase .... etc.How to manage the VE progrmme case study                            **(10)**

**Unit V :**    Concurrent Engineering (CE) Introduction to CE & need of CE CE tools ADvances in design & manufacturing Engineering Design for manufacture, design for assembly Rapid phototyping Concurent approaches in design, manufacturing and aspects of engg.

**Unit VI** :    Just in Time (JIT) Introduction to JIT What is Toyota Production Systems Design, Development & Management of JIT Manufacturing systems, Implementation of JIT.

**BOOKS RECOMMENDED:**

**TEXT BOOKS :**

1)    Besterfield D.H. etal õTotal Quality Management,ö PHI New Jersy , 1995.

2)    Johan S.Okland,öTQMö: Text with Cases, Butterworth einemamn, Oxford, 1995.

3)     õTPM edited notesö by Japan Institute of Plant Management.

4)    Michel Hammer & Jones Champy, õRe-Engineering the Corporation, Nicholas Brealey, London, 1994.

5)    G.Joganathan, õGetting MOre at Less Cost : The Value Engineering Wayö, Tata Mcgraw Hill, 1992.

**REFERENCE  BOOKS:**

1)    Andrew Kausik, :Concurrent Engineering : Automation, Tools & Techniquesö, John Willey & Sons.

2)    Chanan S. Syan & Unny Menon, õConcurrent  Engineering: Concept, Implementation & Practice,  Champman & Hall.

3)    M.G.Korgaonkar, õJust in Time Manufacturingö, Macmillan India Ltd. New Delhi, 1992.

**8ME02**        **PROFESSIONAL ELECTIVE – III**
**(1) REFRIGERATION & AIR CONDITIOING**

### SECTION – A

**Unit I** : Introduction to automotive air conditioning- Vapour compression system:- Analysis of simple vapour compression system. Use of pressure enthalpy. Temperature entropy charts. Effect of operating conditions such as evaporation and condesion pressure, superheating and sub cooling Actual vapour compression system, Refrigerants :- classification: primary & secondary refrigerants, desirable properties of refrigerants; merits & demerits of commonly used refrigerants such as Ammonia R-12, R-22 and their selections and eco friendly refrigeration 134 a, HFC.

**Unit II**: Multi stage pressure systems;- multistage compression: choice of intermediate pressure, complete multi-stage compressions. Multi evaporator systems; single compression individual expansion value, single compression multi expansion valve, individual compressor multi expansion valves, cascade systems, its applications to cryogenics Air liquefaction processes- Linde-Hampson (No numerical treatment to air liquefaction system)
(10 Hours)

**Unit III** : Refrigeration systems components & controls:- brief study of refrigerants compressor, condensers, evaporators, expansion valves, drier, fillers, selection criteria for the components of vapours compression systems Flow controls, temperature controls, pressure controls and safety devices. Defrosting systems, testing & charging of refrigeration systems, leak detection.  (No analytical treatment is expected)
(8 Hours)

### SECTION – B

**Unit IV :** Psychromeric properties of moisair psychrometric chart, concept of thermodynamic wet óbulb temperature, representations of Psychromeric process on Psychromeric charts, mixing of air, evaporating cooling, air washers. Human comfort:- metabolism of human body, factors influencing comfort, concept of effective temperature, optimum effective temperature & comfort charts.
(7 Hours)

**Unit V** : Classification of air conditioning systems & applications. Unitary system package, window type & split type air conditioning. Central system:-System components, types:- direct expansion system, all water system & all air system. Water, summers & year

round air conditioning. Transmission & distribution. Types of supply air ducts, consideration for selection & location of outlet, distribution partners of outlet, location of return air opening & introduction to duct design.
(No numerical treatment is expected)          (9 Hours)

**Unit VI** : Load calculation & applied Psychromety-basic consideration at heat gains/losses sensible & latent , heat due to occupancy lightening, appliances, products, process, air conditioning systems, safety factor cooling load estimates, heating load estimates. Sensible heat factor by pass factor, apparatus dew point, effective sensible heat factor          (8 Hours)

**BOOKS RECOMMENDED :**
**TEXT BOOKS :**
1.   Refrigeration & air conditioning; C.P.Arora; Tata Mcgraw Hill Publication.
2.   Refrigeration & air conditioning; Arora, Domkundwar;Dhanpat Rai Publication.
**REFERENCE BOOKS:**
**1.** Principles of Refrigeration; J.Dossat; Pearson Education, Asia publication
**2.**   Refrigeration & air conditioning- P.L.Balaney
**3.**   Refrigeration & air conditioning- Manohar Prasad.

**8ME02**      **PROFESSIONAL ELECTIVE – III**
**(2) MACHINE TOOL DESIGN**

### SECTION – A

**Unit I :** General requirement of machine tool design kinematics of m/c tool :- Various driving systems used in machine tools, basic design consideration in the design of variable speed range in the machine tools, layout of speed in geometric, logarithmic & earthmatic progression saw diagrams, range ratio, graphical represenation of speed on structural and ray diagrams, design of speed & feed boxes and their classification.          (8 Hours)

**Unit II :** a)   Mechanical, electrical, Hydraulic stepless regulation of speeds.\
        b)   Machine tool structure (bed,column, cross-rail) functions & their    requirements design criteria for machine tool structure design procedure factors effecting stiffness for machine tool structure & their profile. (8 Hours)

**Unit III :** Static & dynamic rigidity, methods of increasing rigidity of structure, machine tool clasfic system, procedure for assessing dynamic stability, dynamic charactorstics, single degree &

multidegree of ferrdom systems, Experimental determination of dynamic charactorstics of m/c tool, dynamic characteristics of cutting process, statrility analysis, single degree, multidegree

( 8 Hrs)

### SECTION – B

**Unit IV** : Vibrations of machine tools :- Effects vibration on m/c tool on cutting condns, workpiece, Sources of cibrations, types of vibrations (forced, chatter, stickup vibrations) and its minimization.

Shock absorberm,isolated tool bioder, chatter in milling lathe, grinding, reduction of chatter in design & production stages.

(8 Hrs)

**Unit V** : a) Machine tool guideways & slideways :- Fuctions, shapes of guideway, materials, methods of adjusting clearance inguideways, design of slideways for wear resistence, determination of maximum and average pressure, on slide way, Hydraulic guideway, antifriction guidway, protecting devices for slideway. (8 Hrs)

**Unit VI** : machine tool spindle and bearings :- Fuctions, requirment, types and materials of spindle, machines tool compliance, design of spindle, antifriction bearing, performance indices, Hydrostatic journal bearing, hydrodynamic bearing. (8 Hrs)

**BOOKS RECOMMENDED:**
**TEXT BOOKS:**
1. Principles of Machine Tools ó Base & Pal
2. M/c Tool Design ó N.K.Mishra.

**REFERENCE BOOKS:**
1. Machine Tool Design Vol. I,II,III,IV, N. Acherkar (Mir Pub.)
2. Principles of Machine Tools ó Sen & Bhattacharya
3. Design Principles of Metal ó Kondsberger Cutting Machine Tools
4. Machine Tool Desting Vol. I to VI ó CMIT, Banglore.

**8ME02        PROFESSIONAL  ELECTIVE-III
                 (3) FINITE  ELEMENT  METHOD**

### SECTION - A

**Unit I :** **Introduction :** Application, Advantages, Steps of FEM, Stress and Equilibrium, Boundary conditions, Strain Displacement Relations, Stress-strain Relations, Von mises stress, Temperature effect, Potential Energy & Equilibrium, Gelerkinø Method, stiffness (Displacement) Method. (7 Hrs)

**Unit II** : **Matrix Algebra & Gausian Elimination :** Matrix Multiplication, Transposition, Diagonal Matrix, Symetric Matrix, Upper Triangular Matrix, Determinant of Matrix, Matrix Inversion Eligen values & Elgenvectors, Gaussian elimination. (7 Hrs)

**Unit III** : **ID Problems :** Finite Element modeling, coordinate Shape function, The potential Energy approah, The Galerkinø Approach, assemblies of the global stiffness matrix and loac vectors, Properties of stiffness Matrix, Treatment of boundary conditions, quadratic Shape Functions, Temperature Effects. (7 Hrs)

### SECTION – B

**Unit IV** : **2D Problems for CST :** Constant strain triangle, isoperimetric Representation , potential Energy energy approach, element stiffness, galaerkinø approach, temperature effects, problem modeling and boundary conditions. (7 Hrs)

**Unit V** : **Development of equations:** Truss equations, derivation of the stiffness, matrix for a bar element in local coordinate, global stiffness matrix, beam equation. Beam stiffness, example assemblage of beam stiffness matrix, plain stress & plain stress stiffness equations, basic concept of plain stress and plain strain, derivation of the CST stiffness matrix and equations Treatment of body and surface forces. (7 Hrs)

**Unit VI** : **Heat Transfer :** Derivation of the basi differential equations, Heat transfer with conduction, radiation, ID Formulation using variational method.
**Fluid Flow :** Derivation of the basic differential equations, Id Finite Element formulation, Computer  Implementation (prepossessing, post processing, input data file, mesh generation)

**BOOKS RECOMMENDED:**
**TEXT  BOOKS :**
1. Introduction to Finite Element Engineering ó T.R.Chandrupatla, Belegunda; PHI
2. A First course in Finite Element Method- Darya Logon, Thompson Learning (TL Publisher)

**REFERENCE BOOKS:**
1. The Finite Element Method in Engineering- S.S.Rao, Elsveir Pub., 4th Edition.
2. Fundamentals of Finite Element Method analysis ó D.V.Huttan, Tata Mcgraw Hill

3.  Concept & Applications of Finite Element Analysis ó Robert D.Cook
4.  Finite & Boundary Element Method in Engineering ó O.P.Gupta
5.  An Introduction to Finite Element Method- J.N.Reddy, Tata Mcgraw Hill, 2nd Edition, 2005.

## 8ME02 PROFESSIONAL ELECTIVE - III
## (4) ROBOTICS
### SECTION – A

**Unit I :** **Fundamentals of Robotics-** Introduction, Automation & Robotics- robot applications robotic systems, robot anatomy and robot configurations, Joint types used in robots, robot wrists, joint notation schemes, work value for various robot anatomies, robot Specifications**.** (8 Hrs.)

**Unit II :** **Robots end-effectors**-classification of end-effectors, mechanical grippers, hooking or Lifting grippers, grippers for molten metals, plastics, vacuum cups,magnetic grippers Electrostatic grippers, multiple grippers, internal & external grippers, drive systems for gripers, active & passive grippers**.** (7 Hrs.)

**Unit III :** **Robot drives & control-**pneumatic power drives, hydraulic systems, electric drives, robot controllers-servo and non servo systems, motion control of robots, point to point and continuous path control, teaching of robots, robot programming methods. (7 Hrs.)

### SECTION – B

**Unit IV :** **Robot Sensors :** Scheme of robotic sensors, contact type sensors, force, torque, touch, position, velocity sensors, non-contact type sensors, electro-optical imaging sensors, proximity sensors, range imaging sensors, robot environment and robot input/output interfaces, machine intelligence, safety measures in robots**.** (7 Hrs.)

**Unit V** : **Robot Kinematics-** Forward & reverse kinematics, forward and reverse transformation of two DOF & three DOF 2-D manipulator, homogeneous transformations.

**Unit VI :** **Quantitative Techniques for economic performance of robots**- Robot investment coats, robot operating expenses. methods of economic evaluation, method of pay-back period, return on investment method, discounted cash flow method. (7 Hrs.)

### RECOMMENDED BOOKS :
### TEXT BOOKS :
1)  Robotics Technology & Flexible Automation by S.RDeb, Tata Mcgraw Hill.

2)  Industrial Robotics by M.P.Groover, McGraw Hill.

### REFERENCE BOOKS:
1.  Robotics for Engineering, Korean Yoram, McGraw Hill.
2.  Robots & Manufacturing automation by Asfahal, C.Ray, John Wiley.
3.  Robotic Engineering by Richard D.Klafter, PHI.

## 8ME03 I. C. ENGINES
### SECTION – A

**UNIT I** : **Introduction to IC Engines and cycle analysis:** Basic of I.C. Engines , Details of two stroke and four stroke engines, Air standard cycles, Fuel air cycle and actual cycle. Variation in specific heat, Dissociation and their effect on engine performance. Review of other losses in IC engines. (7 Hrs)

**UNIT II:** **Fuels and alternative fuels :** Conventional fuels for IC engines, requirement, properties, fuel additive, limitations of fossil fuels. Review of various alternative/non-conventional fuels . Studies of fuel injection systems : Fuel pump and their working, different types of fuel feed systems, studies of injectors nozzles, Bosch type fuel pump. (8 Hrs)

**UNIT III**: **Combustion SI Engine:**- Stages of combustion, factors influencing various stages, Normal and abnormal combustion, Detonation, Factors responsible for detonation. Effect of detonation. Octane rating of fuel, Requirement of combustion chambers for SI engines, important types, relative advantages and disadvantages and application. (8 Hrs.)

### SECTION - B

**UNIT IV:** **Combustion in CI. Engines:**- Stages of combustion in CI Engines, Delay period, factor affecting delay period, diesel knock, cetane rating, Requirements of combustion chamber for CI Engines. Methods of generating turbulence in combustion chamber. Types of combustion chambers for CI Engies. ( 8 Hours)

**UNIT V** : **Performance testing of IC Engines:** Evaluation of various performance parameters of IC Engines including heat balance, sheet and excess air calculation. Methods of determination of friction power. Supercharging : Basic principles, objectives, arrangements for super charging, advantages and limitations of super charging (8 Hours)

**UNIT VI**: **Emission from IC Engines :** review, their effect on human health, cause of formation and approaches to control this pollutants. Study of BIS, EURO emission norms, IC Engines: Recent trends: Microprocessor based engines, management multi-point fuel

injection engines, common rail direct injections engines, variable valve timing engines.                                    (8 Hours)

**TEXT BOOKS:**
1. Internal combustion Engines - M.L.Mathur & Sharma Dhanpatrai & Sons.
2. Internal combustion Engines ó V.Ganeshan, Tata Mcgraw Hills.

**REFERENCE BOOKS :**
1. Internal combustion Engines Fundaments- John B. Heywood, Mcgraw Hills
2. Internal combustion Engines & Air Pollution- Obert E.F.Intext Educational.

## 8ME04          OPERATION RESEARCH  TECHNIQUES

### SECTION – A

**UNIT I :  Operations Research :** Introduction, characteristics, Phases, Limitations, Models and classification of O.R.Models.
**Linear Programming :** Formulation, Standard Form, Graphical and simplex methods, Primal-Dual relationship.       (8 Hrs)

**UNIT II** : Transportation Models : Introduction, LP Formulation of transportation problems, Methods for finding initial solution, MODI method.
**Assignment Models** : Introduction, Mathematical statement and solution methods of assignm. Problems, variations of assignment Problems.                                    (6 Hrs)

**UNIT III**: **Network Models :** Network construction, PERT analysis, CPM analysis, cost analysis & Crashing the network, Updating resources smoothing and leveling.       (6 Hrs)

### SECTION- B

**UNIT IV: Waiting line models :** Introduction, characteristics, classification, analysis of  M/M/1 and M/M/s models.
**Sequencing :** processing of n jobs through two machines, n jobs through m machines, two jobs through m machines**.**  (7 Hrs)

**UNIT V**: **Replacement models :** introduction, value of money, individual and group replacement policies.
`     **Simulation :** introduction, Monte Carlo simulation, advantages and limitations, applications of simulation to queuing models, inventory models, maintenance models , etc.       (7 Hrs)

**UNIT VI**: Dynamic programming: introduction, characteristics, applications of dynamic programming to capital budgeting, production

scheduling, travelling sales men, cargo loading problems, etc.
                                    (6 Hrs)

**RECOMMENDED BOOKS:**
**TEXT BOOKS:**
1. Operations Research and Theory applications- II ed.J.K.Sharma; Macmilan Business Books
2. Operations Research; Prem kumar Gupta, D.S.Hira; S.Chand & Co. ltd.

**REFERENCE BOOKS:**
1. Inroduction to Research Operation, 7th Edition; Hiller/Lieberman; Tata Macgraw Hills.
2. Operations Research : An Introduction, 7th Edition, H.A.Taha; PHI.
3. Operations Research: Principles and practices; 2nd Edition, Ravindran, Philips, Solberg, John Willey & Sons.
4. Operations Research: Kapoor .

## 8 ME05                PROJECT & SEMINAR

## 8ME06                PROFESSIONAL  ELECTIVE-III
### (1)  REFRIGERATION & AIR CONDITIONING - LAB.

**List of Practicals :-**
          Any six of the following should be conducted and a report there of should be submitted

1.      Trial on Vapour compression system.
2.      Trial on Air-conditioning system.
3.      Study of Electrolux system.
4.      Study of Water cooler.
5.      Study of window Air conditioner.
6.      Study of household refrigerator.
7.      Study of desert cooler.
8.      Study of cold storage plant.
9.      Testing and changing of refrigeration system.
10.     Study of defrosting system.
11.     Study/trial of ice plant.
12.     Study of various refrigeration and air-conditioning controls.

**Practical Examination:**
It shall consists of viva-voce based on term work and syllabus.

## 8ME06          PROFESSIONAL  ELECTIVE-III
### (2)  MACHINE  TOOL  DESIGN - LAB.

**PRACTICALS :-**
(1)      Design of speed box.
(2)      Design of feed box.
(3)      Design of combination guide way.

(4)     Design of combination guide way.

(5)     Acceptance lists

(6)     Pneumatic trainer

(7)     Hydraulic Trainer.

(8)     Design of Laths bed

**Note :- At least 6 practicals from above list should be done.**

**PRACTICAL EXAMINATION:-**

     It shall consists of viva-voce based on term work and syllabus.

**8ME06**       **PROFESSIONAL ELECTIVE- III**
**(3) FINITE ELEMENT METHOD- LAB.**

**PRACTICAL EXAMINATION:-**

     It shall consists of viva-voce based on term work and syllabus.

**8ME06**       **PROFESSIONAL ELECTIVE- III**
**(4) ROBOTICS – LAB.**

**PRACTICAL :** The students are expected to perform 5 practicals based on the above syllabus

**8ME07**       **I. C. ENGINES- LAB.**

**List of Experiments :**

     Any six of the following practical should be performed and

1.     Performance test on a single cylinder diesel engine.

2.     Performance test on a single cylinder petrol engine.

3.     Evaluation of the heat balance for single cylinder diesel engine.

4.     Performance test on a multi-cylinder petrol engine.

5.     Mors test on multi-cylinder petrol engine.

6.     Trial on petrol/ diesel engine to plot p-0 and p-V diagram.

7.     Measurement of exhaust gas emission from S.I.engine

8.     Measurement of smoke density of CI engine exhaust.

9.     Study of Bosch type single plunger fuel pump.

10.     Study of various types of fuel injectors and nosels.

     It shall consist of viva-voce based on term work and syllabus.

**8ME08**     **OPERATION RESEARCH TECHNIQUES - LAB.**

**List of Practicals:-**

     At least 6 practical from above list should be done.

1.     Formulation of LPP from real life situation.

2.     Solution of LPP by using MS Excel.

3.     Case study of transportation problems.

4.     Case study of assignment  problems

5.     Case study on project network.

6.     Case study on sequencing  problems

7.     Constructing and solving the simulation model from real life situations

8.     Study of Replacement model through different problems.

9.     Case study on dynamic programming problems.

External Practical Examination ó Viva voce on the term work and syllabus.

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**SYLLABUS PRESCRIBED FOR**
**BACHELOR OF ENGINEERING**
**ELECTRICAL ( ELECTRONICS & POWER) ENGINEERING**
**SEMESTER PATTERN (CREDIT GRADE SYSTEM)**

**SEMESTER : SEVENTH**

**7 EP01/7EL01/7EE01  CONTROL  SYSTEM - II**

**SECTION-A**

**Unit I :**  **Compensation Techniques:**
     Introduction, Preliminary considerations of Classical Design, Lead Compensator, Lag Compensator, Lag- Lead Compensator, Cascade Compensation in time domain, Cascade compensation in Frequency domain, Feedback compensation in frequency domain .

**Unit II :**  **State Space Techniques I:**
     State, state space and state variables; SISO/MIMO linear systems state variable models - differential equations, Transfer Functions, Block Diagrams and State Diagrams (Signal Flow Graphs); Transfer functions decomposition - Phase variable forms, Canonical forms and Jordan canonical form; Transfer function - state model; Transfer matrix; State equations solution - State transition matrix (STM); STM Computation ó Laplace transformation, Canonical transformation and Cayley Hamilton theorem; Time response ó SISO Systems.

**Unit III :**  **State Space Techniques II:**
     Concept - controllability and observability; SISO/MIMO Linear systems -Gilbertøs method and Kalmanøs test; SISO controllable systems Design -state feedback.

**SECTION-B**

**Unit IV**  **Sampled Data Control Systems:**
     Representation, Z Transforms. review, Sampler and Hold - zero order hold; Sampling theorem; Z Transform analysis ó open loop and closed loop sampled data systems, Z Transfer functions, Difference equation solution and response; Z Transform Method,. Discrete Systems Response, Open and closed loop systems pulse transfer functions - Different sampler locations; Digital Controller - transfer function; Stability analysis - S and Z Domain relationship, Juryøs Test and Bi-Linear Transformation, Root and root locus method.

**Unit V :**  **Non-Linear System Analysis I**     **:**
     Non-linear system behavior ó types and characteristics; Describing functions - typical non-linearity and their

characteristics; Stability analysis - Describing function method and Limit cycles; Limitations - describing function method.

### Unit VI : Non-Linear System Analysis II

Linearization - Around operating point; Singular points ó Classification and Nature; Phase-plane method - non- linear systems analysis; Phase trajectories construction ó analytical method and graphical method by isocline method; Stability analysis - limit cycle; Limitations - phase-plane method.

### TEXT BOOKS:

1. I.J. Nagrath and M. Gopal ó Control System Engineering,Wiley Eastern Limited, New Delhi.
2. K . Ogata - Modern Control Theory, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Modern Control System, Richard Dorf, Robert Bishop, PEARSON education, 11th edition 2008

### REFERENCE BOOKS:

1. Control Engineering, D.Ganesh Rao, k.Chennavenkatesh, 2010
2 . D.Roy Choudhary, Modern Control Engineering,Prentice Hall of India Pvt Ltd. New Delhi.
3. R.C. Sukla ó Control Systems Dhanpat Rai & Co.Pvt Ltd.

## 7EP02/7EL02/7EE02  POWER SYSTEM OPERATION & CONTROL

### SECTION-A

### Unit I : Economic Operation – Part I

Meaning of optimum scheduling, UCP and LSP; Input ó Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs; Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

### Unit II : Economic Operation – Part II

Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

### Unit III : A.  Generator Control Loops

Concept of real and reactive power; Effect of real and reactive power on system parameters; Philosophy of real and reactive power control; Basic generator control loops.

### B.  Automatic Voltage Regulator (AVR)

Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

### SECTION-B

### Unit IV : Automatic Load Frequency Control

Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

### Unit V : Control Area

Meaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system ó Dynamic response; Tie-line bias control.

### Unit VI : Steady-State Instabilities

Natural torsional oscillatory modes in power system; Natural mode of a single generator operating onto infinite bus; Effect of damper winding; Effect of changing excitation; Power system stabilizer; Introduction to modern control application.

### TEXT BOOKS :-

1. O. L. Elgerd ó Electric Energy Systems Theory: An Introduction ó Second edition, McGraw-Hill Book Comp. N. Y. 1987.
2. Power System Operation & Control, N.V.Ramana, PEARSON education, 2010.
3. Power System Operation by R.Miller, J.H.Malinowski,  TMH, 2nd reprint 200

### REFERENCE BOOKS :

1. L. K. Kirchamayor ó Economic Operation of Power System- Wiley Estern Pvt. Ltd., New Delhi.
2. Hadi Saadat ó Power System Analysis ó WCB/McGraw-Hill International Edition 1999
3. I. J. Nagrath, D. P. Kothari ó Modern Power System Analysis ó Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi
4. P. S. R. Murty ó Power System Operation and Control ó Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Wood and Wollenberg ó Power Generation, Operation and Control ó Willey ó Inter Science Publication.

**7EP03 /7EL03/7EE03    ELECTRICAL POWER - II**

### SECTION-A

**Unit I ::    Symmetrical components**
Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank- sequence voltages and currents relationship; power system elements ó sequence impedance and sequence networks ; Various three phase transformer connections ó zero sequence rules; Unbalanced load system ó application.

**Unit II :    Symmetrical Fault Analysis**
Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation.

**Unit III :    Unsymmetrical Fault Analysis**
L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults-loaded and unloaded conditions.

### SECTION-B

**Unit IV :    Overvoltages**
Causes ó internal and external; Voltage surge, Basic insulation level, Protection ó earthing screen, overhead ground wire, lightning arresters.

**Unit V:    HVDC** Transmission Basic principle, Transmission equipments, Comparison with AC links, Inverters ó reactive power requirement; Converters, DC links, Circuit breaking, ground return, Economic distance, modern developments.

**Unit VI :    Flexible AC Transmission Systems (FACTS)**
FACTS concept, Elements, Controllers, Comparison with Conventional AC Transmission system.

**TEXT BOOKS :-**
1. Power System Engineering by D.P.Kothari, I.J.nagrath TMH 2nd edition, 9th reprint 2010
2. Power System Analysis, N.V.Ramana, PEARSON education, 2010
3. Power System Analysis, Arthur R. Bergen, Vijay Vittal,2nd Edition, 2009, PEARSON Education
4. Modern Power System Analysis by D.P.Kothari, I.J.nagrath TMH 3rd edition, 20th reprint 2010

5. Power System Analysis by Hadi Saadat TMH, 1st reprint 2004
6. Electrical Power System, by Syed A. Nasar TMH,Revised 1st edition 2011

**REFERENCE BOOKS :-**
1. S. Rao ó õEHV A.C. and HVDC Transmission Engineering and Practiceö, Khanna Publishers, New Delhi.
2. Narain G. Hingorani and Lazlo Gyugyi ó õUnerstanding FACTS: Concepts and Technology of Flexible AC Transmission Systems.
3. Yong Hua Song and Allan T. Johns  - õFlexible AC transmission Systems (FACTS), T and D reference bookö Westing house.

**7EP04 /7EL04/7EE04   SWITCHGEAR & PROTECTION**

### SECTION-A

**Unit I :    Circuit Interruption**
Circuit breaker control circuit, Fault clearing process, Auto-reclosure, Arc phenomenon- maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.

**UnitII :    A.    Fuses Types, Constructional features, operation, Characteristics and Applications**
**B.    Circuit Breaker (Part ó I)**
Air break, Air blast, Bulk oil and minimum oil-types, constructional features, operationand application.

**Unit III :    Circuit Breaker (Part – II)**
$SF_6$, Vaccum, Miniature, Earth leakage and Moulded Case ó types, Constructional features, operation and application; Testing, Instalation and Maintenance.

### SECTION-B

**UnitIV:    A.    RelayingPrinciple**
Components, Essential features, Characteristics, Terminology, CTøs and PTøs, Relay classification.
**B.    ElectromagneticRelays**
Overcurrent, Directional, Distance and Differential ó types, constructional features, operation, characteristics and application.

**Unit V :    Protection of Transmission Lines**
Relaying schemes ó overcurrent, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, Carrier current relaying, Overload and Power swing.

**Unit VI : A.** Other Power System Elements Protection Transformers, Motors, Generators and Buses.

**B. Static Relaying**
Basic concepts, equipments, comparators, Characteristics realization ó overcurrent, directional, differential and distance relay. Microprocessor based relay introduction.

**TEXT BOOK:-**

1. Sunil S. Rao ó õSwitchgear and Protectionö Khanna Publications New Delhi

**REFERENCE BOOKS:-**

1. R. T. Lythall ó õSwitchgear Handbookö J and P Newness Butterworth, London.

2. C. R. Mason ó õThe Art and Science of Protective Relayingö

3. A. R. Van and C Warringtan ó õProtective Relaying , Vol 1 and 2,ö Chapman Hall, London.

4. Geosonoviz ó õHigh Voltage Circuit Breakersö

5. V. A. Slabikov ó õGeneration Protection and Switchgearö CIT, Coimbatore.

6. Badri Ram and B. N. Vishwkarma ó õPower System Protection and Switchgearö Tata Mc-Graw Hill Publishing Company Limited, New Delhi.

7. B. Ravindranath and M Chander ó õPower System Protection and Switchgearö Wiley Eastern Ltd, New Delhi.

8. Handbook of switchgear by BHEL, TMH 6th reprint,2010

**7EP05 /7EL05/7EE05/ 7EX 05  PROFESSIONAL ELECTIVE - I**
**(1) PROCESS CONTROL SYSTEMS**

**SECTION-A**

**Unit I :** Electronics Instruments for Measurement of Electrical Parameters Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multimeters, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

**Unit II:** **Signal Generation and Analysis**
Signal generators, Function generators. Wave analyzer Harmonic Distorsion Analysers, spectrum Analysis.

**Unit III:** **Signal Counting and Recording**
Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital disply, universal counter, Digital readot devices, storage type CRO, Servotype X-Y recorder.

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**SECTION-B**

**Unit IV :** **Signal conditioning and Conversions.**
Frequency characteristics of various types of signals,active filters bandpass,low pass and high pass filters using opAmps. Various techniques od A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop.

**Unit V:** **Signal Processing**
Pulse times, triggered elayed sweeps, discrete pulse delay circuits, pulses equencing, analog multiplexers and demultiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

**Unit VI :** Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller based instrumentation

**TEXT BOOKS: -**
1. H.S. Kalsi ó Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick ó Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

**REFERENCE BOOKS:-**
1. B.R. Gupta-Electronics and Instrumentation ó Wheeler Publishing.
2. Rangan, Sharma & Mani ó õInstrumentation ó devices & Systems.ö Tata Mc-Graw Hill Publishing Company, New Delhi.
3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.
4. Microprocessors and Digital Systems, by:D.V. Hall,Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.
6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.
7. A.K. Sawhney ó Acourse in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi.

**7EP05/ 7 EX 03     PROFESSIONAL ELECTIVE - I**
**(2) COMPUTER ORGANISATION**

**Unit-I:** Basic strucutre of computer: Hardware & software.Addressing methods. Program sequencing. concept of memory locations & address. Main memory operation. Instructions & instruction sequencing. Addressing modes. BasicI/O operations. Stacks. Queues & subroutines.

**Unit-II:** **Processing Unit:** fundamental concepts. execution of a comlete instruction. hardwired control, performance consideration. Microprogrammed control; microinstructions, microprogram sequencing, microinstruction prefetching, emulation.

**Unit-III:** I/O organizatiion: accessing I/O devices,interrupts, direct memory access:bus arbitration. I/O hardware:processor bus and interfacing circuiuts,standard I/O interfaces: SCSI bus, backplane bus standard.

**Unit-IV:** **Memory Unit:** basic concepts,semiconductor RAM memories,internal organization, static & dynamic RAMs, ROMs. speed, size & cost considerations.Cache memories: performance considerations. Virtual memories, address translation,memory management requirements.

**Unit-V:** Arithmetic; number representation. design of fast adders,signed addition and subtraction. Multiplication of positive numbers, Boothsøalgorithm, Integer division.Floating-point numbers and related operations.

**Unit-VI:** **Computer Peripherals:** Input-output devices like video displays,video terminals, graphics input devices,printers.Online storage devices: magnetic disks,magnetic tape systems, CD-ROM systems. Communication devies: Modems.

**TEXT BOOK:**
V.Carl Hamacher & S. Zaky õ Computer Organizationö (4/e) McGraw-Hill(ISE).

**REFERENCES BOOKS:**
1. Stallings. W. õ Computer Organization & Arcitectureö (5/e) (Pearson Education).
2. Tenanbaum A.S.ö Structured Computer Organizationö (5/e) (Pearson Education).
3. Hayes J.P. õComputer Architecture & Organizationø(4/e) ( McGraw-Hill).

**7EP05 / 7EL05 / 7EE05    PROFESSIONAL  ELECTIVE - I**
   **(3)  COMPUTER METHODS IN POWER SYSTEM ANALYSIS**
### SECTION-A
**Unit I** :    **Representation of power systems for computerized analysis :** Mathematical models of Synchronous generator for steady state and transient analysis . Transformer with tap changer, transmission line,phase shifter and loads.

**Unit II** :   **Topology of Electric Power Systems** ó Network Graphs , Incidence matrices, fundamental loop and cutest matrices,

primitive impedance and admittance matrices, equilibrium equations of networks . Singular and Nonsingular transformation of network matrices .

**Unit III** :   **Formation of bus impedances and admittances matrices by algorithm** ó Modification of bus impedance and admittance matrix to account for change in networks. Derivation of loop impedance matrix.
Three phase network elements ó transformation matrix ó incidence and network matrices for three phase l networks . Algorithm for formulation  of 3 phase bus impedance matrix.

### SECTION-B
**Unit IV:**  **Short circuit studies :** Three phase networks , Symmetrical components. Theveningøs theorem and short circuit analysis  using bus impedance matrix . Short circuit calculations for balanced three phase networks using bus impedance  matrix.

**Unit V** :   **Load flow studies :** formation of load flow problem ó Gauss Seidel method ó Newton Unit III Raphson method ó decoupled method, fast decoupled methods ó sparsity technique.

**Unit VI** :   **Stability studies of power system** ó Development of mathematical model for multimachine system stability analysis óFormation of equations and methods of solutions .Transient stability analysis including synchronous machines , system networks and loads . Solution of state equation by modified Euler  method and Runge Kutta  4th order Approximation method.

**TEXT BOOKS:**
1)    L.P.Singh : Advanced Power System Analysis and Dynamics, WEL.
2)    Y.Wallach : Calculations and programs for Power System Network.
3)    G.W.Stage and A.H.El-Abiad : Computer Methods in Power System Analysis, McGraw Hill.

**REFRENCE BOOKS:**
1)    R.N.Dhar : Computer Aided Power System Operation and Analysis, TMC.
2)    Computer Technniques in Power System Analysis, by M.A.PAi TMH 10th reprint 2011

**7EP05/ 7EL05/7EE05    PROFESSIONAL  ELECTIVE - I**
**(4) ARTIFICIAL  INTELLIGNCE**

### SECTION-A

**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.

**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.

**UNIT III: Unsupervised Learning:**
Introduction,  Counter  propagation  networks,  Kohonenøs  self organizing maps.
Hopfields networks.

### SECTION-B

**UNIT IV: Introduction:**
Uncertainty  in information,basic concepts  of Fuzzy sets , operations on fuzzy  sets , properties.
Fuzzy relations : operations,properties ,value assignments.

**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

**UNIT VI : Genetic Algorithm (GA):**
Introduction to genetic algorithm,working principle,coding of variables, Fitness function. GA operators , similarities & differences  between  GAs   and  Traditional  methods; Unconstrained and constrained optimization   using Genetic Algorithm , real coded GA ,Advanced GA, global optimization using GA .

**TEXT BOOKS**
1    J.M. Zurada : Introduction to Artificial Neural Network, Jaico Publishing  House

2    Meherotra Kishan ,Mohan C.K, Ranka Sanjay : Elements Of Artificial Neural networks  Penram Int Pub Mumbai.
3    D.E Goldberg ,Addision  Genetic Algorithm in Search Optimization and Machine Learning Wesley Publication
4    Kalyanmoy Deb  Optimization for Engineering Design Algorithms and  Examples, Prentice Hall of India New Delhi.
5    M.Kishan, Mohan C.K., Ranka Sanjay; Elements of Artificial Neural Networks, Penram Int. Publications.

**REFRENCE  BOOKS:**
1.    G.J. Khir and T.A. Folger : Fuzzy sets , Uncertainity  and Information PHI Publication
2.    Koska Bart  Neural Network & Fuzzy systems  Prentice Hall of India Pvt Ltd , New Delhi

**7EP06/ 7EL06/7EE06    PROJECT  &  SEMINAR**

**7EP07/ 7EL07/7EE07  ELECTRICAL POWER II - LAB**

**Any TEN experiments based on contents of 7EP03  ELECTRICAL POWER - II**

**7EP08/ 7EL08/7EE08 SWITCHGEAR & PROTECTION - LAB**

**Any TEN experiments based on contents of  7EP04 SWITCHGEAR & PROTECTION**
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**SEMESTER : EIGHT**
**8EP 01/8EL01/8EE01  POWER SYSTEM STABILITY**
### SECTION-A

**Unit I :    Basic Concepts**
Meaning  of  stability, Steady state,  Transient  and  Dynamic stability limits; Three Phase Synchronous Machine-circuit representation,  voltage  equation  and  Parkøs  Transformation; Transient and Sub transient state analysis and Phasor diagrams, Voltage  behind  the  transient  and  sub transient impedances, Parameters and Time Constants determination.

**Unit II:    Steady State Stability - I**
Steady state stability limit-short transmission line, Two machines system, Medium and Long transmission line, Clarkeøs diagrams for system with and without loss, Effect of inertia, Conservative criterion, Synchronizing coefficients and Multi machine system.

**Unit III:    Steady State Stability – II**
Saturation effect, Saturated reactance, Equivalent reactance and its graphical determination; Short circuit ratio, Governor action and automatic voltage regulator effects.

## SECTION-B

**Unit IV:** **Transient State Stability – I**
Review of basics concepts, Transient state stability and equal area criterion, Swing equation and its point by point solution, Critical clearing angle and time.

**Unit V:** **Transient State Stability – II**
Type of faults, Grounding and high speed re-closing effects, Pre-calculated swing curves and their use, Faults clearing Time, Excitation and governing action effects, Stability improvement methods, Multi machine problem, Network analyzer, Digital Computer role.

**Unit VI:** **Excitation System**
Unit exciter and common bus system, Self and separate excitation, Exciter type of and their description, Exciter drives, Quick response excitation system, Voltage-current methods differential equations for obtaining voltage ótime curves, Exciter response from voltage time curves, Dispersion coefficient, Constant leakage Inductance, Eddy current effects on exciter response, Loaded exciter response, Exciter response improvement methods.

**TEXT BOOKS :**
1. E W Kimbark- Power System Stability, Vol.1 and 3, Dover Publications Inc., New York.
2. Power System Stability & Control by Prabha Kundur, TMH 11th reprint 2011
3. S.B Crary- Power System Stability, Vol.1 and 3, Hohn Wiley and Sons, New York.

**REFERENCE BOOKS:**
1. L.P Singh ó Computer Aided Power System Operation and Dynamics, Wiley Eastern Ltd. New Delhi.
2. I.J.Nagrath and D.P.Khothari ó Modern Power System Analysis, Tata Mc-Graw Hill Publishing Company, New Delhi.

**8EP 02/8EL02/8EE02/7EX05 (III)   HIGH VOLTAGE  ENGINEERING**

### SECTION-A

**Unit I :** **Breakdown in Gases**
Insulating materials Classification, Gases as insulating media, Ionization and decay process, Breakdown in gases, Townsendøs law, Streamer mechanism of spark pashanøs law, Corona discharge, Electronegative gases.

**Unit II:** **Breakdown in Liquid and Solid Dielectrics**
Breakdown in pure and commercial liquids, Sold dielectrics and composite dielectrics, High voltage bushings, Guarding, Shielding, Field plotting.

**Unit III:** **Lightning and Switching Over Voltage and Protection**
Lightning strokes to lines and towers; Mechanism, Characteristics and protection of transmission lines from lightning; Lightning arrestors, Insulation co-ordination of HV and EHV power system and substation.

### SECTION-B

**Unit IV:** High Voltage and Current Generation, Generation of high d.c, a.c and impulse voltages, Standard impulse wave shapes, Switching surges, and High impulse generator.

**Unit V:** High Voltage and Current Measurement Peak voltage, Impulse voltage and High direct measurement methods, Non-destructive measurement and testing, High voltage dielectrics loss and capacitance measurement, Radio frequency and Partial discharge measurement.

**Unit VI:** **High Voltage Testing and E.H.V.Lines Design.**
Basic terminology, Testing ó Insulators, Bushings, Cables, Transformers, Surge diverters and Isolators; Electric shock and threshold current, Capacitance of long objects, Electromagnetic interference, E.H.V. line insulation design based upon transient over voltage.

**TEXT BOOK :**
1. M.S.Naidu and V.Kamraju ó High Voltage Engineering, Tata McGraw Hill Publishing, Company, New Delhi.

**REFERENCE BOOKS-**
1. E.Kuffer and W.S.Zaenglo- High Voltage Engineering, Pergamon Press,
2. Rokosh Das Begamudre- EHV AC. Transmission Engineering, Wiley Easter Ltd. New Delhi.
3. E.Kuffer and M.Abdullaha _High Voltage Engineering, Pergamon Press
4. M.S.Naidu and V.N.Maller- SF6 and Vaccum Insulation for High Voltage Application, Khanna Publications, Delhi.
5. Prof.D.V.Razeving (Translated from Russian by Dr.M.P.Chaurasia) ó High Voltage Engineering, Khanna Publications, Delhi.
6. An introduction to High Voltage Engineering by Subir Ray, Prentice óHall & India, Private Limited, New Delhi.
7. High Voltage Engineering by C.L. wadhawa New Age international (P) Ltd. Publications

**8EP 03/8EL03/8EE03 DIGITAL SIGNAL PROCESSING**

### SECTION - A

**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.

**UNIT-II :** Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, DFT and its properties , Circular convolution, Linear convolution from DFT, FFT, decimation in time and frequency algorithm.

**UNIT-III:** Sampling of Bandpass signals-Representation of Bandpass signals, sampling of bandpass signals, discrete time processing of continuous time signal; Analog to digital conversion-sample and hold, quantization and coding, analysis of quantization errors, oversampling of A/D converter; Digital to Analog conversion-sample and hold, first order hold, linear interpolation with delay, oversampling of D/A converter

### SECTION-B

**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.

**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.

**UNIT-VI:** DSP Processors and applications- DSP Microprocessors architectures, fixed point, floating point precision, algorithm design, mathematical, structure and numerical constraints, DSP programming, filtering, data conversion; Real time processing consideration including interrupts

**TEXT BOOKS:**
1. Proakis & Monolakis D.G, ‑Digital Signal Processing‖, PHI Publication
2. Oppenhavm & Scheffer, ‑Discrete Time Processing‖ John Wiley Publication
3. Digital Signal Processing, P Ramesh Babu,SCITECH Publications, Chennai, 4th edition,2010

4. Mitra S.K, ‑Digital Signal Processing‖, TMH Publication

**8EP 04/8EL04/8EE04 PROFESSIONAL ELECTIVE - II**
**(1) ELECTRIC DRIVES & CONTROL**

### SECTION-A

**UNIT I :** **Introduction to Electrical Drives:** Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

**UNIT II:** **Starting and Braking of Electrical Drives:** Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, Braking of d c and induction motors.

**UNIT III:** DC Drive Control Basic machine equations, schewe of control, Single phase separately excited drives, single‑ phase- series motor drives, power factor improvement, Three-phase separately excited drive, Closed loop control, PLL control, microcomputer control.

### SECTION-B

**Unit-IV:** **Ac drive control:** Basic principle of operation, speed control of induction motor, stator voltage control, varible frequency control, Rotor resistance control, slip-power recovery scheme, Synchronus motor drive, Microprocessor controlled AC Drive.

**UNIT V:** Vector controlled Drive,Principle of Vector Control, Equivalent ckt. Direct v.c., Flux vector estimation, Indirect v.c., v.c. of line side pular rectifer exator flux oriented v.c., v.c. of current fed inventer drive & cycloconverter drive servorless control speed estimation controls ‑ EKF method

**UNIT VI:** Direct torque & adoptaive controlled Drive Torque Expression o& control strategy self tuning control MRAC sliding mode control self commissiong of drive, Study of electrical drives in rolling mills, paper mills, cement mills, sugar mills, textile mills, traction and machine tool applications.

**REFERENCE BOOKS :**
1. Power Electronics : ( Converts, Application & Design) ‑ Mohan/ Undeland/ Rossing- John wiley
2. Power Electronics : M.D. Singh, K.B. Khan Chardalli ‑ TMH

3. Power Electronics : M.H. Rashid ó Pearson Education
4. B.K. Bose : Modern Power Electronics and AC Drive, Pearson Education
5 G. K. Dubey Fundamentals of Electrical Drives, , Narosa Publishing House,2005
6 . Electric Drives ó Concepts & Applications by V.Subrahamanyam, TMH 2nd edition 2010

## 8EP 04/8EL04/8EE04  PROFESSIONAL  ELECTIVE - II
### (2) POWER  QUALITY
### SECTION - A

**Unit I:    Introduction**
Power Quality Definition, Need for Power Quality, Sensitive Loads, Nonlinear Loads, Interconnected Power System, Deregulation, Utilities, End Users, Lawyers,

**Unit II:   Power Quality Characteristics**
Power Quality Theory, Types of power Quality Problems, Voltage Swells, Long-Duration  Over voltages, Under voltages, Interruptions, Transients, Voltage Unbalance, Voltage Fluctuations, Harmonics, Electrical Noise, Sources of Power Quality Problems, Utility Side of the meter, End-User Side of the meter, Effects of Power Quality Problems, Power Quality Problem-Solving Procedures, Power Quality Solutions,

**Unit III:  Power Quality Standards**
Power Quality Standards Organizations, Institute of Electrical & Electronics Engineers (IEEE), American National Standards Institute(ANSI), International Electrotechnical Commission(IEC Other International Standards Organizations, Purpose of Power Quality Standards, Types of Power Quality Standards, Voltage Sag (Dip) Standards, Transients of Surges, Voltage Unbalance, Voltage Fluctuation or Flicker Standards, Harmonics Standards, Transformer Overheating Standards, Natural Conductor Loading Standards, Static Electricity, Telephone Power Quality Standards, Grounding and Wiring Standards,
Sensitive Electronics Equipments Standards, Trends in Power Quality Standards.

### SECTION -B

**Unit IV:** Power Quality Solutions
Reduce Effects on Sensitive Equipment, Reduce or Eliminate Cause, Reduce or Eliminate Transfer Medium, Install Power Conditioning Equipments, , Surge Suppressors, Noise Filters, Isolation Transformers, Line-Voltage Regulators, Motor-

Generator Sets, Magnetic Synthesizers, Static VAR Compensators (SVCs), Uninterruptible Power Supply (UPS), Solid-State Switches, Harmonics Solutions, Selection of Appropriate Power Conditioning Equipment, Grounding and Wiring Solutions

**Unit V:   Wiring and Grounding**
Wiring Principles, Grounding Principles, Power System, Utility Power System Grounding,Telecommunication System Grounding, End-User Power System Grounding, Wiring and Grounding Problems, Ground Loops, Electromagnetic Interference (EMI) Noise, Loose Connections, Grounding for Lightning and Static Electricity, Attack of the Triplens,  Solutions That Cause Problems, Wiring Solutions, Separation, Selection of Wire and Cables, Shielding, Grounding Solutions, Ground Rods, Ground Ring, Ground and Reference Signal Grids, Other Grounding Systems, Isolated Grounds, Multipoint Grounding, Separately Derived Source Grounding, Reference

**Unit VI:  Power Quality Measurement Tools & Power Quality Surveys**
Kilowatt-Hour Meter, Multimeters, Average-responding versus True RMS Meters, Crest Factor and Bandwidth, Other Selection Considerations, Oscilloscopes, Disturbance Analyzers, Harmonics Analyzers, Purpose of a Power Quality Surveys (Checkup or Examination), Planning a power Quality Surveys.

**TEXT  BOOKS**: -
1. Barry W. Kennedy: Power Quality Primer, McGraw-Hill
2. Electrical Power System quality by R.C.Dugan, M.F.McGranghan, S.Santoso, H.W.Beaty   TMH 2nd edition 2011

**REFERENCE  BOOK: -**
1. G.T. Heydt: Power Quality Stars in a circle Publication, Indiana, 1991.

## 8EP 04/8EL04/8EE04 PROFESSIONAL  ELECTIVE - II
### (3) EMBEDED SYSTEMS

**Unit-I :** Introduction: Embedded systems design, Embedded system architecture, Embedded systems model, An Overview of Programming Languages and Examples of Their Standards, Standards and Networking, Multiple Standards-Based Device Example: Digital Television (DTV).

**Unit-II:** Embedded Hardware Building Blocks and the Embedded Board, powering the hardware, Instruction Set Aarciteture (ISA) architecture model, internal processor design and its performance.

**Unit-III:** Memory: ROM, RAM and auxiliary memory, Memory Management of Extemal Memory , Performance of memory .I/ O

: Managing Data: Serial vs. Parallel I/O , Interfacing the I/O Components ,I/O performance.Buses: arbitration, timing and performance.

**Unit-IV:** Device Drivers: Device Drivers for Interrupt-Handling, Memory Device Drivers, On-board Bus Device Drivers, Board I/O Driver. Embedded OS: Multitasking and Process Management, Memory Management ,.

**Unit-V:** Embedded OS : I/O and File System Management ,OS Standards: POSIX, OS Performance Guidelines. Middleware :meaning and examples. Application layer software: meanings and examples.

**Unit-VI:** Embedded system design & implementation: Defining the System-Creating the Architecture and Documenting the Design, Stages in creating an Embedded System Architecture. Implementing the Design. Quality Assurance and Testing of the Design.

**TEXT BOOK:**
Tammy Noergaard õEmbedded Systems Architectureö Elsevier Newnes Publication.

**REFERENCE BOOKS:**
1. Rajkamal , õEmbedded Systems, Architecture, Programming & Designö TMH.
2. Jane W. S. Liu ─Real Time Systemsö, Pearson Education
3. Vahid & Givargis õEmbedded System Designö John Wiley & Sons P Ltd.
4. Peter Marwedel õEmbedded Systems Designö Springer, Netherland.

**8EP 04/8EL04/8EE04    PROFESSIONAL  ELECTIVE - II**
**(4)  GENERALISED  MACHINE  THEORY**

**SECTION-A**

**Unit I :** Elements of Generalized Theory: essentials of rotating machines, conventions, basic two pole machines, transformer with movable secondary transformer and speed voltage in armature, kions, primitive machine, leakage fluge, voltage and torque equations.

**Unit II :** Linear transformations in machines: invariance of power transformation from displaced brush axis, three-phase to two-phase transformation power invariance, transformation from rotating axes to stationary axes, impedance matrix, application of generalized theory, electrical torque, limitations of generalized theory.

**Unit III:** D.C.Machines: separately excited DC generators and motors formulation of mathematical model, steady state and transient analysis, Ward-Leonard system of speed control.

Steady state analysis of DC series, shunt and compound machine and their characteristics cross-field machines, metadyne transformer, metadyne generator.

**SECTION-B**

**Unit IV:** Poly-phase synchronous machine, three phase synchronous machine, steady state and transient analysis, phasor equations and phasor diagram, power angle characteristics, DWR synchronous machine generalized mathematical model, steady state analysis, phasor diagram.

**Unit V:** Induction Machine: Transformations, electrical performance, equation, steady state analysis, equivalent circuit, torque-slip characteristics.High torque cage motors- deep bar rotor and double cage rotor induction motors, steady stateanalysis, comparison between single cage and double cage motors.

**Unit VI:** Generalized theory of single-phase series motor, repulsion motor and scharge motor and steady state analysis.

**TEXT BOOKS :**
1. M.B.Say: Introduction to Unified Theory of Electrical Machine, ELBS.
2. SEELY: Electromechanical Energy Conversion

**8EP 05/8EL05/8EE05    PROJECT  &  SEMINAR**

**8EP06  DIGITAL SIGNAL PROCESSING - LAB**

**Any TEN experiments based on contents of**
**8EP03/ 8EL03/ 8EE 03  DIGITAL SIGNAL PROCESSING**

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# SYLLABUS PRESCRIBED FOR
## BACHELOR OF ENGINEERING
## ELECTRICAL & ELECTRONICS ENGINEERING
## SEMESTER PATTERN (CREDIT GRADE SYSTEM)

### SEMESTER : SEVENTH

**7EX01    UTILISATION OF ELECTRICAL ENERGY**

### SECTION-A

**Unit I :** Concept of electrical drive, classification, advantages of electrical drive, selection criterion for electrical motor, size, specification and type of motor, mechanical features of motor, transmission of drive, industrial application, general workshop, Textile mill, Paper mill, Cement mill, Coal mining, Sugar mill, Printing industry.

**Unit II:** Types of duties, continues, intermittent and short time, heating and colling of motor, rating calculations for these duties, use of fly wheel and fly wheel calculations. Introduction for conducting and reporting the test on induction motors as per Indian standard.

**Unit III:** Characteristics of DC motors, three-phase induction motors, single-phase induction motors. Quadrantal diagram of speed-torque characteristics of motors, starting methods, different methods of speed control, braking of motors, plugging, rheostatic and regenerative braking.

### SECTION -B

**Unit IV:** Requirement of ideal traction system, system of track electrification and their comparison, speed time curves, energy consumption calculation, calculation of tractive efforts.

**Unit V :** Traction motors, general features and types, characteristics, control of locomotive motor coaches, series-parallel control. Overhead equipments, collector gear for overhead equipments.

**Unit VI:** a)  Nature of light-units, luminous efficiency, Glare production of light, Polar curves, control of light by reflection, refraction and diffusion. Lighting calculations, factory lighting, flood lighting, street lighting.
    b)  Methods of heating and welding furnaces

**TEXT BOOKS** :

1)  E.O.Taylor : Utilization of Electric Energy in SI Units, published by Orient Longman Ltd.
2)  S.K.Pillai : A First Course in Electrical Drives, published by New Age International.

**REFERENCE BOOKS** :

1)  Vedam Subrahmanyam : Electric Drives, published by Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2)  C.L.Wadhwa : Generation Distribution and Utilization of Electrical Energy, published by New Age International Pvt. Ltd.
3)  Specification of Three Phase Induction Motors as per Indian Standard, published by Indian Standard Institute, New Delhi.
4)  H.Pratap : Utilization of Electrical Energy.

**7EX02        ELECTRONIC COMMUNICATION**

**Unit I :   Signal and Noise :** - Audio signals, frequency range speech and music, sound intensity, loudness, level, frequency response, bandwidth, bandwidth requirement for different types of signals such as telegraph, telephone speech, music and video Noise: External and internal noise, noise figure, signal to noise ratio, noise figure measurement.

**Unit II:   Modulation Techniques : -** Amplitude modulation theory, Frequency spectrum representation of AM, Modulation index side bands, power relations, current relations and voltage relation in the AM wave. Frequency modulation and phase modulation, frequency deviation, modulation index, frequency spectrum.

**Unit III:   AM Transmitters :** - Principles of DSB-FC, DSB-SC, SSB-SC modulation and their comparison, Details of DSB-FC transmitter, Generation of DSB-SC by using balanced modulators (FET & Diodes), DSB-SC transmitter. Generation of SSB-SC by phase-shift method.

**Unit IV :   AM Receivers : -** TRF receiver, superhetrodyne receiver, details of each block such as RF amplifier, Oscillator, IF amplifier, Diode detector, audio amplifier. Mixer: Principle, Need and type of AGC, Practical radio receiver circuit with AGC, characteristics such as selectivity, sensitivity, and fidelity communication receiver.

**Unit V :   FM Transmitter : -** Circuits for direct FM generation using FET and varactor diode. Circuit & analysis of Indirect FM generation, Narrow band and wide band FM, their comparison, de-emphasis and pre-emphasis. FM transmitter & stereo FM transmitter.

**Unit VI :   FM Receivers :-** Details of FM receiver, blocks such as RF amplifier, local oscillator, IF amplifier, Mixer, audio Ampl. AGC, limiter, FM discriminator, single slope and balanced slope detector, analysis of Foster seeley and ratio detectors, stereo FM receiver.

**TEXT BOOK** :

1. Kennedy G.: Electronics Communication System, Tata McGraw Hill Co.New Delhi.

**REFERENCE BOOKS :-**

1. Young P.H.: Electronics Communication Techniques, A Bell and Howell Co. Indiana.
2. Martin James. : Telecommunication and the Computer, Prentice Hall Inc. New Jersey.
3. Roddey D. Coolen S.: Electronics Communication, Prentice Hall India Pvt. Ltd.
4. Beck, Robert and J.Schoen: Electronics Communication, Modulation and Transmission, A Bell and Howell Co.

**7EX03          COMPUTER  ORGANISATION**

**Unit-I:** Basic strucutre of computer: Hardware & software.Addressing methods. Program sequencing. concept of memory locations & address. Main memory operation. Instructions & instruction sequencing. Addressing modes. BasicI/O operations. Stacks. Queues & subroutines.

**Unit-II:** Processing Unit: fundamental concepts. execution of a comlete instruction. hardwired control, performance consideration. Microprogrammed control; microinstructions, microprogram sequencing, microinstruction prefetching, emulation.

**Unit-III:** I/O organizatiion: accessing I/O devices,interrupts, direct memory access:bus arbitration. I/O hardware:processor bus and interfacing circuiuts,standard I/O interfaces: SCSI bus, backplane bus standard.

**Unit-IV:** Memory Unit: basic concepts,semiconductor RAM memories, internal organization, static & dynamic RAMs, ROMs. speed, size & cost considerations.Cache memories: performance considerations. Virtual memories, address translation,memory management requirements.

**Unit-V:** Arithmetic; number representation. design of fast adders,signed addition and subtraction. Multiplication of positive numbers, Boothsøalgorithm, Integer division.Floating-point numbers and related operations.

**Unit-VI:** Computer Peripherals: Input-output devices like video displays, video terminals, graphics input devices,printers.Online storage devices: magnetic disks,magnetic tape systems, CD-ROM systems. Communication devies: Modems.

**TEXT-BOOK:**

V.Carl Hamacher & S. Zaky õComputer Organizationö (4/e) McGraw-Hill (ISE).

**REFERENCE BOOKS :**

1. Stallings. W. õComputer Organization & Arcitectureö (5/e) (Pearson Education).
2. Tenanbaum A.S.ö Structured Computer Organizationö (5/e) (Pearson Education).
3. Hayes J.P. õComputer Architecture & Organizationø(4/e) ( McGraw-Hill).

**7EX04          POWER  ELECTRONICS - II**

**SECTION-A**

**UNIT I :** **Introduction to Electrical Drives:** Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

**UNIT II :** **Starting and Braking of Electrical Drives:** Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, Braking of d c and induction motors.

**UNIT III:** DC Drive Control Basic machine equations, schewe of control, Single phase separately excited drives, singleó phase- series motor drives, power factor improvement, Three-phase separately excited drive, Closed loop control, PLL control, microcomputer control.

**SECTION-B**

**Unit-IV:** **Ac drive control:** Basic principle of operation, speed control of induction motor, stator voltage control, varible frequency control, Rotor resistance control, slip-power recovery scheme, Synchronus motor drive, Microprocessor controlled AC Drive.

**UNIT V:** Vector controlled Drive,Principle of Vector Control, Equivalent ckt. Direct v.c., Flux vector estimation, Indirect v.c., v.c. of line side pular rectifer exator flux oriented v.c., v.c. of current fed inventer drive & cycloconverter drive servorless control speed estimation controls ó EKF method

**UNIT-VI** Direct torque & adoptaive controlled Drive Torque Expression o& control strategy self tuning control MRAC sliding mode control self commissiong of drive, Study of electrical drives in rolling mills, paper mills, cement mills, sugar mills, textile mills, traction and machine tool applications.

**REFERENCE BOOKS:**

1. Power Electronics : ( Converts, Application & Design) ó Mohan/ Undeland/ Rossing- John wiley
2. Power Electronics : M.D. Singh, K.B. Khan Chardalli ó TMH
3. Power Electronics : M.H. Rashid ó Pearson Education
4. B.K. Bose : Modern Power Electronics and AC Drive, Pearson Education
5. G. K. Dubey Fundamentals of Electrical Drives, , Narosa Publishing House,2005
6. Electric Drives ó Concepts & Applications by V.Subrahamanyam, TMH 2nd edition 2010

**7EX05** **PROFESSIONAL ELECTIVE - I**
**(1) PROCESS CONTROL SYSTEMS**

**SECTION - A**

**Unit I :** Electronics Instruments for Measurement of Electrical Parameters Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multimeters, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

**Unit II :** Signal Generation and Analysis Signal generators, Function generators. Wave analyzer Harmonic Distorsion Analysers, spectrum Analysis.

**Unit III : Signal Counting and Recording:** Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital disply, universal counter, Digital readot devices, storage type CRO, Servotype X-Y recorder.

**SECTION-B**

**Unit IV: Signal conditioning and Conversions:**
Frequency characteristics of various types of signals,active filters bandpass,low pass and high pass filters using opAmps. Various techniques od A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop.

**Unit V: Signal Processing :**
Pulse times, triggered elayed sweeps, discrete pulse delay circuits, pulses equencing, analog multiplexers and demultiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital

telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

**Unit VI :** Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller based instrumentation

**TEXT BOOKS:**

1. H.S. Kalsi ó Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick ó Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

**REFERENCE BOOKS :**

1. B.R. Gupta-Electronics and Instrumentation ó Wheeler Publishing.
2. Rangan, Sharma & Mani ó õInstrumentation ó devices & Systems.ö Tata Mc-Graw Hill Publishing Company, New Delhi.
3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.
4. Microprocessors and Digital Systems, by:D.V. Hall,Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.
6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.
7. A.K. Sawhney ó Acourse in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi.

**7EX05** **PROFESSIONAL ELECTIVE - I**
**(2) POWER SYSTEM SIMULATION**

**SECTION-A**

**Unit I** : Representation of power systems for computerized analysis : Mathematical models of Synchronous generator for steady state and transient analysis . Transformer with tap changer, transmission line,phase shifter and loads.

**Unit II** : Topology of Electric Power Systems ó Network Graphs , Incidence matrices, fundamental loop and cutest matrices, primitive impedance and admittance matrices, equilibrium equations of networks . Singular and Nonsingular transformation of network matrices .

**Unit III** : Formation of bus impedances and admittances matrices by algorithm ó Modification of bus impedance and admittance matrix to account for change in networks. Derivation of loop impedance matrix.

Three phase network elements ó transformation matrix ó incidance and network matrices for three phase l networks . Algorithm for formulation of 3 phase bus impedance matrix.

### SECTION-B

**Unit IV :** Short circuit studies : Three phase networks , Symmetrical components. Thevening's theorem and short circuit analysis using bus impedance matrix . Short circuit calculations for balanced three phase networks using bus impedance matrix.

**Unit V:** Load flow studies : formation of load flow problem ó Gauss Seidel method ó Newton Unit III Raphson method ó decoupled method, fast decoupled methods ó sparsity technique.

**Unit VI :** Stability studies of power system ó Development of mathematical model for multimachine system stability analysis óFormation of equations and methods of solutions .Transient stability analysis including synchronous machines , system networks and loads . Solution of state equation by modified Euler method and Runge Kutta 4th order Approximation method.

### TEXT BOOKS:
1) L.P.Singh : Advanced Power System Analysis and Dynamics, WEL.
2) Y.Wallach : Calculations and programs for Power System Network.
3) G.W.Stage and A.H.El-Abiad : Computer Methods in Power System Analysis, McGraw Hill.

### REFERENCE BOOKS:
1) R.N.Dhar : Computer Aided Power System Operation and Analysis, TMC.
2) M.A. Pai : Computer Techniques in Power System Analysis, TMH

**7EX05**      **PROFESSIONAL ELECTIVE - I**
**(3) HIGH VOLTAGE ENGINEERING**

### SECTION-A

**Unit I :** Breakdown in Gases
Insulating materials Classification, Gases as insulating media, Ionization and decay process, Breakdown in gases, Townsend's law, Streamer mechanism of spark pashan's law, Corona discharge, Electronegative gases.

**Unit II:** Breakdown in Liquid and Solid Dielectrics
Breakdown in pure and commercial liquids, Sold dielectrics and composite dielectrics, High voltage bushings, Guarding, Shielding, Field plotting.

**Unit III:** Lightning and Switching Over Voltage and Protection
Lightning strokes to lines and towers; Mechanism, Characteristics and protection of transmission lines from lightning; Lightning arrestors, Insulation co-ordination of HV and EHV power system and substation.

### SECTION-B

**Unit IV:** High Voltage and Current Generation, Generation of high d.c, a.c and impulse voltages, Standard impulse wave shapes, Switching surges, and High impulse generator.

**Unit V:** High Voltage and Current Measurement Peak voltage, Impulse voltage and High direct measurement methods, Non-destructive measurement and testing, High voltage dielectrics loss and capacitance measurement, Radio frequency and Partial discharge measurement.

**Unit VI:** High Voltage Testing and E.H.V.Lines Design.
Basic terminology, Testing ó Insulators, Bushings, Cables, Transformers, Surge diverters and Isolators; Electric shock and threshold current, Capacitance of long objects, Electromagnetic interference, E.H.V. line insulation design based upon transient over voltage.

### TEXT BOOK :
1. M.S.Naidu and V.Kamraju ó High Voltage Engineering, Tata McGraw Hill Publishing, Company, New Delhi.

### REFERENCE BOOKS :
1. E.Kuffer and W.S.Zaenglo- High Voltage Engineering, Pergamon Press,
2. Rokosh Das Begamudre- EHV AC. Transmission Engineering, Wiley Easter Ltd. New Delhi.
3. E.Kuffer and M.Abdullaha _High Voltage Engineering, Pergamon Press
4. M.S.Naidu and V.N.Maller- SF6 and Vaccum Insulation for High Voltage Application, Khanna Publications, Delhi.
5. Prof.D.V.Razeving (Translated from Russian by Dr.M.P.Chaurasia) ó High Voltage Engineering, Khanna Publications, Delhi.
6. An introducation to High Voltage Engineering by Subir Ray, Prentice óHall & India, Private Limited, New Delhi.
7. High Voltage Engineering by C.L. wadhawa New Age international (P) Ltd. Publications

**7EX05**  **PROFESSIONAL ELECTIVE - I**
**(4) WIND ELECTRICAL SYSTEMS**
**SECTION A**

**Unit I :**  **Fundamentals of Wind Turbines**
Power Contained in Wind, Thermodynamics of Wind Energy, Efficiency Limit for Wind Energy Conversion, Maximum Energy Obtainable for a Thrust-operated Converter,Efficiency Limit for a Thrust ó operated Converter Types of Wind Energy Conversion Devices, Dutch Windmills, Multiblade Water ó pumping Windmills , High ó speed Propeller ó type Wind Machines The Savonius Rotor, The Darrieus Rotor, Aerodynamics of Wind Roto Aerodynamic Efficiency, Power ó Speed Characteristics, Torque ó Speed Characteristics, Wind Turbine Control Systems, Control Strategy.

**Unit II:**  **Wind Site Analysis and Selection**
Wind Speed Measurements Robinson Cup Anemometer, Pressure Tube Anemometer, Hot Wire Anemometer, Wind Speed Statistics Statistical Wind Speed Distributions, Site and Turbine Selection

**Unit III:**  **Basics of Induction and Synchronous Machines**
The Induction Machine, Constructional Features, Steady-state Equivalent Circuit Model, Performance Characteristics, Saturation Characteristics, Modified Equivalent Circuits, Effect of Rotor-injected Emf ó Slip Power Recovery Scheme, Dynamic d-q Axis Model
The Wound-field Synchronous Machine, Constructional Features, Dynamic Machine Equations, Steady-state Operation, Steady-state Model with Rectifier Load, The Permanent Magnet Synchronous Machine Constructional Aspects, Steady-state Equations, Power Flow Between Two Synchronous Sources, Induction Generator Versus Synchronous Generator

**SECTION B**

**Unit IV:**  **Grid-connected and Self-excited Induction Generator Operation**
Constant-voltage, Constant-frequency Generation, Single-output System
Double-output System with a Current Converter , Equivalent Circuits, Reactive Power and Harmonics, Double-output Systems with a Voltage Source Inverter, Reactive Power Compensation, Variable-voltage, Variable-frequency Generation, The Self-excitation Process, Circuit Model for the Self-excited Induction Generator, Analysis of the Steady-state Operation, The Steady-state Characteristics, The Excitation Requirement, Effect of a Wind Generator on the Network

**Unit V:**  **Generation Schemes with Variable-speed Turbines**
Classification of Schemes, Operating Area Induction Generators , Cage Rotor Induction Generator, Doubly Fed Induction Generator, Wound-field Synchronous Generator, The Permanent Magnet Generator

**Unit VI:**  **Hybrid Energy System**
Diesel Generator and Photovoltaic System, Diesel Engine, Photovoltaic Power Generation Wind-Diesel Hybrid System. System With No Storage, System With Battery Backup Wind-Photovoltaic Systems, Wind Solar hybrid system

**TEXT BOOK :-**
S.N.Bhadra, S.Banerjee, D.Kastha Wind Electrical System, Oxford University Press, India.

**7EX06**  **PROJECT & SEMINAR**

**7EX07**  **UTILISATION OF ELECTRICAL ENERGY - LAB**
Any TEN experiments based on contents of
7EX01 UTILISATION OF ELECTRICAL ENERGY

**7EX08**  **COMPUTER ORGANIZATION - LAB**
Any TEN experiments based on contents of
7EX03 COMPUTER ORGANIZATION

**7EX09**  **POWER ELECTRONICS - LAB**
Any TEN experiments based on contents of
7EX04 POWER ELECTRONICS - II

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**SEMESTER : EIGHTH**

**8EX01**  **POWER SYSTEM OPERATION & CONTROL**

**SECTION-A**

**Unit I :**  **Economic Operation – Part I**
Meaning of optimum scheduling, UCP and LSP; Input ó Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs; Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

**Unit II :**  **Economic Operation – Part II**
Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

**Unit III : A. Generator Control Loops**

Concept of real and reactive power; Effect of real and reactive power on system parameters; Philosophy of real and reactive power control; Basic generator control loops.

**B. Automatic Voltage Regulator (AVR)**

Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

**SECTION-B**

**Unit IV : Automatic Load Frequency Control**

Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

**Unit V : Control Area**

Meaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system ó Dynamic response; Tie-line bias control.

**Unit VI : Steady-State Instabilities**

Natural torsional oscillatory modes in power system; Natural mode of a single generator operating onto infinite bus; Effect of damper winding; Effect of changing excitation; Power system stabilizer; Introduction to modern control application.

**TEXT BOOKS :-**

1. O. L. Elgerd ó Electric Energy Systems Theory: An Introduction ó Second edition, McGraw-Hill Book Comp. N. Y. 1987.
2. Power System Operation & Control, N.V.Ramana, PEARSON education, 2010.
3. Power System Operation by R.Miller, J.H.Malinowski, TMH, 2$^{nd}$ reprint 2009

**REFERENCE BOOKS :**

1. L. K. Kirchamayor ó Economic Operation of Power System- Wiley Estern Pvt. Ltd., New Delhi.
2. Hadi Saadat ó Power System Analysis ó WCB/McGraw-Hill International Edition 1999
3. I. J. Nagrath, D. P. Kothari ó Modern Power System Analysis ó Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi
4. P. S. R. Murty ó Power System Operation and Control ó Tata Mc-Graw Hill Publishing Company, New Delhi.

5. Wood and Wollenberg ó Power Generation, Operation and Control ó Willey ó Inter Science Publication

**8EX02 SWITCHGEAR & PROTECTION**

**SECTION-A**

**Unit I : Circuit Interruption**

Circuit breaker control circuit, Fault clearing process, Auto-reclosure, Arc phenomenon- maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.

**Unit II : A. Fuses** Types, Constructional features, operation, Characteristics and Applications

**B. Circuit Breaker (Part ó I)**

Air break, Air blast, Bulk oil and minimum oil-types, constructional features, operationand application.

**Unit III : Circuit Breaker (Part – II)**

$SF_6$, Vaccum, Miniature, Earth leakage and Moulded Case ó types, Constructional features, operation and application; Testing, Instalation and Maintenance.

**SECTION-B**

**UnitIV : A. RelayingPrinciple**

Components, Essential features, Characteristics, Terminology, CTós and PTós, Relay classification.

**B. ElectromagneticRelays**

Overcurrent, Directional, Distance and Differential ó types, constructional features, operation, characteristics and application.

**Unit V : Protection of Transmission Lines**

Relaying schemes ó overcurrent, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, Carrier current relaying, Overload and Power swing.

**Unit VI : A.** Other Power System Elements Protection Transformers, Motors, Generators and Buses.

**B. Static Relaying**

Basic concepts, equipments, comparators, Characteristics realization ó overcurrent, directional, differential and distance relay. Microprocessor based relay introduction.

**TEXT BOOK :**

1. Sunil S. Rao ó õSwitchgear and Protectionö Khanna Publications New Delhi

**REFERENCE BOOKS :**

1. R. T. Lythall ó õSwitchgear Handbookö J and P Newness Butterworth, London.
2. C. R. Mason ó õThe Art and Science of Protective Relayingö
3. A. R. Van and C Warringtan ó õProtective Relaying , Vol 1 and 2,ö Chapman Hall, London.
4. Geosonoviz ó õHigh Voltage Circuit Breakersö
5. V. A. Slabikov ó õGeneration Protection and Switchgearö CIT, Coimbatore.
6. Badri Ram and B. N. Vishwkarma ó õPower System Protection and Switchgearö Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
7. B. Ravindranath and M Chander ó õPower System Protection and Switchgearö Wiley Eastern Ltd, New Delhi.
8. Handbook of switchgear by BHEL, TMH 6th reprint,2010

## 8EX03    EMBEDDED SYSTEMS

**Unit-I :** Introduction: Embedded systems design, Embedded system architecture, Embedded systems model, An Overview of Programming Languages and Examples of Their Standards, Standards and Networking, Multiple Standards-Based Device Example: Digital Television (DTV).

**Unit-II:** Embedded Hardware Building Blocks and the Embedded Board, powering the hardware, Instruction Set Aarciteture (ISA) architecture model, internal processor design and its performance.

**Unit-III:** Memory: ROM, RAM and auxiliary memory, Memory Management of Extemal Memory , Performance of memory .I/ O : Managing Data: Serial vs. Parallel I/O , Interfacing the I/O Components ,I/O performance.Buses: arbitration, timing and performance.

**Unit-IV:** Device Drivers: Device Drivers for Interrupt-Handling, Memory Device Drivers, On-board Bus Device Drivers, Board I/O Driver. Embedded OS: Multitasking and Process Management, Memory Management ,.

**Unit-V:** Embedded OS : I/O and File System Management ,OS Standards: POSIX, OS Performance Guidelines. Middleware :meaning and examples. Application layer software: meanings and examples.

**Unit-VI:** Embedded system design & implementation: Defining the System-Creating the Architecture and Documenting the Design, Stages in creating an Embedded System Architecture.

Implementing the Design. Quality Assurance and Testing of the Design.

**TEXT BOOK:**
Tammy Noergaard õEmbedded Systems Architectureö Elsevier Newnes Publication.

**REFERENCE BOOKS:**
1. Rajkamal , õEmbedded Systems, Architecture, Programming & Designö TMH.
2. Jane W. S. Liu ÷Real Time Systemsö, Pearson Education
3. Vahid & Givargis õEmbedded System Designö John Wiley & Sons P Ltd.
4. Peter Marwedel õEmbedded Systems Designö Springer, Netherland.

## 8EX04    PROFESSIONAL  ELECTIVE - II
## (1) POWER SYSTEM MANAGEMENT

### SECTION-A

**UNIT-I: Principle and Practice of Management:**
**Basic Concepts-** basic concepts of management-Role and importance of management in modern society, management as a profession
**The Process of Management-** The process of management; planning, organizing, directing, controlling, decision-making, leading etc.
**Management Concepts-** Managerial authority and responsibility-delegation and decentralization- Line and staff concepts-concepts in e-commerce etc.

**UNIT-II : Marketing & Production/Operation Management:**
**Marketing Management-** Introduction to Marketing, Marketing strategy, Consumer Behaviour, Marketing Research, Product/ Services Decisions, Pricing Products/Services, Distribution management, Advertising & Sales promotion etc.
**Production/Operation Management-** Introduction to Production Planning and Process, Issues in Material and Inventory Management, Quality control and Management (quality circle, ISO 9000 series, just-in-time, TQM.), Maintenance Management, Purchasing Decision.

**UNIT-III : Project, Financial & Human Resource Management:**
**Project Report:** Preparation of -Project Report, Profit and Loss statement, Balance Sheet.
**Financial Management:** Costing- Principles, types- operating, marginal, incremental, embedded etc, Budgeting & financial planning, Risk management etc.

**Human Resource Management:** Human resource planning-concepts & process, Job analysis & description- recruitment, selection process, Training & development, Employee welfare, issues related to management of trade union.

## SECTION-B

**UNIT-IV: Dimensions of Power System Restructuring**

**Power system Restructuring:**: Introduction to Power Sector Reforms/Restructuring/ Deregulation ó issues, prospects and lessons to developing countries

**Environmental dimensions in power sector**: Pollution & Depletion of natural resources, Waste Management, environmental legislation, green power, strategies for environmental management in power sector.

**Rural Electrification**: Issues relating to revised definition of village electrification, issues in electrifying remaining villages, decentralized generation and distribution for rural electrification etc.

**Power Sector Restructuring in India:** History, Problems and status in India, Accelerated Power Development and Reform Programme (APDRP), Reforms in G,T, D sector, Electricity Act:2003- issues, Problems & prospects, Legal and regulatory framework, Rural Electrification Programme, Environmental Pollution Programme.

**UNIT-V: Management issues in Power Sector:**

**Financing of power sector:**: Financial problems of SEBs, strategies - for financing capacity addition to generation, transmission and rural electrification, Risk management in power sector.

**Human Resource development in power utilities:** Change management, Training & Development, Culture of empowerment and accountability etc.

**Transmission & Distribution Management:** Transmission management under open access- transmission Pricing/Tariff, Congestion Management, Micro distribution models- private investors, Multi Licensee System, Distribution Management, Power Quality, Demand Side Management, Energy Metering, Accounting and Auditing, SCADA etc.

**UNIT-VI: Marketing issues in Power Sector:**

Issues of Power Tariff, Prices in Competitive Electricity Markets, Bidding strategy, Availability Based Tariff (ABT), Embedded and Spot pricing, Power Trading, Market Operations in Electric Power Systems, Marketing of energy and services in competitive electricity markets.

**TEXT BOOKS:**

1. Koontz H., OøDonnel C. and Whierich: Principle of Management, Tata McGraw Hill Publishing Co., Ltd., New Delhi
2. Muhlemann , Production Operation Management, Macmillan publication
3. Dencenzo & Robbins, Human Resource Management
4. Monappaa, Human Resource Management, Macmillan Publication
5. Ramaswamy & Namamkumari, Marketing Management Macmillan Publication
6. Philip Kotler, Marketing Management, PHI, New Delhi

**REFERENCE BOOKS:**

1. Economic Evaluation of Projects in the Electricity Supply Industry, by H. Khatib.
2. Fundamentals of Power System Economics, by Daniel S. Kirschen, Goran Strabac
3. Energy and Power Risk Management by Alexander Eydeland, KrzysztofmWolyniec
4. Power System Economics, by Steven Stoft
5. Market Operations in Electric Power Systems, by M. Shahidehpour, H. Yamin, Zuyi Li.
6. Electricity Economics, by Geoffrey Rothwell, Tomas Gomez
7. Modelling Prices in Competitive Electricity Markets (The Wiley Finance Series), by Derek W. Bunn.
8. A Shock to the System, by Timothy J. Brennan, Karen L. Palmer, Raymond J. Kopp, Alan J. Krupnick, Vito Stagliano, Dallas Burtraw.
9. Power pricing by Dolan & Siman, The free Press,1996
10. Customer Choice: Purchasing Energy In A Deregulated Market: by Albert Thumann
11. Indiaøs Power Sector Reforms Update, Paryas, Pune

**8EX04      PROFESSIONAL ELECTIVE -II**
**(2) FUZZY  LOGIC & CONTROL**

### SECTION - A

**UNIT - I: THE MATHEMATICS OF FUZZY CONTROL:**

Basic definitions, a-level sets, comparison with classical (crisp) sets Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, Fuzzy complement, t-norms, t-conorms, combination of operations, aggregation operations. , fuzzy relations, the extension principle

**UNIT–II: THEORY OF APPROXIMATE REASONING:**

Fuzzy numbers, linguistic variables, arithmetic operations on intervals, arithmetic operations on fuzzy numbers, lattice of fuzzy numbers, fuzzy equations.

Linguistic variables, Fuzzy proportions, Fuzzy if- then statements, inference rules, compositional rule of inference.

**Unit-III: Fuzzy Relations:** Crisp versus fuzzy relation, projections and cylindric extensions, binary fuzzy relations, binary relations on a single set, fuzzy equivalence relations, fuzzy compatibility and fuzzy ordering relations.

**Possibility Theory:** Fuzzy measures, evidence theory, possibility theory, fuzzy sets and possibility theory.

## SECTION - B

**Unit -IV: Fuzzy Logic:** An overview of classical logic, multivalued logic, fuzzy propositions, fuzzy quantifiers, linguistic hedges, inference from conditional fuzzy propositions, inference from conditional and qualified propositions.

**NON-LINEAR FUZZY CONTROL:** FKBC as a linear transient element, PID like FKBC, sliding mode FKBC, Sugeno FKBC.

**Unit -V: FUZZY KNOWLEDGE BASED CONTROLLERS(FKBC):** Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication procedures. Simple applications of FKBC (washing machines, traffic regulations, lift control, etc).

**UNIT-VI: ADAPTIVE FUZZY CONTROL:** Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

**TEXT BOOKS:**
1. An Introduction to Fuzzy Control- D. Diankar, H. Hellendoom and M. Reinfrank- Narosa Publishers India, 1996.
2. Fuzzy Sets Uncertainty and Information- G. J. Klir and T. A. Folger- PHI IEEE, 1995.

**REFERENCE BOOKS:**
1. Essentials of Fuzzy Modeling and Control- R. R. Yaser and D. P. Filer -John Wiley, 1994.
2. Fuzzy Logic With Engineering Applications- Timoty Ross,- McGraw Hill.
3. Fuzzy Logic Intelligence Control And Information- Yen- Pearson education.

**8EX04          PROFESSIONAL ELECTIVE -II**
**(3) RPC & FACTS CONTROLLER**

**UNIT-I: CONTROL OF VOLTAGE AND REACTIVE POWER**
Introduction, Generation and absorption of reaction power, relation between voltage, power and reactive power at a node,

methods of voltage control. Injection of reactive power, use of tap changing transformers, combined use of tap changing transformers and reactive power injection.

**Unit II:** Introduction to FACTS- Basic Types of FACTS controllers, Description and definition of FACTS controllers ó Benefits from FACTS technology- Static Var Compensator(SVC): Principle of operation, configuration and control, Thyristor Controlled Series compensator(TCSC): Principle of operation, configuration and control, Application of TCSC for damping electromechanical Oscillations, Application of TCSC for mitigation of SSR ó

**Unit III:** Static Compensator(STATCOM): Principle of operation, configuration and control ó Static Synchronous Series Compensator(SSSC): Principle of operation, configuration and control, Thyristor Controlled Phase Angle Regulator(TCPAR): Principle of operation, configuration and control, Unified Power Flow Controller(UPFC): Principle of operation, configuration and control, Simulation of UPFC, Steady state model of UPFC, Interline Power Flow Controller(IPFC) - Principle of operation, configuration and control.

**Unit IV:** Oscillation Stability Analysis and Control: Introduction ó Linearised model of power systems installed with FACTS based Stabilisers ó Heffron-Phillips model of a SMIB system installed with SVC, TCSC and TCPS ó Heffron-Phillips model of a SMIB system with UPFC ó Heffron-Phillips model of a Multimachine system installed with SVC, TCSC and TCPS

**Unit V:** Analysis and Design of FACTS based stabilisers: Analysis of damping torque contribution by FACTS based stabilisers installed in SMIB systems, Design of robust FACTS based stabilisers installed in SMIB systems by phase compensation method  - Selection of installing locations and feed back signal for FACTS based stabilizers

**Unit VI:** Transient Stability control with FACTS: Introduction ó Analysis of Power systems installed with FACTS devices: Power transmission control using Controllable Series Compensation(CSC), Power Transmission Control using SSSC, Power Transmission Control using UPFC, Power Transmission Control using Phase Shifting Transformer(PST), Power Transmission Control using UPFC, Control of FACTS devices for transient stability improvement ó General considerations of FACTS control strategy: CSC,SSSC, SVC, STATCOM and UPFC control strategy ó General Structure of the FACTS devices control.

**REFERENCE BOOKS :-**

1. *Reactive Power Control in Power Systems*øT J E Miller,John Wiley, 1982
2. *Computer modeling of Electrical Power Systems*ø J Arriliga and N R Watson, ó John Wiley, 2001
3. *Understanding FACTS*ø N G Hingorani and L Gyugyi, IEEE Press, 2000
4. *Flexible ac Transmission Systems(FACTS)*ø, Y.H. Song and A.T. Johns, IEE Press, 1999

**8EX04    PROFESSIONAL  ELECTIVE - II**
**(4) POWER QUALITY**

**SECTION - A**

**Unit I:    Introduction**
Power Quality Definition, Need for Power Quality, Sensitive Loads, Nonlinear Loads, Interconnected Power System, Deregulation, Utilities, End Users, Lawyers,

**Unit II:   Power Quality Characteristics**
Power Quality Theory, Types of power Quality Problems, Voltage Swells, Long-Duration  Over voltages, Under voltages, Interruptions, Transients, Voltage Unbalance, Voltage Fluctuations, Harmonics, Electrical Noise, Sources of Power Quality Problems, Utility Side of the meter, End-User Side of the meter, Effects of Power Quality Problems, Power Quality Problem-Solving Procedures, Power Quality Solutions,

**Unit III:  Power Quality Standards**
Power Quality Standards Organizations, Institute of Electrical & Electronics Engineers (IEEE), American National Standards Institute(ANSI), International Electrotechnical Commission(IEC Other International Standards Organizations, Purpose of Power Quality Standards, Types of Power Quality Standards, Voltage Sag (Dip) Standards, Transients of Surges, Voltage Unbalance, Voltage Fluctuation or Flicker Standards, Harmonics Standards, Transformer Overheating Standards, Natural Conductor Loading Standards, Static Electricity, Telephone Power Quality Standards, Grounding and Wiring Standards, Sensitive Electronics Equipments Standards, Trends in Power  Quality Standards.

**SECTION -B**

**Unit IV: Power Quality Solutions**
Reduce Effects on Sensitive Equipment, Reduce or Eliminate Cause, Reduce or Eliminate Transfer Medium, Install Power Conditioning Equipments, , Surge Suppressors, Noise Filters,

Isolation Transformers, Line-Voltage Regulators, Motor-Generator Sets, Magnetic Synthesizers, Static VAR Compensators (SVCs), Uninterruptible Power Supply (UPS), Solid-State Switches, Harmonics Solutions, Selection of Appropriate Power Conditioning Equipment, Grounding and Wiring Solutions

**Unit V:   Wiring and Grounding**
Wiring Principles, Grounding Principles, Power System, Utility Power System Grounding,Telecommunication System Grounding, End-User Power System Grounding, Wiring and Grounding Problems, Ground Loops, Electromagnetic Interference (EMI) Noise, Loose Connections, Grounding for Lightning and Static Electricity, Attack of the Triplens, Solutions That Cause Problems, Wiring Solutions, Separation, Selection of Wire and Cables, Shielding, Grounding Solutions, Ground Rods, Ground Ring, Ground and Reference Signal Grids, Other Grounding Systems, Isolated Grounds, Multipoint Grounding, Separately Derived Source Grounding, Reference

**Unit VI:** Power Quality Measurement Tools & Power Quality Surveys Kilowatt-Hour Meter, Multimeters, Average-responding versus True RMS Meters, Crest Factor and Bandwidth, Other Selection Considerations, Oscilloscopes, Disturbance Analyzers, Harmonics Analyzers, Purpose of a Power Quality Surveys (Checkup or Examination), Planning a power Quality Surveys.

**TEXT BOOKS**: -

1. Barry W. Kennedy: Power Quality Primer, McGraw-Hill
2. Electrical Power System quality by R.C.Dugan, M.F.McGranghan, S.Santoso, H.W.Beaty   TMH 2nd edition 2011

**REFERENCE BOOK: -**

1. G.T. Heydt: Power Quality Stars in a circle Publication, Indiana, 1991.

**8EX05  PROJECT AND SEMINAR**

**8EX06  EMBEDED SYSTEMS - LAB**
**Any TEN experiments based on contents of**
**8EX03 EMBEDED SYSTEMS**

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**SYLLABUS PRESCRIBED FOR**
**BACHELOR OF ENGINEERING**
**ELECTRICAL (ELECTRICAL & POWER) ENGINEERING**
**SEMESTER PATTERN (CREDIT GRADE SYSTEM)**

**SEMESTER : SEVENTH**

**7 EL01/7EP01/7EE01   CONTROL SYSTEM - II**

**SECTION-A**

**Unit I :   Compensation Techniques:**
Introduction, Preliminary considerations of Classical Design, Lead Compensator, Lag Compensator, Lag- Lead Compensator, Cascade Compensation in time domain, Cascade compensation in Frequency domain, Feedback compensation in frequency domain .

**Unit II :   State Space Techniques I:**
State, state space and state variables; SISO/MIMO linear systems state variable models - differential equations, Transfer Functions, Block Diagrams and State Diagrams (Signal Flow Graphs); Transfer functions decomposition - Phase variable forms, Canonical forms and Jordan canonical form; Transfer function - state model; Transfer matrix; State equations solution - State transition matrix (STM); STM Computation – Laplace transformation, Canonical transformation and Cayley Hamilton theorem; Time response – SISO Systems.

**Unit III :   State Space Techniques II:**
Concept - controllability and observability; SISO/MIMO Linear systems -Gilbert's method and Kalman's test; SISO controllable systems Design -state feedback.

**SECTION-B**

**Unit IV   Sampled Data Control Systems:**
Representation, Z Transforms. review, Sampler and Hold - zero order hold; Sampling theorem; Z Transform analysis – open loop and closed loop sampled data systems, Z Transfer functions, Difference equation solution and response; Z Transform Method,. Discrete Systems Response, Open and closed loop systems pulse transfer functions - Different sampler locations; Digital Controller - transfer function; Stability analysis - S and Z Domain relationship, Jury's Test and Bi-Linear Transformation, Root and root locus method.

**Unit V :  Non-Linear System Analysis I            :**
Non-linear system behavior – types and characteristics; Describing functions - typical non-linearity and their

characteristics; Stability analysis - Describing function method and Limit cycles;  Limitations - describing function method.

**Unit VI :   Non-Linear System Analysis II**
Linearization - Around operating point; Singular points – Classification and  Nature; Phase-plane method - non- linear systems analysis; Phase trajectories  construction – analytical method and graphical method by isocline method; Stability analysis - limit cycle; Limitations - phase-plane method.

**TEXT BOOKS:**
1.   I.J. Nagrath and M. Gopal – Control System Engineering,Wiley Eastern Limited, New Delhi.
2.   K . Ogata - Modern Control Theory, Prentice Hall of India Pvt. Ltd. New Delhi.
3.   Modern Control System, Richard Dorf, Robert Bishop, PEARSON education, 11$^{th}$ edition 2008

**REFERENCE BOOKS:**
1.   Control Engineering, D.Ganesh Rao, k.Chennavenkatesh, 2010
2 .   D.Roy Choudhary, Modern Control Engineering,Prentice Hall of India Pvt Ltd. New Delhi.
3.   R.C. Sukla – Control Systems  Dhanpat Rai & Co.Pvt Ltd.

**7 EL02/7EP02/7EE02   POWER SYSTEM OPERATION & CONTROL**

**SECTION-A**

**Unit I :   Economic Operation – Part I**
Meaning of optimum scheduling, UCP and LSP; Input – Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs; Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

**Unit II :   Economic Operation – Part II**
Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

**Unit III :   A.   Generator Control Loops**
Concept of real and reactive power; Effect of real and reactive power on system parameters; Philosophy of real and reactive power control; Basic generator control loops.

B. **Automatic Voltage Regulator (AVR)**

Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

### SECTION-B

**Unit IV : Automatic Load Frequency Control**

Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

**Unit V : Control Area**

Meaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system ó Dynamic response; Tie-line bias control.

**Unit VI : Steady-State Instabilities**

Natural torsional oscillatory modes in power system; Natural mode of a single generator operating onto infinite bus; Effect of damper winding; Effect of changing excitation; Power system stabilizer; Introduction to modern control application.

**TEXT BOOKS** :-

1. O. L. Elgerd ó Electric Energy Systems Theory: An Introduction ó Second edition, McGraw-Hill Book Comp. N. Y. 1987.
2. Power System Operation & Control, N.V.Ramana, PEARSON education, 2010.
3. Power System Operation by R.Miller, J.H.Malinowski, TMH, 2nd reprint 200

**REFERENCE BOOKS :**

1. L. K. Kirchamayor ó Economic Operation of Power System- Wiley Estern Pvt. Ltd., New Delhi.
2. Hadi Saadat ó Power System Analysis ó WCB/McGraw-Hill International Edition 1999
3. I. J. Nagrath, D. P. Kothari ó Modern Power System Analysis ó Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi
4. P. S. R. Murty ó Power System Operation and Control ó Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Wood and Wollenberg ó Power Generation, Operation and Control ó Willey ó Inter Science Publication

**7 EL03/ 7EP03/7EE03     ELECTRICAL  POWER - II**

### SECTION-A

**Unit I ::    Symmetrical components**

Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank- sequence voltages and currents relationship; power system elements ó sequence impedance and sequence networks ; Various three phase transformer connections ó zero sequence rules; Unbalanced load system ó application.

**Unit II :    Symmetrical Fault Analysis**

Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation.

**Unit III :    Unsymmetrical Fault Analysis**

L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults-loaded and unloaded conditions.

### SECTION-B

**Unit IV :    Overvoltages**

Causes ó internal and external; Voltage surge, Basic insulation level, Protection ó earthing screen, overhead ground wire, lightning arresters.

**Unit V:**    HVDC Transmission Basic principle, Transmission equipments, Comparison with AC links, Inverters ó reactive power requirement; Converters, DC links, Circuit breaking, ground return, Economic distance, modern developments.

**Unit VI :    Flexible AC Transmission Systems (FACTS)**

FACTS concept, Elements, Controllers, Comparison with Conventional AC Transmission system.

**TEXT BOOKS :-**

1. Power System Engineering by D.P.Kothari, I.J.nagrath TMH 2nd edition, 9th reprint 2010
2. Power System Analysis, N.V.Ramana, PEARSON education, 2010
3. Power System Analysis, Arthur R. Bergen, Vijay Vittal,2nd Edition, 2009, PEARSON Education
4. Modern Power System Analysis by D.P.Kothari, I.J.nagrath TMH 3rd edition, 20th reprint 2010

5. Power System Analysis by Hadi Saadat TMH, 1ˢᵗ reprint 2004
6. Electrical Power System, by Syed A. Nasar TMH, Revised 1ˢᵗ edition 2011

**REFERENCE BOOKS :-**

1. S. Rao ó õEHV A.C. and HVDC Transmission Engineering and Practiceö, Khanna Publishers, New Delhi.
2. Narain G. Hingorani and Lazlo Gyugyi ó õUnerstanding FACTS: Concepts and Technology of Flexible AC Transmission Systems.
3. Yong Hua Song and Allan T. Johns - õFlexible AC transmission Systems (FACTS), T and D reference bookö Westing house.

## 7 EL04/7EP04/7EE04 SWITCHGEAR & PROTECTION
### SECTION-A

**Unit I : Circuit Interruption**
Circuit breaker control circuit, Fault clearing process, Auto-reclosure, Arc phenomenon- maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.

**Unit II :**
A. Fuses Types, Constructional features, operation, Characteristics and Applications
B. Circuit Breaker (Part ó I)
Air break, Air blast, Bulk oil and minimum oil-types, constructional features, operation and application.

**Unit III : Circuit Breaker (Part – II)**
$SF_6$, Vaccum, Miniature, Earth leakage and Moulded Case ó types, Constructional features, operation and application; Testing, Instalation and Maintenance.

### SECTION-B

**Unit IV :**
A. Relaying Principle
Components, Essential features, Characteristics, Terminology, CTøs and PTøs, Relay classification.
B. Electromagnetic Relays
Overcurrent, Directional, Distance and Differential ó types, constructional features, operation, characteristics and application.

**Unit V : Protection of Transmission Lines**
Relaying schemes ó overcurrent, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, Carrier current relaying, Overload and Power swing.

**Unit VI : A.** Other Power System Elements Protection Transformers, Motors, Generators and Buses.
**B. Static Relaying**
Basic concepts, equipments, comparators, Characteristics realization ó overcurrent, directional, differential and distance relay. Microprocessor based relay introduction.

**TEXT BOOK:-**

1. Sunil S. Rao ó õSwitchgear and Protectionö Khanna Publications New Delhi

**REFERENCE BOOKS: -**

1 R. T. Lythall ó õSwitchgear Handbookö J and P Newness Butterworth, London.
2 C. R. Mason ó õThe Art and Science of Protective Relayingö
3 A. R. Van and C Warringtan ó õProtective Relaying , Vol 1 and 2,ö Chapman Hall, London.
4 Geosonoviz ó õHigh Voltage Circuit Breakersö
5 V. A. Slabikov ó õGeneration Protection and Switchgearö CIT, Coimbatore.
6 Badri Ram and B. N. Vishwkarma ó õPower System Protection and Switchgearö Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
7 B. Ravindranath and M Chander ó õPower System Protection and Switchgearö Wiley Eastern Ltd, New Delhi.
8. Handbook of switchgear by BHEL, TMH 6ᵗʰ reprint,2010

## 7 EL05/7EP05/7EE05/ 7EX05 PROFESSIONAL ELECTIVE - I
### (1) PROCESS CONTROL SYSTEMS
### SECTION-A

**Unit I :** Electronics Instruments for Measurement of Electrical Parameters
Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multimeters, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

**Unit II : Signal Generation and Analysis**
Signal generators, Function generators. Wave analyzer Harmonic Distorsion Analysers, spectrum Analysis.

**Unit III : Signal Counting and Recording**
Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital disply, universal counter, Digital readot devices, storage type CRO, Servotype X-Y recorder.

## SECTION-B

**Unit IV :  Signal conditioning and Conversions.**

Frequency characteristics of various types of signals,active filters bandpass,low pass and high pass filters using opAmps. Various techniques od A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop.

**Unit V:   Signal Processing**

Pulse times, triggered elayed sweeps, discrete pulse delay circuits, pulses equencing, analog multiplexers and demultiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

**Unit VI :**  Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller based instrumentation

### TEXT BOOKS: -

1. H.S. Kalsi ó Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick ó Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

### REFERENCE BOOKS: -

1. B.R. Gupta-Electronics and Instrumentation ó Wheeler Publishing.
2. Rangan, Sharma & Mani ó õInstrumentation ó devices & Systems.ö Tata Mc-Graw Hill Publishing Company, New Delhi.
3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.
4. Microprocessors and Digital Systems, by:D.V. Hall,Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.
6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.
7. A.K. Sawhney ó Acourse in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi.

### 7 EL05/7EP05/7EX03  PROFESSIONAL  ELECTIVE - I
#### (2) COMPUTER ORGANISATION

**Unit-I:**   Basic strucutre of computer: Hardware & software.Addressing methods. Program sequencing. concept of memory locations & address. Main memory operation. Instructions & instruction sequencing. Addressing modes. BasicI/O operations. Stacks. Queues & subroutines.

**Unit-II:**   Processing Unit: fundamental concepts. execution of a comlete instruction. hardwired control, performance consideration. Microprogrammed control; microinstructions, microprogram sequencing, microinstruction prefetching, emulation.

**Unit-III:**  I/O organizatiion: accessing I/O devices,interrupts, direct memory access:bus arbitration. I/O hardware:processor bus and interfacing circuiuts,standard I/O interfaces: SCSI bus, backplane bus standard.

**Unit-IV:**  Memory Unit: basic concepts,semiconductor RAM memories,internal organization, static & dynamic RAMs, ROMs. speed, size & cost considerations.Cache memories: performance considerations. Virtual memories, address translation,memory management requirements.

**Unit-V:**   Arithmetic; number representation. design of fast adders,signed addition and subtraction. Multiplication of positive numbers, Boothsøalgorithm, Integer division.Floating-point numbers and related operations.

**Unit-VI:**  Computer Peripherals: Input-output devices like video displays,video terminals, graphics input devices,printers.Online storage devices: magnetic disks,magnetic tape systems, CD-ROM systems. Communication devies: Modems.

### TEXT-BOOK:

V.Carl Hamacher & S. Zaky õ Computer Organizationö (4/e) McGraw-Hill(ISE).

### REFERENCE BOOKS:

1. Stallings. W. õ Computer Organization & Arcitectureö (5/e) (Pearson Education).
2. Tenanbaum A.S.ö Structured Computer Organizationö (5/e) (Pearson Education).
3. Hayes J.P. õComputer Architecture & Organizationø(4/e) ( McGraw-Hill).

### 7 EL05/7EP05/7EE05  PROFESSIONAL  ELECTIVE - I
#### (3)  COMPUTER METHODS IN POWER SYSTEM ANALYSIS

#### SECTION-A

**Unit I** :  Representation of power systems for computerized analysis : Mathematical models of Synchronous generator for steady state and transient analysis . Transformer with tap changer, transmission line,phase shifter and loads.

**Unit II** :  Topology of Electric Power Systems ó Network Graphs , Incidence matrices, fundamental loop and cutest matrices, primitive

impedance and admittance matrices, equilibrium equations of networks . Singular and Nonsingular transformation of network matrices .

**Unit III** : Formation of bus impedances and admittances matrices by algorithm ó Modification of bus impedance and admittance matrix to account for change in networks. Derivation of loop impedance matrix.

Three phase network elements ó transformation matrix ó incidance and network matrices for three phase l networks . Algorithm for formulation of 3 phase bus impedance matrix.

### SECTION-B

**Unit IV:** Short circuit studies : Three phase networks , Symmetrical components. Thevening theorem and short circuit analysis using bus impedance matrix . Short circuit calculations for balanced three phase networks using bus impedance matrix.

**Unit V**: Load flow studies : formation of load flow problem ó Gauss Seidel method ó Newton Unit III Raphson method ó decoupled method, fast decoupled methods ó sparsity technique.

**Unit VI** : Stability studies of power system ó Development of mathematical model for multimachine system stability analysis óFormation of equations and methods of solutions .Transient stability analysis including synchronous machines , system networks and loads . Solution of state equation by modified Euler method and Runge Kutta 4th order Approximation method.

**TEXT BOOKS:**

1) L.P.Singh : Advanced Power System Analysis and Dynamics, WEL.

2) Y.Wallach : Calculations and programs for Power System Network.

3) G.W.Stage and A.H.El-Abiad : Computer Methods in Power System Analysis, McGraw Hill.

**REFERENCE BOOKS:**

1) R.N.Dhar : Computer Aided Power System Operation and Analysis, TMC.

2) Computer Technniques in Power System Analysis, by M.A.PAi TMH 10th reprint 2011

**7 EL05/7EP05/7EE05  PROFESSIONAL  ELECTIVE - I
(4)  ARTIFICIAL   INTELLIGNCE**

### SECTION-A

**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.

**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.

**UNIT III:  Unsupervised Learning:**

Introduction, Counter propagation networks, Kohonenø self organizing maps.

Hopfields networks.

### SECTION-B

**UNIT IV:  Introduction:**

Uncertainty  in information,basic concepts of Fuzzy sets , operations on fuzzy sets , properties.

Fuzzy relations : operations,properties ,value assignments.

**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

**UNIT VI:  Genetic Algorithm (GA):**

Introduction to genetic algorithm,working principle,coding of variables, Fitness function. GA operators , similarities & differences between GAs  and Traditional methods; Unconstrained and constrained optimization   using Genetic Algorithm , real coded GA ,Advanced GA, global optimization using GA .

**TEXT BOOKS :**

1    J.M. Zurada : Introduction to Artificial Neural Network, Jaico Publishing  House

2    Meherotra Kishan ,Mohan C.K, Ranka Sanjay : Elements Of Artificial Neural networks  Penram Int Pub Mumbai.

3    D.E Goldberg ,Addision  Genetic Algorithm in Search Optimization and Machine Learning Wesley Publication

4    Kalyanmoy Deb  Optimization for Engineering Design Algorithms and Examples, Prentice Hall of India New Delhi

5.    M.Kishan, Mohan C.K., Ranka Sanjay; Elements of Artificial Neural Networks, Penram Int. Publications.

## REFRENCE BOOKS

1.    G.J. Khir and T.A. Folger : Fuzzy sets , Uncertainity and Information PHI Publication

2.    Koska Bart  Neural Network & Fuzzy systems  Prentice Hall of India Pvt Ltd , New Delhi

## 7 EL06/7EP06/7EE06  PROJECT & SEMINAR

## 7 EL07/7EP07/7EE07  ELECTRICAL POWER II - LAB

**Any TEN experiments based on contents of 7EP03  ELECTRICAL POWER II**

## 7 EL08/7EP08/7EE08 SWITCHGEAR & PROTECTION - LAB

**Any TEN experiments based on contents of  7EP04 SWITCHGEAR & PROTECTION**

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## SEMESTER : EIGHT
## 8 EL 01 /8EP01/8EE01  POWER SYSTEM STABILITY

### SECTION-A

**Unit I :    Basic Concepts**
Meaning of stability, Steady state, Transient and Dynamic stability limits; Three Phase Synchronous Machine-circuit representation, voltage equation and Park's Transformation; Transient and Sub transient state analysis and Phasor diagrams, Voltage behind the transient and sub transient impedances, Parameters and Time Constants determination.

**Unit II:    Steady State Stability - I**
Steady state stability limit-short transmission line, Two machines system, Medium and Long transmission line, Clarke's diagrams for system with and without loss, Effect of inertia, Conservative criterion, Synchronizing coefficients and Multi machine system.

**Unit III:    Steady State Stability – II**
Saturation effect, Saturated reactance, Equivalent reactance and its graphical determination; Short circuit ratio, Governor action and automatic voltage regulator effects.

### SECTION-B

**Unit IV:    Transient State Stability  – I**
Review of basics concepts, Transient state stability and equal area criterion, Swing equation and its point by point solution, Critical clearing angle and time.

**Unit V:    Transient State Stability  – II**
Type of faults, Grounding and high speed re-closing effects, Pre-calculated swing curves and their use, Faults clearing Time, Excitation and governing action effects, Stability improvement methods, Multi machine problem, Network analyzer, Digital Computer role.

**Unit VI:    Excitation System**
Unit exciter and common bus system, Self and separate excitation, Exciter type of and their description, Exciter drives, Quick response excitation system, Voltage-current methods differential equations for obtaining voltage ótime curves, Exciter response from voltage time curves, Dispersion coefficient, Constant leakage Inductance, Eddy current effects on exciter response, Loaded exciter response, Exciter response improvement methods.

## TEXT BOOKS

1    E W Kimbark- Power System Stability, Vol.1 and 3, Dover Publications Inc., New York.

2    Power System Stability & Control by Prabha Kundur, TMH 11th reprint 2011

3.    S.B Crary- Power System Stability, Vol.1 and 3, Hohn Wiley and Sons, New York.

## REFERENCE BOOKS:

1    L.P Singh ó Computer Aided Power System Operation and Dynamics, Wiley Eastern Ltd. New Delhi.

2    I.J.Nagrath and D.P.Khothari ó Modern Power System Analysis, Tata Mc-Graw Hill Publishing Company,  New Delhi.

## 8 EL 02 /8EP02/8EE02  HIGH VOLTAGE ENGINEERING

### SECTION-A

**Unit I :    Breakdown in Gases**
Insulating materials Classification, Gases as insulating media, Ionization and decay process, Breakdown in gases, Townsend's law, Streamer mechanism of spark pashan's law, Corona discharge, Electronegative gases.

**Unit II:** **Breakdown in Liquid and Solid Dielectrics**
Breakdown in pure and commercial liquids, Sold dielectrics and composite dielectrics, High voltage bushings, Guarding, Shielding, Field plotting.

**Unit III:** **Lightning and Switching Over Voltage and Protection**
Lightning strokes to lines and towers; Mechanism, Characteristics and protection of transmission lines from lightning; Lightning arrestors, Insulation co-ordination of HV and EHV power system and substation.

### SECTION-B

**Unit IV:** High Voltage and Current Generation, Generation of high d.c, a.c and impulse voltages, Standard impulse wave shapes, Switching surges, and High impulse generator.

**Unit V:** High Voltage and Current Measurement Peak voltage, Impulse voltage and High direct measurement methods, Non-destructive measurement and testing, High voltage dielectrics loss and capacitance measurement, Radio frequency and Partial discharge measurement.

**Unit VI:** **High Voltage Testing and E.H.V.Lines Design.**
Basic terminology, Testing ó Insulators, Bushings, Cables, Transformers, Surge diverters and Isolators; Electric shock and threshold current, Capacitance of long objects, Electromagnetic interference, E.H.V. line insulation design based upon transient over voltage.

**TEXT BOOK :**
1.  M.S.Naidu and V.Kamraju ó High Voltage Engineering, Tata McGraw Hill Publishing, Company, New Delhi.

**REFERENCE BOOKS-**
1.  E.Kuffer and W.S.Zaenglo- High Voltage Engineering, Pergamon Press,
2.  Rokosh Das Begamudre- EHV AC. Transmission Engineering, Wiley Easter Ltd. New Delhi.
3.  E.Kuffer and M.Abdullaha _High Voltage Engineering, Pergamon Press
4.  M.S.Naidu and V.N.Maller- SF6 and Vaccum Insulation for High Voltage Application, Khanna Publications, Delhi.
5.  Prof.D.V.Razeving (Translated from Russian by Dr.M.P.Chaurasia) ó High Voltage Engineering, Khanna Publications, Delhi.
6.  An introducation to High Voltage Engineering by Subir Ray, Prentice óHall & India, Private Limited, New Delhi.

7.  High Voltage Engineering by C.L. wadhawa New Age international (P) Ltd. Publications

## 8 EL 03 /8EP03/8EE03   DIGITAL SIGNAL PROCESSING

### SECTION - A

**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.

**UNIT-II :** Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, DFT and its properties , Circular convolution, Linear convolution  from DFT, FFT, decimation in  time and frequency algorithm.

**UNIT-III:** Sampling of Bandpass signals-Representation of Bandpass signals, sampling of bandpass signals, discrete time processing of continuous time signal; Analog to digital conversion-sample and hold, quantization and coding, analysis of quantization errors, oversampling of A/D converter; Digital to Analog conversion-sample and hold, first order hold, linear interpolation with delay, oversampling of D/A converter

### SECTION-B

**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.

**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.

**UNIT-VI:** DSP Processors and applications- DSP Microprocessors architectures, fixed point, floating point precision, algorithm design, mathematical, structure and numerical constraints, DSP programming, filtering, data conversion; Real time processing consideration including interrupts

**TEXT BOOKS:**
1.  Proakis & Monolakis D.G, ─Digital Signal Processing∅ PHI Publication
2.  Oppenhavm & Scheffer, ─Discrete Time Processing∅ John Wiley Publication

3. Digital Signal Processing, P Ramesh Babu,SCITECH Publications, Chennai, 4th edition,2010
4. Mitra S.K, –Digital Signal Processing‖, TMH Publication

## 8 EL 04 /8EP04/8EE04 PROFESSIONAL ELECTIVE - II
### (1) ELECTRIC DRIVES & CONTROL

#### SECTION-A

**UNIT I : Introduction to Electrical Drives:** Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

**UNIT II: Starting and Braking of Electrical Drives:** Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, Braking of d c and induction motors.

**UNIT III:** DC Drive Control Basic machine equations, schewe of control, Single phase separately excited drives, single– phase- series motor drives, power factor improvement, Three-phase separately excited drive, Closed loop control, PLL control, microcomputer control.

#### SECTION-B

**Unit-IV: Ac drive control:** Basic principle of operation, speed control of induction motor, stator voltage control, varible frequency control, Rotor resistance control, slip-power recovery scheme, Synchronus motor drive, Microprocessor controlled AC Drive.

**UNIT V:** Vector controlled Drive,Principle of Vector Control, Equivalent ckt. Direct v.c., Flux vector estimation, Indirect v.c., v.c. of line side pular rectifer exator flux oriented v.c., v.c. of current fed inventer drive & cycloconverter drive servorless control speed estimation controls – EKF method

**UNIT VI:** Direct torque & adoptaive controlled Drive Torque Expression o& control strategy self tuning control MRAC sliding mode control self commissiong of drive, Study of electrical drives in rolling mills, paper mills, cement mills, sugar mills, textile mills, traction and machine tool applications.

#### REFERENCE BOOKS:

1. Power Electronics : ( Converts, Application & Design) – Mohan/ Undeland/ Rossing- John wiley

2. Power Electronics : M.D. Singh, K.B. Khan Chardalli – TMH
3. Power Electronics : M.H. Rashid – Pearson Education
4. B.K. Bose : Modern Power Electronics and AC Drive, Pearson Education
5 G. K. Dubey Fundamentals of Electrical Drives, , Narosa Publishing House,2005
6 . Electric Drives – Concepts & Applications by V.Subrahamanyam, TMH 2nd edition 2010

## 8 EL 04 /8EP04/8EE04 PROFESSIONAL ELECTIVE - II
### (2) POWER QUALITY

#### SECTION - A

**Unit I: Introduction**
Power Quality Definition, Need for Power Quality, Sensitive Loads, Nonlinear Loads, Interconnected Power System, Deregulation, Utilities, End Users, Lawyers,

**Unit II: Power Quality Characteristics**
Power Quality Theory, Types of power Quality Problems, Voltage Swells, Long-Duration Over voltages, Under voltages, Interruptions, Transients, Voltage Unbalance, Voltage Fluctuations, Harmonics, Electrical Noise, Sources of Power Quality Problems, Utility Side of the meter, End-User Side of the meter, Effects of Power Quality Problems, Power Quality Problem-Solving Procedures, Power Quality Solutions,

**Unit III: Power Quality Standards**
Power Quality Standards Organizations, Institute of Electrical & Electronics Engineers (IEEE), American National Standards Institute(ANSI), International Electrotechnical Commission(IEC Other International Standards Organizations, Purpose of Power Quality Standards, Types of Power Quality Standards, Voltage Sag (Dip) Standards, Transients of Surges, Voltage Unbalance, Voltage Fluctuation or Flicker Standards, Harmonics Standards, Transformer Overheating Standards, Natural Conductor Loading Standards, Static Electricity, Telephone Power Quality Standards, Grounding and Wiring Standards,
Sensitive Electronics Equipments Standards, Trends in Power Quality Standards.

#### SECTION-B

**Unit IV:** Power Quality Solutions
Reduce Effects on Sensitive Equipment, Reduce or Eliminate Cause, Reduce or Eliminate Transfer Medium, Install Power Conditioning Equipments, , Surge Suppressors, Noise Filters,

Isolation Transformers, Line-Voltage Regulators, Motor-Generator Sets, Magnetic Synthesizers, Static VAR Compensators (SVCs), Uninterruptible Power Supply (UPS), Solid-State Switches, Harmonics Solutions, Selection of Appropriate Power Conditioning Equipment, Grounding and Wiring Solutions

**Unit V: Wiring and Grounding**
Wiring Principles, Grounding Principles, Power System, Utility Power System Grounding,Telecommunication System Grounding, End-User Power System Grounding, Wiring and Grounding Problems, Ground Loops, Electromagnetic Interference (EMI) Noise, Loose Connections, Grounding for Lightning and Static Electricity, Attack of the Triplens, Solutions That Cause Problems, Wiring Solutions, Separation, Selection of Wire and Cables, Shielding, Grounding Solutions, Ground Rods, Ground Ring, Ground and Reference Signal Grids, Other Grounding Systems, Isolated Grounds, Multipoint Grounding, Separately Derived Source Grounding, Reference

**Unit VI: Power Quality Measurement Tools & Power Quality Surveys**
Kilowatt-Hour Meter, Multimeters, Average-responding versus True RMS Meters, Crest Factor and Bandwidth, Other Selection Considerations, Oscilloscopes, Disturbance Analyzers, Harmonics Analyzers, Purpose of a Power Quality Surveys (Checkup or Examination), Planning a power Quality Surveys.

**TEXT BOOKS:-**
1. Barry W. Kennedy: Power Quality Primer, McGraw-Hill
2. Electrical Power System quality by R.C.Dugan, M.F.McGranghan, S.Santoso, H.W.Beaty   TMH 2nd edition 2011

**REFERENCE BOOK:-**
1. G.T. Heydt: Power Quality Stars in a circle Publication, Indiana, 1991.

**8 EL 04 /8EP04/8EE04  PROFESSIONAL  ELECTIVE - II**
**(3) EMBEDED SYSTEMS**

**Unit-I :** Introduction: Embedded systems design, Embedded system architecture, Embedded systems model, An Overview of Programming Languages and Examples of Their Standards, Standards and Networking, Multiple Standards-Based Device Example: Digital Television (DTV).

**Unit-II:** Embedded Hardware Building Blocks and the Embedded Board, powering the hardware, Instruction Set Aarciteture (ISA) architecture model, internal processor design and its performance.

**Unit-III:** Memory: ROM, RAM and auxiliary memory, Memory Management of Extemal Memory , Performance of memory .I/ O : Managing Data: Serial vs. Parallel I/O , Interfacing the I/O Components ,I/O performance.Buses: arbitration, timing and performance.

**Unit-IV:** Device Drivers: Device Drivers for Interrupt-Handling, Memory Device Drivers, On-board Bus Device Drivers, Board I/O Driver. Embedded OS: Multitasking and Process Management, Memory Management ,.

**Unit-V:** Embedded OS : I/O and File System Management ,OS Standards: POSIX, OS Performance Guidelines. Middleware :meaning and examples. Application layer software: meanings and examples.

**Unit-VI:** Embedded system design & implementation: Defining the System-Creating the Architecture and Documenting the Design, Stages in creating an Embedded System Architecture. Implementing the Design. Quality Assurance and Testing of the Design.

**TEXT BOOK:**
Tammy Noergaard õEmbedded Systems Architectureö Elsevier Newnes Publication.

**REFERENCE BOOKS:**
1. Rajkamal , õEmbedded Systems, Architecture, Programming & Designö TMH.
2. Jane W. S. Liu ÷Real Time Systemsö, Pearson Education
3. Vahid & Givargis õEmbedded System Designö John Wiley & Sons P Ltd.
4. Peter Marwedel õEmbedded Systems Designö Springer, Netherland.

**8 EL 04 /8EP04/8EE04  PROFESSIONAL  ELECTIVE - II**
**(4)  GENERALISED MACHINE THEORY**

**SECTION-A**

**Unit I :** Elements of Generalized Theory: essentials of rotating machines, conventions, basic two pole machines, transformer with movable secondary transformer and speed voltage in armature, kions, primitive machine, leakage fluge, voltage and torque equations.

**Unit II :** Linear transformations in machines: invariance of power transformation from displaced brush axis, three-phase to two-phase transformation power invariance, transformation from rotating axes to stationary axes, impedance matrix, application of generalized theory, electrical torque, limitations of generalized theory.

**Unit III:** D.C.Machines: separately excited DC generators and motors formulation of mathematical model, steady state and transient analysis, Ward-Leonard system of speed control.

Steady state analysis of DC series, shunt and compound machine and their characteristics cross-field machines, metadyne transformer, metadyne generator.

## SECTION-B

**Unit IV:** Poly-phase synchronous machine, three phase synchronous machine, steady state and transient analysis, phasor equations and phasor diagram, power angle characteristics, DWR synchronous machine generalized mathematical model, steady state analysis, phasor diagram.

**Unit V:** Induction Machine: Transformations, electrical performance, equation, steady state analysis, equivalent circuit, torque-slip characteristics.High torque cage motors- deep bar rotor and double cage rotor induction motors, steady stateanalysis, comparison between single cage and double cage motors.

**Unit VI:** Generalized theory of single-phase series motor, repulsion motor and scharge motor and steady state analysis.

**TEXT BOOKS :**
1. M.B.Say: Introduction to Unified Theory of Electrical Machine, ELBS.
2. SEELY: Electromechanical Energy Conversion

**8 EL05/ 8EP05/8EE05   PROJECT & SEMINAR**

**8 EL06/ 8EP06/8EE06  DIGITAL SIGNAL PROCESSING - LAB**

**Any TEN experiments based on contents of**
**8 EL03/ 8EP03/8EE03 DIGITAL SIGNAL PROCESSING**

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**SYLLABUS PRESCRIBED FOR**
**BACHELOR OF ENGINEERING**
**ELECTRICAL ENGINEERING**
**SEMESTER PATTERN (CREDIT GRADE SYSTEM)**

**SEMESTER : SEVENTH**

**7 EE01/7EP01/7EL01 CONTROL SYSTEM - II**

### SECTION-A

**Unit I :** **Compensation Techniques:**
Introduction, Preliminary considerations of Classical Design, Lead Compensator, Lag Compensator, Lag- Lead Compensator, Cascade Compensation in time domain, Cascade compensation in Frequency domain, Feedback compensation in frequency domain .

**Unit II :** **State Space Techniques I:**
State, state space and state variables; SISO/MIMO linear systems state variable models - differential equations, Transfer Functions, Block Diagrams and State Diagrams (Signal Flow Graphs); Transfer functions decomposition - Phase variable forms, Canonical forms and Jordan canonical form; Transfer function - state model; Transfer matrix; State equations solution - State transition matrix (STM); STM Computation ó Laplace transformation, Canonical transformation and Cayley Hamilton theorem; Time response ó SISO Systems.

**Unit III :** **State Space Techniques II:**
Concept - controllability and observability; SISO/MIMO Linear systems -Gilbertøs method and Kalmanøs test; SISO controllable systems Design -state feedback.

### SECTION-B

**Unit IV** **Sampled Data Control Systems:**
Representation, Z Transforms. review, Sampler and Hold - zero order hold; Sampling theorem; Z Transform analysis ó open loop and closed loop sampled data systems, Z Transfer functions, Difference equation solution and response; Z Transform Method,. Discrete Systems Response, Open and closed loop systems pulse transfer functions - Different sampler locations; Digital Controller - transfer function; Stability analysis - S and Z Domain relationship, Juryøs Test and Bi-Linear Transformation, Root and root locus method.

**Unit V :** **Non-Linear System Analysis I** :
Non-linear system behavior ó types and characteristics; Describing functions - typical non-linearity and their

characteristics; Stability analysis - Describing function method and Limit cycles; Limitations - describing function method.

## Unit VI : Non-Linear System Analysis II

Linearization - Around operating point; Singular points ó Classification and Nature; Phase-plane method - non- linear systems analysis; Phase trajectories construction ó analytical method and graphical method by isocline method; Stability analysis - limit cycle; Limitations - phase-plane method.

### TEXT BOOKS:

1. I.J. Nagrath and M. Gopal ó Control System Engineering, Wiley Eastern Limited, New Delhi.
2. K . Ogata - Modern Control Theory, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Modern Control System, Richard Dorf, Robert Bishop, PEARSON education, 11th edition 2008

### REFERENCE BOOKS:

1. Control Engineering, D.Ganesh Rao, k.Chennavenkatesh, 2010
2. D.Roy Choudhary, Modern Control Engineering,Prentice Hall of India Pvt Ltd. New Delhi.
3. R.C. Sukla ó Control Systems Dhanpat Rai & Co.Pvt Ltd.

## 7 EE02/7EP02/7EL02 POWER SYSTEM OPERATION & CONTROL

### SECTION-A

#### Unit I : Economic Operation – Part I

Meaning of optimum scheduling, UCP and LSP; Input ó Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs; Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

#### Unit II : Economic Operation – Part II

Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

#### Unit III : A. Generator Control Loops

Concept of real and reactive power; Effect of real and reactive power on system parameters; Philosophy of real and reactive power control; Basic generator control loops.

#### B. Automatic Voltage Regulator (AVR)

Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

### SECTION-B

#### Unit IV : Automatic Load Frequency Control

Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

#### Unit V : Control Area

Meaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system ó Dynamic response; Tie-line bias control.

#### Unit VI : Steady-State Instabilities

Natural torsional oscillatory modes in power system; Natural mode of a single generator operating onto infinite bus; Effect of damper winding; Effect of changing excitation; Power system stabilizer; Introduction to modern control application.

### TEXT BOOKS :-

1. O. L. Elgerd ó Electric Energy Systems Theory: An Introduction ó Second edition, McGraw-Hill Book Comp. N. Y. 1987.
2. Power System Operation & Control, N.V.Ramana, PEARSON education, 2010.
3. Power System Operation by R.Miller, J.H.Malinowski, TMH, 2nd reprint 200

### REFERENCE BOOKS :

1. L. K. Kirchamayor ó Economic Operation of Power System- Wiley Estern Pvt. Ltd., New Delhi.
2. Hadi Saadat ó Power System Analysis ó WCB/McGraw-Hill International Edition 1999
3. I. J. Nagrath, D. P. Kothari ó Modern Power System Analysis ó Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi 4.
   P. S. R. Murty ó Power System Operation and Control ó Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Wood and Wollenberg ó Power Generation, Operation and Control ó Willey ó Inter Science Publication

## 7 EE03/7EP03/7EL03    ELECTRICAL POWER - II

### SECTION-A

**Unit I ::    Symmetrical components**

Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank- sequence voltages and currents relationship; power system elements ó sequence impedance and sequence networks ; Various three phase transformer connections ó zero sequence rules; Unbalanced load system ó application.

**Unit II :    Symmetrical Fault Analysis**

Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation.

**Unit III :    Unsymmetrical Fault Analysis**

L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults-loaded and unloaded conditions.

### SECTION-B

**Unit IV :    Overvoltages**

Causes ó internal and external; Voltage surge, Basic insulation level, Protection ó earthing screen, overhead ground wire, lightning arresters.

**Unit V:    HVDC Transmission** Basic principle, Transmission equipments, Comparison with AC links, Inverters ó reactive power requirement; Converters, DC links, Circuit breaking, ground return, Economic distance, modern developments.

**Unit VI :    Flexible AC Transmission Systems (FACTS)**

FACTS concept, Elements, Controllers, Comparison with Conventional AC Transmission system.

### TEXT BOOKS :-

1. Power System Engineering by D.P.Kothari, I.J.nagrath TMH $2^{nd}$ edition, $9^{th}$ reprint 2010
2. Power System Analysis, N.V.Ramana, PEARSON education, 2010
3. Power System Analysis, Arthur R. Bergen, Vijay Vittal, $2^{nd}$ Edition, 2009, PEARSON Education
4. Modern Power System Analysis by D.P.Kothari, I.J.nagrath TMH $3^{rd}$ edition, $20^{th}$ reprint 2010

5. Power System Analysis by Hadi Saadat TMH, $1^{st}$ reprint 2004
6. Electrical Power System, by Syed A. Nasar TMH,Revised $1^{st}$ edition 2011

### REFERENCE BOOKS :-

1. S. Rao ó õEHV A.C. and HVDC Transmission Engineering and Practiceö, Khanna Publishers, New Delhi.
2. Narain G. Hingorani and Lazlo Gyugyi ó õUnerstanding FACTS: Concepts and Technology of Flexible AC Transmission Systems.
3. Yong Hua Song and Allan T. Johns - õFlexible AC transmission Systems (FACTS), T and D reference bookö Westing house.

## 7 EE04/7EP04/7EL04    SWITCHGEAR & PROTECTION

### SECTION-A

**Unit I :    Circuit Interruption**

Circuit breaker control circuit, Fault clearing process, Auto-reclosure, Arc phenomenon- maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.

**Unit II :    A.    Fuses** Types, Constructional features, operation, Characteristics and Applications

     B.    **Circuit Breaker (Part ó I)**

Air break, Air blast, Bulk oil and minimum oil-types, constructional features, operationand application.

**Unit III :    Circuit Breaker (Part – II)**

$SF_6$ , Vaccum, Miniature, Earth leakage and Moulded Case ó types, Constructional features, operation and application; Testing, Instalation and Maintenance.

### SECTION-B

**Unit IV:    A.    Relaying Principle**

Components, Essential features, Characteristics, Terminology, CTøs and PTøs, Relay classification.

     B.    **Electromagnetic Relays**

Overcurrent, Directional, Distance and Differential ó types, constructional features, operation, characteristics and application.

**Unit V :    Protection of Transmission Lines**

Relaying schemes ó overcurrent, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, Carrier current relaying, Overload and Power swing.

**Unit VI : A.** Other Power System Elements Protection Transformers, Motors, Generators and Buses.

**B. Static Relaying**
Basic concepts, equipments, comparators, Characteristics realization ó overcurrent, directional, differential and distance relay. Microprocessor based relay introduction.

**TEXT BOOK:-**

1. Sunil S. Rao ó õSwitchgear and Protectionö Khanna Publications New Delhi

**REFERENCE BOOKS: -**

1 R. T. Lythall ó õSwitchgear Handbookö J and P Newness Butterworth, London.

2 C. R. Mason ó õThe Art and Science of Protective Relayingö

3 A. R. Van and C Warringtan ó õProtective Relaying , Vol 1 and 2,ö Chapman Hall, London.

4 Geosonoviz ó õHigh Voltage Circuit Breakersö

5 V. A. Slabikov ó õGeneration Protection and Switchgearö CIT, Coimbatore.

6 Badri Ram and B. N. Vishwkarma ó õPower System Protection and Switchgearö Tata Mc-Graw Hill Publishing Company Limited, New Delhi.

7 B. Ravindranath and M Chander ó õPower System Protection and Switchgearö Wiley Eastern Ltd, New Delhi.

8. Handbook of switchgear by BHEL, TMH 6th reprint,2010

## 7 EE05/7EP05/7EL05      PROFESSIONAL ELECTIVE - I
### (1) PROCESS CONTROL SYSTEMS
### SECTION-A

**Unit I :** Electronics Instruments for Measurement of Electrical Parameters Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multimeters, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

**Unit II: Signal Generation and Analysis**
Signal generators, Function generators. Wave analyzer Harmonic Distorsion Analysers, spectrum Analysis.

**Unit III: Signal Counting and Recording**
Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital disply, universal counter, Digital readot devices, storage type CRO, Servotype X-Y recorder.

### SECTION-B

**Unit IV : Signal conditioning and Conversions.**
Frequency characteristics of various types of signals,active filters bandpass,low pass and high pass filters using opAmps. Various techniques od A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop.

**Unit V: Signal Processing**
Pulse times, triggered elayed sweeps, discrete pulse delay circuits, pulses equencing, analog multiplexers and demultiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

**Unit VI :** Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller based instrumentation

**TEXT BOOKS: -**
1. H.S. Kalsi ó Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick ó Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

**REFERENCE  BOOKS: -**
1. B.R. Gupta-Electronics and Instrumentation ó Wheeler Publishing.
2. Rangan, Sharma & Mani ó õInstrumentation ó devices & Systems.ö Tata Mc-Graw Hill Publishing Company, New Delhi.
3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.
4. Microprocessors and Digital Systems, by:D.V. Hall,Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.
6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.
7. A.K. Sawhney ó Acourse in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi.

## 7 EE05/7EP05/7EL05      PROFESSIONAL  ELECTIVE - I
### (2) COMPUTER ORGANISATION

**Unit-I:** Basic strucutre of computer: Hardware & software.Addressing methods. Program sequencing. concept of memory locations & address. Main memory operation. Instructions & instruction sequencing. Addressing modes. BasicI/O operations. Stacks. Queues & subroutines.

**Unit-II:** Processing Unit: fundamental concepts. execution of a comlete instruction. hardwired control, performance consideration. Microprogrammed control; microinstructions, microprogram sequencing, microinstruction prefetching, emulation.

**Unit-III:** I/O organizatiion: accessing I/O devices,interrupts, direct memory access:bus arbitration. I/O hardware:processor bus and interfacing circuiuts,standard I/O interfaces: SCSI bus, backplane bus standard.

**Unit-IV:** Memory Unit: basic concepts,semiconductor RAM memories,internal organization, static & dynamic RAMs, ROMs. speed, size & cost considerations.Cache memories: performance considerations. Virtual memories, address translation,memory management requirements.

**Unit-V:** Arithmetic; number representation. design of fast adders,signed addition and subtraction. Multiplication of positive numbers, Boothsøalgorithm, Integer division.Floating-point numbers and related operations.

**Unit-VI:** Computer Peripherals: Input-output devices like video displays,video terminals, graphics input devices,printers.Online storage devices: magnetic disks,magnetic tape systems, CD-ROM systems. Communication devies: Modems.

**TEXT-BOOK:**
V.Carl Hamacher & S. Zaky õ Computer Organizationö (4/e) McGraw-Hill(ISE).

**REFERENCES:**
1. Stallings. W. õ Computer Organization & Arcitectureö (5/e) (Pearson Education).
2. Tenanbaum A.S.ö Structured Computer Organizationö (5/e) (Pearson Education).
3. Hayes J.P. õComputer Architecture & Organizationø(4/e) ( McGraw-Hill).

**7 EE05/7EP05/7EL05    PROFESSIONAL  ELECTIVE - I**
  **(3)  COMPUTER METHODS IN POWER SYSTEM ANALYSIS**
**SECTION-A**

**Unit I** :  Representation of power systems for computerized analysis : Mathematical models of Synchronous generator for steady state and transient analysis . Transformer with tap changer, transmission line,phase shifter and loads.

**Unit II** :  Topology of Electric Power Systems ó Network Graphs , Incidence matrices, fundamental loop and cutest matrices, primitive impedance and admittance matrices, equilibrium equations of networks . Singular and Nonsingular transformation of network matrices .

**Unit III** :  Formation of bus impedances and admittances matrices by algorithm ó Modification of bus impedance and admittance matrix to account for change in networks. Derivation of loop impedance matrix.
Three phase network elements ó transformation matrix ó incidance and network matrices for three phase l networks . Algorithm for formulation  of 3 phase bus impedance matrix.

**SECTION-B**

**Unit IV:** Short circuit studies : Three phase networks , Symmetrical components. Theveninøs theorem and short circuit analysis  using bus impedance matrix . Short circuit calculations for balanced three phase networks using bus impedance  matrix.

**Unit V** :  Load flow studies : formation of load flow problem ó Gauss Seidel method ó Newton Unit III Raphson method ó decoupled method, fast decoupled methods ó sparsity technique.

**Unit VI** :  Stability studies of power system ó Development of mathematical model for multimachine system stability analysis óFormation of equations and methods of solutions .Transient stability analysis including synchronous machines , system networks and loads . Solution of state equation by modified Euler  method and Runge Kutta  4$^{th}$ order Approximation method.

**TEXT BOOKS:**
1) L.P.Singh : Advanced Power System Analysis and Dynamics, WEL.
2) Y.Wallach : Calculations and programs for Power System Network.
3) G.W.Stage and A.H.El-Abiad : Computer Methods in Power System Analysis, McGraw Hill.

**REFRENCE BOOKS:**
1) R.N.Dhar : Computer Aided Power System Operation and Analysis, TMC.
2) Computer Technniques in Power System Analysis, by M.A.PAi TMH 10$^{th}$ reprint 2011

**7 EE05/7EP05/7EL05    PROFESSIONAL  ELECTIVE - I**
**(4) ARTIFICIAL  INTELLIGNCE**

### SECTION-A

**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.

**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.

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

### SECTION-B

**UNIT IV:  Introduction:**
Uncertainty  in  information,basic  concepts  of  Fuzzy sets , operations on fuzzy  sets , properties.
Fuzzy relations : operations,properties ,value assignments.

**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

**UNIT VI: Genetic Algorithm (GA):**
Introduction to genetic algorithm,working principle,coding of variables, Fitness function. GA operators , similarities & differences  between  GAs   and  Traditional  methods; Unconstrained and constrained optimization   using Genetic Algorithm , real coded GA ,Advanced GA, global optimization using GA .

**TEXT BOOKS**
1    J.M. Zurada : Introduction to Artificial Neural Network, Jaico Publishing  House

2    Meherotra Kishan ,Mohan C.K, Ranka Sanjay : Elements Of Artificial Neural networks  Penram Int Pub Mumbai.
3    D.E Goldberg ,Addision  Genetic Algorithm in Search Optimization and Machine Learning Wesley Publication
4    Kalyanmoy Deb  Optimization for Engineering Design Algorithms and  Examples, Prentice Hall of India New Delhi
5.    M.Kishan, Mohan C.K., Ranka Sanjay; Elements of Artificial Neural Networks, Penram Int. Publications.

**REFRENCE BOOKS**
1.    G.J. Khir and T.A. Folger : Fuzzy sets , Uncertainity and Information PHI Publication
2.    Koska Bart  Neural Network & Fuzzy systems  Prentice Hall of India Pvt Ltd , New Delhi

**7 EE06/7EP06/ 7EL06  PROJECT & SEMINAR**

**7 EE07/7EP07/ 7EL07  ELECTRICAL POWER II - LAB**

**Any TEN experiments based on contents of 7EE03  ELECTRICAL POWER II**

**7 EE08/7EP08/ 7EL08 SWITCHGEAR & PROTECTION - LAB**

**Any TEN experiments based on contents of  7EE04 SWITCHGEAR & PROTECTION**

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**SEMESTER : EIGHT**
**8EE 01/8EL01/8EP01  POWER SYSTEM STABILITY**

### SECTION - A

**Unit I :    Basic Concepts**
Meaning  of  stability,  Steady state,  Transient and  Dynamic stability limits;  Three Phase Synchronous Machine-circuit representation,  voltage equation and Park's Transformation; Transient and Sub transient state analysis and Phasor diagrams, Voltage behind the transient and sub transient impedances, Parameters and Time Constants determination.

**Unit II:    Steady State Stability - I**
Steady state stability limit-short transmission line, Two machines system, Medium and Long transmission line, Clarke's diagrams for system with and without loss, Effect of inertia, Conservative criterion, Synchronizing coefficients and Multi machine system.

**Unit III: Steady State Stability – II**

Saturation effect, Saturated reactance, Equivalent reactance and its graphical determination; Short circuit ratio, Governor action and automatic voltage regulator effects.

### SECTION-B

**Unit IV: Transient State Stability – I**

Review of basics concepts, Transient state stability and equal area criterion, Swing equation and its point by point solution, Critical clearing angle and time.

**Unit V: Transient State Stability – II**

Type of faults, Grounding and high speed re-closing effects, Pre-calculated swing curves and their use, Faults clearing Time, Excitation and governing action effects, Stability improvement methods, Multi machine problem, Network analyzer, Digital Computer role.

**Unit VI: Excitation System**

Unit exciter and common bus system, Self and separate excitation, Exciter type of and their description, Exciter drives, Quick response excitation system, Voltage-current methods differential equations for obtaining voltage ótime curves, Exciter response from voltage time curves, Dispersion coefficient, Constant leakage Inductance, Eddy current effects on exciter response, Loaded exciter response, Exciter response improvement methods.

**TEXT BOOKS:**

1  E W Kimbark- Power System Stability, Vol.1 and 3, Dover Publications Inc., New York.

2  Power System Stability & Control by Prabha Kundur, TMH 11th reprint 2011

3.  S.B Crary- Power System Stability, Vol.1 and 3, Hohn Wiley and Sons, New York.

**REFERENCE BOOKS:**

1  L.P Singh ó Computer Aided Power System Operation and Dynamics, Wiley Eastern Ltd. New Delhi.

2  I.J.Nagrath and D.P.Khothari ó Modern Power System Analysis, Tata Mc-Graw Hill Publishing Company, New Delhi.

## 8EE 02/8EL02/8EP02 HIGH VOLTAGE ENGINEERING

### SECTION-A

**Unit I : Breakdown in Gases**

Insulating materials Classification, Gases as insulating media, Ionization and decay process, Breakdown in gases, Townsendøs law, Streamer mechanism of spark pashanøs law, Corona discharge, Electronegative gases.

**Unit II: Breakdown in Liquid and Solid Dielectrics**

Breakdown in pure and commercial liquids, Sold dielectrics and composite dielectrics, High voltage bushings, Guarding, Shielding, Field plotting.

**Unit III: Lightning and Switching Over Voltage and Protection**

Lightning strokes to lines and towers; Mechanism, Characteristics and protection of transmission lines from lightning; Lightning arrestors, Insulation co-ordination of HV and EHV power system and substation.

### SECTION-B

**Unit IV:** High Voltage and Current Generation, Generation of high d.c, a.c and impulse voltages, Standard impulse wave shapes, Switching surges, and High impulse generator.

**Unit V:** High Voltage and Current Measurement Peak voltage, Impulse voltage and High direct measurement methods, Non-destructive measurement and testing, High voltage dielectrics loss and capacitance measurement, Radio frequency and Partial discharge measurement.

**Unit VI: High Voltage Testing and E.H.V.Lines Design.**

Basic terminology, Testing ó Insulators, Bushings, Cables, Transformers, Surge diverters and Isolators; Electric shock and threshold current, Capacitance of long objects, Electromagnetic interference, E.H.V. line insulation design based upon transient over voltage.

**TEXT BOOK :**

1.  M.S.Naidu and V.Kamraju ó High Voltage Engineering, Tata McGraw Hill Publishing, Company, New Delhi.

**REFERENCE BOOKS-**

1.  E.Kuffer and W.S.Zaenglo- High Voltage Engineering, Pergamon Press,

2.  Rokosh Das Begamudre- EHV AC. Transmission Engineering, Wiley Easter Ltd. New Delhi.

3.  E.Kuffer and M.Abdullaha _High Voltage Engineering, Pergamon Press

4. M.S.Naidu and V.N.Maller- SF6 and Vaccum Insulation for High Voltage Application, Khanna Publications, Delhi.

5. Prof.D.V.Razeving (Translated from Russian by Dr.M.P.Chaurasia) ó High Voltage Engineering, Khanna Publications, Delhi.

6. An introduction to High Voltage Engineering by Subir Ray, Prentice óHall & India, Private Limited, New Delhi.

7. High Voltage Engineering by C.L. wadhawa New Age international (P) Ltd. Publications

## 8EE 03/8EL03/8EP03   DIGITAL SIGNAL PROCESSING

### SECTION - A

**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.

**UNIT-II :** Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, DFT and its properties , Circular convolution, Linear convolution  from DFT, FFT, decimation in time and frequency algorithm.

**UNIT-III:** Sampling of Bandpass signals-Representation of Bandpass signals, sampling of bandpass signals, discrete time processing of continuous time signal; Analog to digital conversion-sample and hold, quantization and coding, analysis of quantization errors, oversampling of A/D converter; Digital to Analog conversion-sample and hold, first order hold, linear interpolation with delay, oversampling of D/A converter

### SECTION-B

**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.

**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.

**UNIT-VI:** DSP Processors and applications- DSP Microprocessors architectures, fixed point, floating point precision, algorithm design, mathematical, structure and numerical constraints, DSP programming, filtering, data conversion; Real time processing consideration including interrupts

**TEXT BOOKS:**

1. Proakis & Monolakis D.G, ÷Digital Signal Processingø, PHI Publication

2. Oppenhavm & Scheffer, ÷Discrete Time Processingø, John Wiley Publication

3. Digital Signal Processing, P Ramesh Babu,SCITECH Publications, Chennai, 4th edition,2010

4. Mitra S.K, ÷Digital Signal Processingø, TMH Publication

## 8EE 04/8EL04/8EP04    PROFESSIONAL ELECTIVE - II
### (1)  ELECTRIC DRIVES & CONTROL

### SECTION-A

**UNIT I :** **Introduction to Electrical Drives:** Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

**UNIT II:** **Starting and Braking of Electrical Drives:** Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, Braking of d c and induction motors.

**UNIT III:** DC Drive Control Basic machine equations, schewe of control, Single phase separately excited drives, singleó phase- series motor drives, power factor improvement, Three-phase separately excited drive, Closed loop control, PLL control, microcomputer control.

### SECTION-B

**Unit-IV:** **Ac drive control:** Basic principle of operation, speed control of induction motor, stator voltage control, varible frequency control, Rotor resistance control, slip-power recovery scheme, Synchronus motor drive, Microprocessor controlled AC Drive.

**UNIT V:** Vector controlled Drive,Principle of Vector Control, Equivalent ckt. Direct v.c., Flux vector estimation, Indirect v.c., v.c. of line side pular rectifier exator flux oriented v.c., v.c. of current fed inventer drive & cycloconverter drive servorless control speed estimation controls ó EKF method

**UNIT VI:** Direct torque & adoptaive controlled Drive Torque Expression o& control strategy self tuning control MRAC sliding mode control self commissiong of drive, Study of electrical drives in rolling mills, paper mills, cement mills, sugar mills, textile mills, traction and machine tool applications.

**REFERENCE BOOKS:**

1. Power Electronics : ( Converts, Application & Design) ó Mohan/ Undeland/ Rossing- John wiley
2. Power Electronics : M.D. Singh, K.B. Khan Chardalli ó TMH
3. Power Electronics : M.H. Rashid ó Pearson Education
4. B.K. Bose : Modern Power Electronics and AC Drive, Pearson Education
5. G. K. Dubey Fundamentals of Electrical Drives, , Narosa Publishing House,2005
6. . Electric Drives ó Concepts & Applications by V.Subrahamanyam, TMH 2nd edition 2010

**8EE 04/8EL04/8EP04    PROFESSIONAL ELECTIVE - II**
**(2)  POWER QUALITY**

**SECTION - A**

**Unit I:    Introduction**

Power Quality Definition, Need for Power Quality, Sensitive Loads, Nonlinear Loads, Interconnected Power System, Deregulation, Utilities, End Users, Lawyers,

**Unit II:  Power Quality Characteristics**

Power Quality Theory, Types of power Quality Problems, Voltage Swells, Long-Duration  Over voltages, Under voltages, Interruptions, Transients, Voltage Unbalance, Voltage Fluctuations, Harmonics, Electrical Noise, Sources of Power Quality Problems, Utility Side of the meter, End-User Side of the meter, Effects of Power Quality Problems, Power Quality Problem-Solving Procedures, Power Quality Solutions,

**Unit III: Power Quality Standards**

Power Quality Standards Organizations, Institute of Electrical & Electronics Engineers (IEEE), American National Standards Institute(ANSI), International Electrotechnical Commission(IEC Other International Standards Organizations, Purpose of Power Quality Standards, Types of Power Quality Standards, Voltage Sag (Dip) Standards, Transients of Surges, Voltage Unbalance, Voltage Fluctuation or Flicker Standards, Harmonics Standards, Transformer Overheating Standards, Natural Conductor Loading Standards, Static Electricity, Telephone Power Quality Standards, Grounding and Wiring Standards,

Sensitive Electronics Equipments Standards, Trends in Power Quality Standards.

**SECTION-B**

**Unit IV:  Power Quality Solutions**

Reduce Effects on Sensitive Equipment, Reduce or Eliminate Cause, Reduce or Eliminate Transfer Medium, Install Power Conditioning Equipments, , Surge Suppressors, Noise Filters, Isolation Transformers, Line-Voltage Regulators, Motor-Generator Sets, Magnetic Synthesizers, Static VAR Compensators (SVCs), Uninterruptible Power Supply (UPS), Solid-State Switches, Harmonics Solutions, Selection of Appropriate Power Conditioning Equipment, Grounding and Wiring Solutions

**Unit V:    Wiring and Grounding**

Wiring Principles, Grounding Principles, Power System, Utility Power System Grounding,Telecommunication System Grounding, End-User Power System Grounding, Wiring and Grounding Problems, Ground Loops, Electromagnetic Interference (EMI) Noise, Loose Connections, Grounding for Lightning and Static Electricity, Attack of the Triplens, Solutions That Cause Problems, Wiring Solutions, Separation, Selection of Wire and Cables, Shielding, Grounding Solutions, Ground Rods, Ground Ring, Ground and Reference Signal Grids, Other Grounding Systems, Isolated Grounds, Multipoint Grounding, Separately Derived Source Grounding, Reference

**Unit VI:  Power Quality Measurement Tools & Power Quality Surveys**

Kilowatt-Hour Meter, Multimeters, Average-responding versus True RMS Meters, Crest Factor and Bandwidth, Other Selection Considerations, Oscilloscopes, Disturbance Analyzers, Harmonics Analyzers, Purpose of a Power Quality Surveys (Checkup or Examination), Planning a power Quality Surveys.

**TEXT BOOKS**:-

1. Barry W. Kennedy: Power Quality Primer, McGraw-Hill
2. Electrical Power System quality by R.C.Dugan, M.F.McGranghan, S.Santoso, H.W.Beaty   TMH 2nd edition 2011

**REFERENCE BOOK: -**

1. G.T. Heydt: Power Quality Stars in a circle Publication, Indiana, 1991.

**8EE 04/8EL04/8EX04 (i)   PROFESSIONAL ELECTIVE - II**
**(3) POWER SYSTEM MANAGEMENT**

**SECTION-A**

**UNIT-I :  Principle and Practice of Management:**

**Basic Concepts-** basic concepts of management-Role and importance of management in modern society, management as a profession

**The Process of Management-** The process of management; planning, organizing, directing, controlling, decision-making, leading etc.

**Management Concepts-** Managerial authority and responsibility-delegation and decentralization- Line and staff concepts-concepts in e-commerce etc.

**UNIT-II : Marketing & Production/Operation Management:**

**Marketing Management-** Introduction to Marketing, Marketing strategy, Consumer Behaviour, Marketing Research, Product/ Services Decisions, Pricing Products/Services, Distribution management, Advertising & Sales promotion etc.

**Production/Operation Management-** Introduction to Production Planning and Process, Issues in Material and Inventory Management, Quality control and Management (quality circle, ISO 9000 series, just-in-time, TQM.), Maintenance Management, Purchasing Decision.

**UNIT-III : Project, Financial & Human Resource Management:**

**Project Report:** Preparation of -Project Report, Profit and Loss statement, Balance Sheet.

**Financial Management:** Costing- Principles, types- operating, marginal, incremental, embedded etc, Budgeting & financial planning, Risk management etc.

**Human Resource Management:** Human resource planning-concepts & process, Job analysis & description- recruitment, selection process, Training & development, Employee welfare, issues related to management of trade union.

### SECTION-B

**UNIT-IV: Dimensions of Power System Restructuring**

**Power system Restructuring::** Introduction to Power Sector Reforms/Restructuring/ Deregulation ó issues, prospects and lessons to developing countries

**Environmental dimensions in power sector:** Pollution & Depletion of natural resources, Waste Management, environmental legislation, green power, strategies for environmental management in power sector.

**Rural Electrification:** Issues relating to revised definition of village electrification, issues in electrifying remaining villages, decentralized generation and distribution for rural electrification etc.

**Power Sector Restructuring in India:** History, Problems and status in India, Accelerated Power Development and Reform Programme (APDRP), Reforms in G,T, D sector, Electricity Act:2003- issues, Problems & prospects, Legal and regulatory

framework, Rural Electrification Programme, Environmental Pollution Programme.

**UNIT-V: Management issues in Power Sector:**

**Financing of power sector::** Financial problems of SEBs, strategies - for financing capacity addition to generation, transmission and rural electrification, Risk management in power sector.

**Human Resource development in power utilities:** Change management, Training & Development, Culture of empowerment and accountability etc.

**Transmission & Distribution Management:** Transmission management under open access- transmission Pricing/Tariff, Congestion Management, Micro distribution models- private investors, Multi Licensee System, Distribution Management, Power Quality, Demand Side Management, Energy Metering, Accounting and Auditing, SCADA etc.

**UNIT-VI: Marketing issues in Power Sector:**

Issues of Power Tariff, Prices in Competitive Electricity Markets, Bidding strategy, Availability Based Tariff (ABT), Embedded and Spot pricing, Power Trading, Market Operations in Electric Power Systems, Marketing of energy and services in competitive electricity markets.

**TEXT BOOKS:**

1. Koontz H., OøDonnel C. and Whierich: Principle of Management, Tata McGraw Hill Publishing Co., Ltd., New Delhi

2. Muhlemann , Production Operation Management, Macmillan publication

3. Dencenzo & Robbins, Human Resource Management

4. Monappaa, Human Resource Management, Macmillan Publication

5. Ramaswamy & Namamkumari, Marketing Management Macmillan Publication

6. Philip Kotler, Marketing Management, PHI, New Delhi

**REFERENCE BOOKS:**

1. Economic Evaluation of Projects in the Electricity Supply Industry, by H. Khatib.

2. Fundamentals of Power System Economics, by Daniel S. Kirschen, Goran Strabac

3. Energy and Power Risk Management by Alexander Eydeland, KrzysztofmWolyniec

4. Power System Economics, by Steven Stoft

5. Market Operations in Electric Power Systems, by M. Shahidehpour, H. Yamin, Zuyi Li.

6. Electricity Economics, by Geoffrey Rothwell, Tomas Gomez

7. Modelling Prices in Competitive Electricity Markets (The Wiley Finance Series), by Derek W. Bunn.

8. A Shock to the System, by Timothy J. Brennan, Karen L. Palmer, Raymond J. Kopp, Alan J. Krupnick, Vito Stagliano, Dallas Burtraw.

9. Power pricing by Dolan & Siman, The free Press,1996

10. Customer Choice: Purchasing Energy In A Deregulated Market: by Albert Thumann

11. India's Power Sector Reforms Update, Paryas, Pune

## 8EE 04/8EL04/8EP04 PROFESSIONAL ELECTIVE - II
### (4) GENERALISED MACHINE THEORY

### SECTION-A

**Unit I :** Elements of Generalized Theory: essentials of rotating machines, conventions, basic two pole machines, transformer with movable secondary transformer and speed voltage in armature, kions, primitive machine, leakage fluge, voltage and torque equations.

**Unit II :** Linear transformations in machines: invariance of power transformation from displaced brush axis, three-phase to two-phase transformation power invariance, transformation from rotating axes to stationary axes, impedance matrix, application of generalized theory, electrical torque, limitations of generalized theory.

**Unit III:** D.C.Machines: separately excited DC generators and motors formulation of mathematical model, steady state and transient analysis, Ward-Leonard system of speed control.
Steady state analysis of DC series, shunt and compound machine and their characteristics cross-field machines, metadyne transformer, metadyne generator.

### SECTION-B

**Unit IV:** Poly-phase synchronous machine, three phase synchronous machine, steady state and transient analysis, phasor equations and phasor diagram, power angle characteristics, DWR synchronous machine generalized mathematical model, steady state analysis, phasor diagram.

**Unit V:** Induction Machine: Transformations, electrical performance, equation, steady state analysis, equivalent circuit, torque-slip characteristics.High torque cage motors- deep bar rotor and

double cage rotor induction motors, steady stateanalysis, comparison between single cage and double cage motors.

**Unit VI:** Generalized theory of single-phase series motor, repulsion motor and scharge motor and steady state analysis.

**TEXT BOOKS :**
1. M.B.Say: Introduction to Unified Theory of Electrical Machine, ELBS.
2. SEELY: Electromechanical Energy Conversion

## 8EE 05/8EL05/8EP05 PROJECT & SEMINAR

### 8EE 06 DIGITAL SIGNAL PROCESSING LAB

**Any TEN experiments based on contents of 8EP03 DIGITAL SIGNAL PROCESSING**

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**SYLLABUS PRESCRIBED FOR**
**BACHELOR OF ARCHITECTURE**
**SEMESTER PATTERN (CREDIT GRADE SYSTEM)**

**SEMESTER : SEVENTH**

**07AR01      ADVANCE CONSTRUCTION - I**

**Objective :** The course will enable the learning in progression , starting from simple building elements, components, materials and construction techniques to develop strong sense of visualization.

**Unit I**: Analysis of different type of foundation as per load bearing capacity of soils, types of soil and building loading conditions. Caisson foundation its types and purposes. Combined foundation its purposes types.

**Unit II**: Earthquake resistant structure.
   a) Introduction of earthquake, types of earthquake, origin and causes of earthquake.
   b) Failure mechanism of structures due to earthquake. Analysis of earthquake affected load bearing masonary and framed structures

**Unit III**: a) Remedial measures in terms of planning , designing , materials and techniques for earthquake resistant structure.
   b) Retrofitting of earthquake affected buildings.

**Unit IV**: a) General study of standardisation of building elements its uses for various construction.
   b) Study of Modular co-ordination and its multipurpose functional application.

**Unit V**: Concept of curtain wall and structural glazing material and construction techniques, fixing details of various metal casements.

**Unit VI:** Architectural glass system.

Sessional work: Assignments, test, site visit and drawing on the above topics.

**REFERENCE BOOKS**:
1. S.C. Rangwala, Engineering Materials, Charotar Publishing House, Anand,1997
2. HUDCO - All you want to know about soil stabilized mud blocks, HUDCO Pub, New, Delhi, 1989.
3. W.B. Mckay Building Constrution, vol. 1,2,3, Longmans, U.K.1981.
4. Don A Watson, Construction Materials and Processes, McGraw Hill Co.,1972.

5. R. Chudley, Construction technology, Richard Clay (Chaucer Press) Ltd.,Suffolk,1978.
6. J.H.callender,Time saver standard for Architectural Design Data, McGraw-Hill,1994.

**07AR02    ENVIRONMENTAL  SERVICES – I**

**Objective:** To impart knowledge of various aspects of city level water supply systems, drainage and solid waste disposal.

**Unit I**: Sources of water supply their types, water collection, water treatment, distribution of water from various sources.

**Unit II**: Rain water disposal and roof drain and rain water harvesting system.

**Unit III:** Water pollution and preventive measures.

**Unit IV**: Sewage treatment plant and its locational factor..

**Unit V**: Garbage disposal and recycling methods. Concept of recycling of solid and liquid waste in building. Vermicomposition, Biogas production.

**Unit VI**: Sewage disposal systems in unsewered location viz. septic tank, soak pit, acqua privy.

Sessional work: Assignments, test, site visit and drawings on the above topics.

**REFERENCE BOOKS**:
1. Manual of Water supply and treatment , second edition, CPHEEO, Ministry of Works and housing, New Delhi, 1977.
2. Manual of Sewerage and sewage treatment, CPHEEO Ministry of Works and housing, New Delhi, 1980.
3. S.C.Rangwala, water supply and sanitary Engineering,Charotar publishing House , Anand 1989.
4. Bureau of Indian Standards.
5. Pachauri, A.K., õWater Supply and Sanitary Installations, Design, Construction and Maintenanceö, New Age International Ltd.
6. Manas Handbook of Plumbing, Manas Publishers

**07AR03      PROFESSIONAL  PRACTICE**

**Objective:** The objective of the course is to expose the students to the present trends of architectural practice and valuation.

**Unit I**: Role of professional bodies such as The Indian Institute of Architects, working, byelaws, categories of membership, election procedure and code of conduct; The Architects Act of 1972 and the Council of Architecture.

**Unit II**: Professional responsibilities of the architect, copyrights, scale of charges, variation of charges, mode of payment, termination of services, specialized building services.

**Unit III**: Techniques of valuation, elements of valuation and factors affecting valuation. Methods, valuation of landed and building property, comparable cost of sale, purchase and mortgage.

**Unit IV**: Valuation for compensation on acquisition, compensation under central and state legislation, relevance of the Town Planning Act.

**Unit V**: Valuation for renewal or lease/extension of lease, standard rent, easement rights, dilapidation, insurance, estate development and advice on investment policy.

**Unit VI**: Arbitration, arbitrators, umpire and nature of arbitration.
Sessional work: Assignments, test, site visit and drawings on the above topics.

**REFERENCE BOOKS**:
1. Rangwala, S C , õValuation of Real Propertiesö, Charotar Book Stall.
2. Piotrowski, A. and Williams, Julia, õThe Discipline of Architectureö, University of Minnesota Press. 3. Eldred, G.W., õThe Beginners Guide to Real Estate Investingö, John Wiley & Sons
4. Publications of COA, IIA Hand Book on Professional Practice, The Architects publishing Corporation of India, and Bombay 1987.

**07AR04 :**  **URBAN  PLANNING**

**Objective:** The objective of the course to develop the understanding of urban planning process through surveys, analysis, alternative planning strategies and urban planning issue.

**Unit I**: Need and study of Urban planning interrelationship between urban planning, urban design, urban landscape design and Architecture planning as a team work and role of urban planner in planning team. Hierarchical levels of planning.

**Unit II**: Planning during Medieval and renaissance period in western and Indian context.

**Unit III**: Evolution of modern planning concepts. Impact of industrial revolution on planning process. Planning theories developed by Patric Geddis, Ebenzer Howard, Lewis Mumford, C. L. Doxiadis, Patric Abercrombie.

**Unit IV**: Introduction to TPS, master plans, structure plan, regional plans, land use planning , Neighbourhood Planning, zoning.

**Unit V**: Recent trends in urban planning, New towns development, SEZ, JNNURM, Green cities, ISHDP, Urban renewal process.

**Unit VI**: National habitat and housing policy. Slum improvement scheme, ISHDP, DCR relevant to housing.
Sessional work: Assignments, test, site visit and drawings on the above topics.

**REFERENCE  BOOKS :**

1. Gallion Arthur B & Eisna Simon, The Urban Pattern, City Planning and Housing.
2. C. L. Doxiadis, Ekistics, An introduction to the Science of Human Settlements, Hutchinson, London, 1968
3. John Ratchiffe, An Introduction to Town and Country Planning.
4. Gupta, V., õEnergy and Habitat: Town Planning and Building Design for Energy Conservationö, Wiley Eastern.
5. Rangwala, S.C., õTown Planningö, Charotar Publishing House.
6. Eleanor, S.M., õBritish Town Planning and Urban Design: Principles and Policiesö, Longman.
7. Randall, A., õCrossroads, Hamlet, Village, Town: Design Characteristics of Traditional Neighbourhoods, Old and Newö, American Planning Association.

**07AR05**  **ARCHITECTURAL  STRUCTURE-VI**

**Objective:** Understanding of Basic Theory and principles of structural analysis and structural properties of elements.

**Unit I** : Design and detailing of simple G + 1 structure.

**Unit II**: Walls and chimneys subjected to kind pressure.

**Unit III**: Introduction to flat slabs, combined and eccentric footings selection criteria for above structures. (only Theory no Design)

**Unit IV**: Failure of structured
   a.   Types of failure in various structure.
   b.   Causes of failure.
   c.   Evaluation of damage
   d.   Non destructive testing techniques .
   e.   Techniques to prevent collapse failure of structures.
   f.   Repaired and rehabilitation of structures.

**Unit V**: Simple welded and riveted connection (without moments) only axial loads .

**Unit VI:** Design of simple tension and compression member of trusses.

**Sessional work:**

Visit to construction sites to study R.C.C. Structures and steel fabrication work and preparing report.

**REFERENCE BOOKS:**

1. P.C.Punmia, Strength of Materials and Theory of Structures; vol I, Laxmi Publications, Delhi 1994.

2. S.Ramanmurtham, Strength of Materials ó Dhanpatrai & Sons, Delhi 1990

3. W.A.Nash, Strength of Materials ó Schaums Series ó McGraw Hill Book Company, 1989

4. R.K.Bansal ó engineering Mechanics and Strength of Materials ó Lakshmi Publications, Delhi, 1990

## 07AR06 ARCHITECTURAL DESIGN STUDIO - VII

**Objective:** To enable the student to design the large scale housing and housing project in an urban environment with emphasis on advanced building services and systems, urban development regulations, building byelaws.

**BASIC CONTENTS:**

1) Introduction to the designing of multifunctional community housing project on an appropriate scale.

2) Importance of case studies, data collection, area analysis, evolution of plan forms, climatic oriented planning and design features, space utilization, building & site services, site analysis and site planning ,etc; in the Architectural design process.

3) Importance of culture, tradition, topography, climate and building bye laws in generating built form.

4) Planning and designing of large scale housing and building projects in an urban environment, advance building services, energy conservations, cost effective techniques and materials, building bye laws, housing schemes etc.

5) Architectural study tour relevant to design project.

**Sessional work:** One major design project and one time project with other task and assignments.

Viva Voce by external examiner at the end of Semester.

**Suggested text books:**

1. Ching, F.D.R.: Form, Space and Order, Van Nostrand Rheinhold, New York (1979).

2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)

3. Scott: Design Fundamentals ,Edward d Mills- Planning the Architects Hand Book ó Bitterworth, London, 1985.

4. Watson,D (editor) Time ósaver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.

5. Neufert,P; Architects Data; Blackwell Science, 2000.

6. Agkathidis, A, Hudert, M and Schiling, G., õForm defining strategis: experimental architectural designö. Wasmuth, 2007.

## 07AR07 ADVANCE CONSTRUCTION STUDIO - I

**Sessional work;**

Assignments and drawing on the above topics given in the subject 07AR01 Advance construction ó I.

Viva Voce by external examiner at the end of Semester.

## 07AR08 URBAN PLANNING STUDIO

**Sessional work;**

Assignments and drawing on the above topics given in the subject 07AR04 Urban Planning.

Viva Voce by external examiner at the end of Semester.

## SEMESTER : EIGHTH

## 08AR01 ARCHITECTURAL DESIGN - VIII

**Objective :** To expose students for designing of large scale urban design projects with emphasis on modern material, techniques , architectural styles advanced services, sustainable architecture, green architecture, climate responsive architecture etc.

**Basic contents:**

1) Introduction to urban design project planning and design consideration.

2) Importance of case studies, data collection, area analysis, evolution of plan forms, climatic oriented planning and design features, space utilization, building & site services, site analysis and site planning ,etc; in the Architectural design process.

3) Importance of culture, tradition, topography, climate and building bye laws in generating built form.

4) Major design project may include high rise/tall buildings viz. apartment and commercial mixed used complexes, five star Hotel, multifunctional complex, community centers, super specialty hospital, institutions etc.

5) Architectural study tour relevant to design project.

**Sessional work:**

One major design project and one time project with other task and assignments.

**SUGGESTED TEXT BOOKS**:

1.  Ching, F.D.R.: Form, Space and Order, Van Nostrand Rheinhold, New York (1979).

2.  Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)

3.  Scott: Design Fundamentals  Edward d Mills- Planning the Architects Hand Book ó Bitterworth, London, 1985.

4.  Watson,D (editor) Time ósaver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.

5.  Neufert,P; Architects Data; Blackwell Science, 2000.

6.  Agkathidis, A, Hudert, M and Schiling, G., õForm defining strategis: experimental architectural designö. Wasmuth, 2007.

**08AR02          ADVANCE  CONSTRUCTION - II**

**Objective:** The course will enable the learning in progression , starting from simple building elements, components, materials and construction techniques to develop strong sense of visualization.

**Unit I:**   General introduction to large span structures and high rise structures, planning features  and its construction aspects. Chronological development of large span structural framework such as lamella, laminated portal frame , R.C.C. & steel portal frames.

**Unit II:** A)   R.C.C. and steel space frame structures. B) Study of shell structures and its construction techniques from historical perspective. C) Shell structures such as Geodesic Schwedeler and Gitter Kuppel and its construction aspect.

**Unit III:**  Constructions aspect consider in temporary structures which are in portable nature for various short terms events. Use of modular techniques and materials.

**Unit IV:**  Ferrow cement techniques and its appropriate various uses for building construction elements.

**Unit V:**   Introduction to prestressed concrete, principle and method of prestressing, advantages and disadvantages.

**Unit VI:**  Types of elevators ó Electric, hydraulic, passenger, hospital, capsule, freight etc., details of lift shaft and other mechanism

escalators and conveyors. Parallel and criss cross escalators, horizontal belt conveyors , horizontal moving walkwayøs.

**Sessional work:**

Assignments, test, site visit and drawing on the above topics.

**REFERENCE BOOKS:**

1.  S.C. Rangwala, Engineering Materials, Charotar Publishing House, Anand,1997

2.  HUDCO - All you want to know about soil stabilized mud blocks, HUDCO Pub, New, Delhi, 1989.

3.  W.B. Mckay Building Constrution, vol. 1,2,3, Longmans, U.K.1981.

4.  Don A Watson, Construction Materials and Processes, McGraw Hill Co.,1972.

5.  R. Chudley, Construction technology, Richard Clay (Chaucer Press) Ltd.,Suffolk,1978.

6.  J.H.callender,Time saver standard for Architectural Design Data, McGraw-Hill,1994.

**08AR03          ENVIRONMENTAL SERVICES – II**

**Objective:** To expose the students specialized services in buildings.

**Unit I:**    Natural and artificial ventilation system in buildings. Air conditioning methods equipments and ducting.

**Unit II:**   Refuse disposal system in high-rise buildings, viz. ó refuse chute, purpose of service floor and other services.

**Unit III:**  Lift , escalator, different type and use their lay out , lighting conductors, building automation system.

**Unit IV:**  Energy construction, low energy systems, hybrid systems, integration and P. V. and wind system in the building, wind , solar and other non-conventional energy systems, solar thermal application for heating and cooling, electricity generation in building.

**Unit V:**   Fire safety ó general provisions. Causes of fire in buildings, Fire protection standards ó safety regulation ó NBC ó planning consideration in building like non- combustible material, construction , stair cases and lift lobbies , fire escapes and A.C. system. Special features required for physically handicraft and elderly in building types.

**Unit VI:**  Fire detectors and fighting installation. Type of detectors and usage. Alarm system, Fire fighting pumps , fire tank , dry and wet risers, automatic sprinkler, fire drill , refuge areas.

**Sessional work:**

Assignments, test, site visit and drawings on the above topics.

**REFERENCE BOOKS**:

1. Manual of Water supply and treatment , second edition, CPHEEO, Ministry of Works and housing, New Delhi, 1977.
2. Manual of Sewerage and sewage treatment, CPHEEO Ministry of Works and housing, New Delhi, 1980.
3. S.C.Rangwala, water supply and sanitary Engineering,Charotar publishing House , Anand 1989.
4. Bureau of Indian Standards.
5. Pachauri, A.K., õWater Supply and Sanitary Installations, Design, Construction and Maintenanceö, New Age International Ltd.
6. Manas Handbook of Plumbing, Manas Publishers

## 08AR04 SUSTAINABLE ARCHITECTURE

**Objective:** To sensitize students about the importance and need for Sustainable Planning concept and appropriate Architectural design concept as an emerging thrust area.

**UNIT-I**: Introduction : Planning concept ó Environmental Impact Analysis ó Ecological foot prints ó Essential ingredients of sustainable development apart from social and economical ó environment , stake holder, participation , institutional mechanism.

**UNIT-II**: Development in Historical Context - Early settlement pattern ó Climate Responsive Planned Layouts ó orientation of Streets and Buildings, Creation of Habitable Environment , Early Planning Methods.

**UNIT-III**: Resource Efficiency ó Land , Water, Energy, Human Resource, Biodiversity ó Suitable practices at settlement, Campus and Building Level.

**UNIT-IV**: Sustainable Architecture ó Appropriate materials and construction ó review of their properties workability, Eco Friendly construction practices ó sustainable campuses and case studies..

**UNIT-V**: Sustainable Planning and Policies ó Awareness programme at National, International levels Rio de Jenero agenda ó Earth summits ó agenda involved ó their realization.

**Sessional work:** Assignments and test on the above topics.

**REFERENCE BOOKS:**

1. O.H.keonigsberger; T.G. Ingersoll and others; Manual of tropical housing and building- Part-I; Longmans,London-1980
2. M. Evans; Housing, climate and comfort; Architectural press London- 1980
3. B.G.Givoni; Man,climate,and architecture; Applied science, banking, Essex, 1982

4. N.K Bansal and others; Passive building design; Elsevier science-1994.
5. S.Drake; The third skin architecture,technology and environment;UNSWópress-2007.
6. Manik & Girish Komisva, IIPA, keeping Cities Clean and Green, Uppal Publishing House, 1997.
7. Beer, Environment Planning for Site Development.

## 08AR05 LANDSCAPE DESIGN

**Objective:** To enable students realize that architectural design could enhance and enrich built environment through a study and understanding of plants and vegetation historical achievements and techniques of application in the overall context of ecology.

**UNIT-I**: Introduction : Landscape Architecture. Understanding man and nature land and landscape. Relationship of architecture and Landscape Architecture.

**UNIT-II**: History of the art of garden design of India, China, Persia, Japan, Italy, France and England.

**UNIT-III**: Garden Design of the modern world.

**UNIT-IV**: Basic Principles of landscape design and element. Types of landscape elements and its various uses.

**UNIT-V**: Plant classification and nomenclature, plant identification. Characteristics of various types of plants and their suitability of landscaping, plant selection criteria, planting design and visual aspects of plant form.

**UNIT-VI**: Methodology and process of site analysis, data collection, compilation , Presentation and analysis techniques. Preparation, interpretation and evolution of landscape plans site planning.

**Sessional work:**
Assignments, tests, and tutorials on the above topics

**REFERENCE BOOKS:**

1. Sylvia Crowe Sheila Haywood, The Gardens of Mughal India , Vikas Publishing House, Pvt. Ltd, India, Delhi,1973.
2. Garrett Eckbo, The Art the Home Landscaping, McGraw-hill Book Co., London, 1956.
3. Testsuro Yoshida, Gardens of Japan, Jr. Marcus G. Sims, 1963.
4. Sir Banister Fletcher, A History of Architecture, University of London, The Antholone press, 1986.

5.   Percy Brown, Indian Architecture (Islamic period), Taraporevala and Sons, Bombay, 1983tt

6.   Satish Grover, The Architecture of India (Buddhist and Hindu Period), Vikas Publishing Housing Pvt. Ltd., New Delhi, 1981

7.   Christopher Tadgelli, The History of Architecture in India from the Dawn of Civilization to the end of Raj, Longman group, U.K.Ltd., London, 1990

## 08AR06   PROFESSIONAL ELECTIVE – I  (1) HOUSING

**Objective:** To sensitize students about the need for , demand and supply of housing in India, to expose the role or function of various housing agencies, the typologies of housing with basic environmental issues.

**UNIT-I**:   Housing Issues ó Indian Context. Housing as Architecture ó basic need ó demand and supply of housing ó Housing Agencies and their role in housing development.

**UNIT-II**:   Social factors influencing housing design, affordability , economic factors and influence of traditional housing and planning features.

**UNIT-III:** Housing surveys and standards. Sources of Data and information, methods and techniques of housing survey, housing standards etc.

**UNIT-IV**: Housing Design ó Traditional Patterns ó Row housing and cluster housing ó layout concepts ó use of open spaces ó utilities and common facilities.

**UNIT-V**:   Case studies of housing schemes designed by eminent architects. High Rise Housing.

**UNIT-VI**:   National habitat and housing policy slum improvement scheme, ISHDP, DCR relevant to housing.

**Sessional work :**
Assignment and case studies of above topics.

**TEXT BOOKS :**

1.   Joseph de chiara and others ó Time Saver Standards for Housing and Residential Development McGraw-Hill Co., New York, 1995

2.   Karnataka state Housing Board ó MANE ó Publication - 1980

## 08AR06      PROFESSIONAL ELECTIVE – I (2) ENVIRONMENTAL PLANNING

**Objective:** To Provide advanced knowledge on how all issues and concerns of environment can integrate to architectural design process.

**UNIT-I**:   Introduction to the ideas, issues and  concepts of sustainable Architecture, Global Environment , Principles of environmentally and ecologically supportive Architecture.

**UNIT-II**:   Early Settlement Patter ó Climate Responsive Planned Layouts ó Orientation of streets and buildings. Creation of Habitable Environment, Early Planning Methods.

**UNIT-III:** Quality of Urban Environment and Living ó Past , Present and Future Trends role of Urban Design in Urban Environment, Planning for Quality Living in Urban Areas.

**UNIT-IV**:   Conservation of Water, Land, Energy its methods. Environmental impact assessment.

**UNIT-V**:   Solid & Liquid Waste from residential & Commercial Buildings ó Environmental significance ó Segregation and treatment of waste-degradation of environment due to wast .

**UNIT-VI**: Salient Features of environmental laws ó Rain Water Harvesting Techniques. Biological and Thermal Energy Options ó Biogas Production ó Liquid Waste, Recycling Methods & Practices.

**Sessional work :**
Assignment and case studies of above topics.

**TEXT BOOK :**

1.   Gosling and Maitland ó Environmental Planning ó St. Martinøs Press, 1984

## 08AR06      PROFESSIONAL ELECTIVE – I (3) CONSTRUCTION  MANAGEMENT

**Objective:** To establish and develop construction management skills network techniques, construction equipments and methods along with quality control in construction.

**UNIT-I**:   Introduction to project management concepts ó background of management, purpose, goal and objectives. Traditional management system, Ganttøs approaches, load chart, progress chart, bar charts, merits and limitation schedule time estimates units.

**UNIT-II**: Project management, resources balancing, phasing of activities, programmes, scheduling project control, reviewing, updating and monitoring.

**UNIT-III**: Introduction to modern management concepts. Introduction to PERT and CPM network concepts, inter relationship , information, data sheets and development of network. CPM for management, CPM network analysis, identification of critical path floats computation result sheets.

**UNIT-IV**: PERT Network, introduction to the theory of probability and statistics, probabilistic aim estimates for the activities of PERT Network.

**UNIT-V**: Financial management. Introduction to two dimensional network analysis activity cost information. Cost time relationship, crashed estimates for the activities, project direct cost and indirect cost.

**UNIT-VI**: Construction quality control and inspection, significance of variability and estimation of risks , construction cost control, crashing of networks.

**Sessional work :**

Assignment and case studies of above topics.

**TEXT BOOKS :**

1.    Dr. B. C. Punmiya and K. K. Khandelwal ó Project Planning and Control with PERT/CPM Laxmi Publications, New Delhi, 1987.
2.    S. P. Mukhopadyay, Project Management for Architects and Civil Engineers, IIt, Kharagpur.
3.    Ahuja H. N. õConstruction Performance Control by Networksö, Wiley Inter science Publication.
4.    Peurifoy, R. I. õConstruction Planning Equipments and Methodsö McGraw Hill Book Co. Inc.
5.    Srivastva, U. K. õConstruction Planning Managementö Galgotia Publisher.

**08AR07   ARCHITECTURAL  DESIGN  STUDIO - VIII**

**Sessional work:**

Assignments and drawing on the above topics given in the subject 08AR01 Architectural Design Studio ó VIII.

Viva Voce by external examiner at the end of Semester.

**08AR08   ADVANCE  CONSTRUCTION  STUDIO - II**

**Sessional work:**

Assignments and drawing on the above topics given in the subject 08AR08 Advance construction Studio ó II.

Viva Voce by external examiner at the end of Semester.

**08AR09  LANDSCAPE  DESIGN  STUDIO - II**

**Sessional work:**

Assignments and Sketches, Case Studies of contemporary period, Landscape Proposals for Residential, Public , Institutional Buildings on the above topics given in the subject 08AR09 Landscape Design Studio ó II.

Viva Voce by external examiner at the end of Semester.

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**SEMESTER : NINTH**

**09AR01                PRACTICAL  TRAINING**

Each candidate shall have to prepare a detail report along with necessary drawing, sketches, measurement, record, reading, observations, survey analysis, log sheets and modes, if necessary on the following siz aspects which are concerned with the poetical training. This report shall be submitted for the Viva-Voce examination duly certified by the Principal of the College.

1.    Critical appraisal - of any building that he/she-øor his/her employer has designed and executed. The building shall be used and the students may record the reactions of the users to support his/her appraisal in addition to photographs, drawing etc.

Marks (Sessional)- 25

2.    Site Supervision and Practice-A detail report of any major part of a small building that has been personally supervised by the candidate. It may include checking site measurement preparation of a bill, site instructions and checking of the executed work.

Marks(Sessional)- 25

3.    Field Observation - A report on architectural use of the site conditions. For example, Electric poles, Water tanks, slope of the site etc.

Marks (Sessional)- 25

4.    Log sheet and office certificate - A student shall fill the log sheets as a record of his every day work aid shall submit the same along with the certificate from his/her employer.

Marks (Sessional)- 25

5.    Working drawing and complete estimate of small project - A student shall submit all die working details prepared by him/her during his/ heir practical training along with estimate of small project.

Marks (Sessional)- 100

6.     Viva-Voce Each candidate shall be individually interviewed and questioned on any of the sublet mentioned above by a Principal,

Head of Department of Architecture and Two external examiner appointed by the University.

Marks(Viva-Voce)-100
Total Marks -    300
Pass Marks -    150

### SEMESTER: TENTH

**10AR01            PROFESSIONAL ELECTIVE – II
(1) INDUSTRIAL ARCHITECTURE**

**Objective:** To impart knowledge of planning and design features, materials and techniques useful in industrial structures.

**UNIT -I** : Meaning of industrial architecture, scope , context. Impact of industrial revolution ó origin in the context of Britain and the United States ó Impact of materials and technology.

**UNIT-II** : Automation techniques & its impact, circulation and area requirement, influence on design ó Internal & External Environment Control ó Precaution at site.

**UNIT-III** : Pioneers and Architects role in industrial design. Study of examples of pioneer to include Peter Behrens, Max Berg, Hans Poelzigøs and P. L. Nervi ó impact of expressionism and international style.

**UNIT-IV** : Responsibilities of architect in innovative corporate image, understanding industrial environments through Indian case studies.

**UNIT-V** : Zoning principle, Factories Act and Rules ( 1948) in India ó Role of Pollution Control Boards, organizing principles. Environmental Control & Waste Management.

**Sessional work :**
Assignments and drawing on the above topics given in the subject 10AR01 Climate Responsive Architecture .

**10AR01            PROFESSIONAL ELECTIVE – II
(2) CLIMATE RESPONSIVE ARCHITECTURE**

**Objective:** To sensitize students about the importance and need for Climate Responsive Architecture Design concept.

**UNIT -I** : Introduction to the ideas, issues and concepts of sustainable Architecture, related to types of climates. Global Environment & Principles of Environmentally and supportive Architecture.

**UNIT-II** : Non- conventional Energy Systems, Solar Thermal Application for heating and cooling.

**UNIT-III** : Low Energy design Hybrid Systems, Integration of PV and wind systems in the buildings.

**UNIT-IV** : Day Light principles , Glare amount of daylight, daylight factor, orientations and sizes of opening to achieve diffused lights.

**UNIT-V** : Application of Climatic Principles ó Evolution of Plan Form to minimize Heat Gain in Tropical Climates, Orientation of Building with respect to sun , wind, sizes of fenestration & its orientation, Use of evaporative cooling, ground coiling, cavity walls, topography , water bodies, vegetation. Landscape elements, cross ventilation system to achieve natural comfort level in indoor & outdoor spaces.

**UNIT-VI** : Planning and Design features to be considered with respect to various Climate.

**Sessional work :**
Assignments and drawing on the above topics given in the subject 10AR01 Climate Responsive Architecture .

**10AR01            PROFESSIONAL ELECTIVE – II
(3) VERNACULAR ARCHITECTURE**

**Objective:** To impart knowledge about various manmade and natural forces behind the evolution of traditional architecture.

**UNIT -I :** Approaches and Concepts to the study of vernacular architecture ó Aesthetics ó Anthropological ó Architectural ó Developmental ó Geographical ó Historical ó Spatial ó Folkloristic.

**UNIT-II** : Traditional Principles of Planning in Western & Northern India ó Primitive Forms, Symbolism, Colour, Folk Art etc. in the Architecture of the Deserts of Kutch and Gujrat State ó Wooden Houses & Mansions (Havelis) Gujrat & Rajsthan ó House boats (Dhugas) Kashmir ó Material of Construction & Construction details.

**UNIT-III** : Vernacular Architectural of South India ó Wooden Houses, Palaces & Theatres in Kerala, Palaces in Tamilnadu, Principles of Planning, Proportions, Elements, Beliefs & Culture, Material of construction and construction detail.

**UNIT-IV** : Western influences on Vernacular Architecture ó Colonial influence on the traditional House, Bangla & Bungalow, House typologies, settlement planning, Pondicherry & Cochin.

**UNIT-V** : Secular Architecture ó Medieval Period ó Citadels, Palaces, Towers, Gateways, Public Buildings etc. in the medieval towns of Jodhpur, Jaipur, Jaisalmer, Gwalior etc.

**Sessional work;**

Assignments and drawing on the above topics given in the subject 10AR01 Climate Responsive Architecture .

**10AR02          ARCHITECTURAL PROJECT / THESIS**

**Objective:** Develop any chosen architectural design project, emphasis being on integration of all technical, human & aesthetic aspect in the Architectural design solution.

The topic would be selected by students, subject to approval by the department. The topic selected may be a live design project or research oriented but essentially concluding in its application in architectural design project. The work progress evaluation would also be based on intermediate reviews of the study in presence of panel of teachers and experts from professional field.

The Viva-voce would be in the form of final Review on the basis of sessional submission in presence of two External Examiners. The H.O.D. Department of Architecture and student's teacher Guide would act as Internal Examiners.

The students would be required to explain and defend their study and design. The submission would consist of proper Presentation of Drawings, Thesis Report and Model.

The candidate shall carry out thesis considering the following aspect ó Research analysis and data collection, site selection & justification, user requirements & justification, climatic conditions, socio-economic problems, communication, Transportation, Landscape & Urban Planning.

**10AR03          SEMINAR**

**Objective:** Seminar is intended to evaluated the student's ability to explore in the field of architecture and make in depth investigation in the chosen area.

The students are expected to choose topics which are of special interest to them and prepare a Report and Drawings to show analysis of investigation. The Review of work would be done in presence of H.O.D. Department of Architecture, and nominated teacher guide, and other teachers.

The Viva-voce would be in the form of proper presentation of the Drawings, Information/ Data and Report. The Viva-voce would be in

presence of External Examiner. The H.O.D. Department of Architecture, and student's teacher Guide would act as internal examiners.

The Seminar topic can be related to any of the following subject ó Architectural theory , history, design determinates, design language , design evaluation, building types, urban planning and design, housing, interior design, landscape design, building technology and environmental sciences, professional practice and any other related field, accepted and approved by the Department.

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SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
INFORMATION TECHNOLOGY
SEMESTER PATTERN (CREDIT GRADE SYSTEM)

### SEMESTER : SEVENTH

**7IT 01          DIGITAL SIGNAL PROCESSING**

**Unit I:** Discrete óTime Signals and Systems: Introduction to DSP, Advantages, basic elements of DSP system, sampling theorem, A/D, D/A conversion, quantization. Elementary discrete-time sequences. Discretetime systems: description, representation, classification (linear, time-invariant, static, casual, stable)

**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.

**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 steadystate responses, causality, stability, pole-zero cancellation, the Schur-Cohn stability test

**Unit IV:** Fourier Transforms, the DFT and FFT: Definition & properties of Fourier transform, relation with ztransform. 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

**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

**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.

**TEXT BOOK :**
J G Prokis and D G Manolokis, õDigital Signal Processing: Principles Algorithms and Applications (Pearson Education)

**REFERENCE BOOKS:**
1.    S.Salivahanan, A Vallavaraj,C Gnanapriya õDigital Signal Processingö ( TaTa McGraw Hill)
1.    S K Mitra: õDigital Signal Processing: A Computer-Based Approachö ( TaTa McGraw Hill)
2.    E C Ifeacthor and B W Jervis õDigital Signal Processing A Practical Approachö (Pearson Education)
3.    A V Oppenheim, R W Schafer with J R Buck õDiscrete Time Signal Processingö(PHI)

**7IT02          OBJECT ORIENTED ANALYSIS AND DESIGN**

**UNIT-I:** Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle.

**UNIT-II:** Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams.

**UNIT-III:** Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Instances, Object Diagram

**UNIT-IV:** Basic Behavioral Modeling-I: Interactions, Use cases, Use case Diagrams, Interaction diagrams, Activity Diagrams.

**UNIT-V:** Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

**UNIT-VI:** Architectural Modeling: Component, Deployment, Collaborations, Component diagrams and Deployment diagrams.

**TEXT BOOK:**
1.    Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education.

**REFERENCE BOOKS:**
1.    Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY-Dreamtech India Pvt. Ltd.
2.    Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
3.    Pascal Roques: Modeling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.
4.    Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.

5.  Mark Priestley: Practical Object-Oriented Design with UML,TATA McGrawHill

6.  Appling UML and Patterns: An introduction to Object ó Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

**7IT03**                                    **WEB TECHNOLOGY**

**Unit –I :**  **Web Essentials:** The internet, Basic Internet Protocols, The World Wide Web, HTTP Request Massage, HTTP Response Massage, Web Clients, Web Servers, **Markup Languages: XHTML 1.0,** Basics of XHTML, Fundamentals HTML Elements, Relative URLs, Lists, Tables, Frames, Forms, Defining XHTMLø abstract syntax: XML, Creating HTML Documents.

**Unit – II:**  **Style Sheets:** Introduction to Cascading Style Sheets, CSS Features, CSS Core Syntax, Style Sheets and HTML, Style Rule Cascading and Inheritance, Text Properties, CSS Box Model, Normal Flow Box Layout, Beyond the Normal Flow

**Unit–III:**  **Client-Side Programing:** Introduction to Java Script™ Language, JavaScript in Perspective, Basic Syntax, Variables and Data types, Statements, Operators, Literals, Functions, Objects, Arrays, Built-in Objects, JavaScript Debuggers, **Host Objects:** Introduction to the Document object Model, Intrinsic Event Handling, Modifying Element Style, The Document Tree, DOM Event Handling, Accommodation Noncompliant Browsers, Additional Properties of Window

**Unit-IV:**  **Server-Side Programming : Java Servlets** Servlet Architecture Overview, Servlet Generating Dynamic Content, Servlet Life Cycle, Parameter Data, Sessions, Cookies, URl Rewriting, Other Servlet Capabilities, Data Storage, Servlet and Concurrency,

**Unit-V:**  **Representing Web Data:** XML Documents and Vocabularies, XML versions and XML Declaration, XML Namespaces, JavaScript And XML:Ajax , Dom-Based XML Processing, Event-Oriented parsing: SAX,  Transforming XML Documents, Selecting XML Data : XPath, Template-Based Transformation: XSLT, Displaying XML Documents in Browsers, Introduction to Java Server Pages, JSP and Servlets, Running JSP Applications, Basic JSP, JavaBeans Classes and JSP, Tag Libraries and Files,

**Unit-VI:**  **Web Services:** Web Service Concepts, Writing a Java Web Service, Writing a Java Web Service Client, Describing Web Services: WSDL, Representing Data Types :XML Schema, Communicating Object Data :SOAP,

**TEXT BOOK:**

1.  Web technologies by Jeffrey C. Jackson (Pearson )

**REFERENCE  BOOKS:**

1.  The Web Warrior guide to Web Programming by Xue Bai, Micheal Ekedahl, Don Gosselin (CENGAGE Learning)

2.  Internet Protocols by Subrata Goswami (Springer India)

3.  Dietel and Dietel: WWW: How to Program, (LPE )

4.  Dustin R Callaway: Inside Servlets (LPE)

**7 IT 04**          **REAL TIME & EMBEDDED SYSTEMS**

**UNIT I:**   Introduction to embedded systems, Processor in the system, Hardware units required in the exemplary cases, Software embedded into a system. Final Machine implement able software for a product, Software in Processor specific assembly language and high level language, Device drivers device management using an operating systems, Software design for scheduling multiple tasks and devices using RTOS, Embedded SoC and in VLSI circuits.

**UNIT II:**  Structural units of the processor, Allocation of memory to program segment and blocks, memory map of the system, Memory blocks for different data sets and structures, serial communication using I2C, CAN and advanced I/O buses between the networked multiple devices, Device drivers, Virtual Devices, Device drivers for parallel port, serial and timing devices, Context and periods for context switching, deadline and interrupt latency.

**UNIT III:** Software programming in assembly language and C, Use of data structures, Queues, Stacks, Lists and Trees, Function pointers, Function queues and ISR queues, Queues for implementing protocol for a network, Queuing of functions on interrupts, Use of FIFO queues, Stacks, Lists and Ordered Lists, Embedded programming

**UNIT IV:** Modeling process, Use of dataflow & control data flow graphs, Programming model for event controlled or response time constraint, Real time programs, Inter process Communication and Synchronization, Multiple processes in an application, Sharing data by multiple tasks, use of finite states machine model & Petri net Model, Process, Tasks, Threads.

**UNIT V:**  Use of Semaphores for a task or for Critical section of code, Mutex & P & V, Priority inversion problems & deadlock situations IPC issues, Use of Semaphore flags or Mutex as resource key, use of message queues, mailboxes, pipes, virtual sockets, RPCs.

**UNIT VI:** Introduction to RTOS, OS Services, RTOS Services, Schedule management for multiple tasks in Real Time, Handling of interrupt source call, RTOS task scheduling models, Cooperative Round Robin Scheduling using a Circular Queue of ready tasks and using and Ordered list as per precedence constraints, Cycling scheduling in Time Sharing, Preemptive scheduling, Critical section service by preemptive scheduler, fixed Real Time scheduling, Precedence assignment in Scheduling algorithms. Performance metrics, IEEE Standard POSIX 1003.1B, fifteen-point÷strategy for Synchronization, Embedded Linux Kernel.

**PRACTICALS** : Minimum 12 experiments based on above syllabus.

**TEXT BOOK:**
1. Rajkamal Embedded Systems, Architecture, Programming & Design, TMH.

**REFERENCE BOOKS:**
1. Real Time Systems, Jane W. S. Liu, Pearson Education
2. Embedded System Design, A Unified Hardware/Software Introduction, Frank Vahid, Tony Givargis, John Wiley & Sons P Ltd

### PROFESSIONAL ELECTIVE - I
### 7IT05 (1) DISTRIBUTED DATABASE MANAGEMENT SYSTEM

**UNIT-I:** Introduction to DDBS: Introduction, Promises of DDBs, Problem areas. Overview of Relational DBMS: RDBMS concept, Normalization, Integrity Rules. Review of Computer Networks: Data Communication Concepts, Types of Network, Protocol Standard. (8)

**UNIT-II:** Distributed DBMS architecture: DBMS standardization, Architectural Models, Distributed DBMS arch. Distributed Database Design: Alternative Design Strategies, Distributed Design issues, Fragmentation, Allocation Semantic Data Control: View Management, Data Security, Semantic Integrity Control. (8)

**UNIT-III:** Overview of Query Processing: Problem & objectives of Query Processing, Characteristics of Query processors, Layers of Query processing. (9)

**UNIT-IV:** Distributed Transaction management and Concurrency control: Definition, Properties and types of Transaction. Distributed Concurrency control: Serilizability, Taxonomy, Locking based concurrency control algorithms, Deadlock management. (9)

**UNIT-V:** Distributed DBMS reliability: Reliability concepts and measures, Failures and Fault tolerance in distributed systems, Failures in DDBMS, Local reliability protocols, dealing with site failures. (8)

**UNIT-VI:** Distributed Object Database Management Systems: Fundamental, Design and Architectural issues of ODBMS, Current issues: Data Delivery Alternatives, Dataware housing. World wide web, Mobile databases. (8)

**TEXT BOOKS :**
1. M. Tamer Oizsu and Patrick Valdurlez : Principles of Distributed Database Systems, 2nd ed. (Text Book) Person Education, LPE.
2. Ceri and Palgetti : Distributed Database System-(Reference Book) TMH.

### PRFESSIONAL ELECTIVE - I
### 7IT05 (2) MODELING & SIMULATION

**UNIT I:** **System Models and System Studies**
Basic concepts of systems ,System Environment , system modeling ,Types of Models, Principles used in modeling, Corporate models, Types of System Study-analysis, design and postulation of systems.

**UNIT II:** **Basic Concepts and continuous systems**
Monte Carlo Method ,Numerical Computation Technique for Continuous Models, & Discrete Models, Distributed log models, Cobweb Models , Analog and hybrid computers CSMP III.

**UNIT III:** System dynamics, probability concepts and basic principles of discrete simulation Growth and decay models system dynamics diagrams examples. Discrete Probability functions , Continuous Probability functions , Measures of Probability functions , Numerical on evaluation of Continuous Probability functions, Continuous Uniformly Distributed Randam Numbers ,Computer Generation of Random number .

**UNIT IV:** Simulation of Queueing System and PERT Network
Simulation of Queueing systems: Rudiments of queueing theory, simulation of a single server queue, Simulation of a two-server queue, simulation of more general queues.
Simulation of a PERT Network: Network model of a project, Analysis of an activity network, critical path computation, and uncertainties in activity durations, simulation of an activity network.

**UNIT V:** Simulation of Inventory Control & Forecasting Design and Evaluation of Simulation Experiments
Inventory Control and Forecasting: Elements of inventory theory, More complex inventory models, Simulation example-1, Generation of Poisson and Erlang variates, Simulation example-2, Forecasting and regression analysis.

Design and Evaluation of Simulation Experiments: Length of simulation runs, variance reduction techniques,Experimental layout, validation, summary an conclusions.

**UNITVI:** Simulation Languages and Introduction to GPSS

Different special purpose languages used for continuous and discrete systems and comparison-factors affecting the selection of discrete system simulation language-comparison of GPSS and SIMSCRIPT. A detailed study of GPSS with examples.

**TEXT BOOKS:**
1. Groffrey Gordon õSystem Simulationö, IInd Edition, PHI Pvt. Ltd.,New Delhi-1987.
2. Narsingh Deo, õSystem Simulation with Digital Computersö PHI Pvt.Ltd., New Delhi.

**REFERENCE BOOKS:**
1. Shannon R.E., õSystem Simulation: The Art of Scienceö Prentice Hall, Englewood Cliffs, NY, 1975.
2. Hugh J. Watson, John H. Blackstone, Jr., õComputer SimulationöIInd Edition, John Wiley & Sons.

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**PRFESSIONAL  ELECTIVE - I**

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**7IT05   (3) ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**

**Unit-I:** **Introduction to Artificial Intelligence:** The AI Problems, The Underlying Assumption, What is an AI Technique; **Problems, Problem Spaces, and Search,** Production Systems, Problem Characteristics , Production System Characteristics, Issues in the Design of Search Programs

**Unit-II:** **Heuristic Search Techniques:** Generate-and-Test, Hill Climbing, Best-first Search, A* Algorithm, Problem Reduction, AND-OR Graphs, The AO* Algorithm, Constraint Satisfaction, Means-ends Analysis,

**Unit–III:** **Knowledge Representation Issues:** Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, The Frame Problem, **Predicate Logic:** Representing Simple Facts in Logic,
Representing Instance and *ISA* Relationships, Computable Functions and Predicates, Resolution,  Natural Deduction **Representing Knowledge Using Rules,** Procedural Versus Declarative Knowledge, Logic Programming  Forward Versus Backward Reasoning , Matching, Control Knowledge.

**Unit –IV:** **Symbolic Reasoning Under Uncertainty** Introduction to Nonmonotonic Reasoning , Logics for Nonmonotonic Reasoning, Implementation Issues, Augmenting a Problem-solver,

Implementation: Depth-first Search, Implementation: Breadth-first Search,  **Statistical Reasoning** Probability and Bayesø Theorem,  Certainty Factors and Rule-based Systems,  Bayesian Networks, Semantic Nets, Frames.

**Unit-V:** **Understanding** What is Understanding?, Understanding as Constraint Satisfaction, **Natural Language Processing,** Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking, **Common Sense** Qualitative Physics, Common Sense Ontologies.

**Unit-VI:** **Expert Systems** Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition, **Fuzzy Logic Systems:** Introduction,  Crisp Sets, Fuzzy Sets, Some Fuzzy Terminology, Fuzzy Logic Control,  **Genetic Algorithms:** Significance of the Genetic Operators, Termination Parameters, Evolving Neural Networks.

**TEXT BOOK:**
Artificial Intelligence ó Elaine Rich, Kevin Knight, Nair (Third Edition) [Mc Graw Hill]

**REFERENCE BOOKS.:**
1. Introduction to Artificial Intelligence and expert system ó Dan W. Patterson
2. Expert System- Peter Jackson (Third Edition)
3. Introduction to Artificial Intelligence ó Rajendra Akerkar

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**PRFESSIONAL  ELECTIVE - I**

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**7IT05            (4) 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.

**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.

**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.

**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.

**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

**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).

**TEXT BOOK:**

Ze-Nian, Li, Mark S. Drew õFundamentals of Multimediaö (Pearson Education)

**REFERENCE BOOKS :**

1. Rajan Parekh õPrinciples of Multimediaö (Tata McGraw-Hill)
2. S.J.Gibbs & D.C.Tsichritzis õMultimedia Programmingö, Addison Wesley 1995
3. P.W.Agnew & A.S.Kellerman õDistributed Multimediaö, , Addison-Wesley 1996
4. C.A.Poynton, õA Technical Introduction to Digital Videoö Wiley 1996
5. F.Fluckiger, õUnderstanding Networked Multimediaö, Prentice-Hall 1995

**7IT06**     **DIGITAL SIGNAL PROCESSING - LAB:**
Minimum 8 experiments based on the syllabus of 7IT01.

**7IT07**   **WEB TECHNOLOGY - LAB:**
Minimum 8 experiments based on the syllabus of 7IT03.

**7IT08**   **REAL TIME EMBEDDED SYSTEMS - LAB:**
Minimum 8 experiments based on the syllabus of 7IT04.

**7IT08**     **REAL TIME & EMBEDDED SYSTEMS**

**UNIT I:** Introduction to embedded systems, Processor in the system, Hardware units required in the exemplary cases, Software embedded into a system. Final Machine implement able software for a product, Software in Processor specific assembly language and high level language, Device drivers device management using an operating systems, Software design for scheduling multiple tasks and devices using RTOS, Embedded SoC and in VLSI circuits.

**UNIT II:** Structural units of the processor, Allocation of memory to program segment and blocks, memory map of the system, Memory blocks for different data sets and structures, serial communication using I2C, CAN and advanced I/O buses between the networked multiple devices, Device drivers, Virtual Devices, Device drivers for parallel port, serial and timing devices, Context and periods for context switching, deadline and interrupt latency.

**UNIT III:** Software programming in assembly language and C, Use of data structures, Queues, Stacks, Lists and Trees, Function pointers, Function queues and ISR queues, Queues for implementing protocol for a network, Queuing of functions on interrupts, Use of FIFO queues, Stacks, Lists and Ordered Lists, Embedded programming

**UNIT IV:** Modeling process, Use of dataflow & control data flow graphs, Programming model for event controlled or response time constraint, Real time programs, Inter process Communication and Synchronization, Multiple processes in an application, Sharing data by multiple tasks, use of finite states machine model & Petri net Model, Process, Tasks, Threads.

**UNIT V:** Use of Semaphores for a task or for Critical section of code, Mutex & P & V, Priority inversion problems & deadlock situations IPC issues, Use of Semaphore flags or Mutex as resource key, use of message queues, mailboxes, pipes, virtual sockets, RPCs.

**UNIT VI:** Introduction to RTOS, OS Services, RTOS Services, Schedule management for multiple tasks in Real Time, Handling of interrupt source call, RTOS task scheduling models, Cooperative Round Robin Scheduling using a Circular Queue of ready tasks and

using and Ordered list as per precedence constraints, Cycling scheduling in Time Sharing, Preemptive scheduling, Critical section service by preemptive scheduler, fixed Real Time scheduling, Precedence assignment in Scheduling algorithms. Performance metrics, IEEE Standard POSIX 1003.1B, fifteen-point÷ strategy for Synchronization, Embedded Linux Kernel.

**PRACTICALS** : Minimum 12 experiments based on above syllabus.

**TEXT BOOK:**
1. Rajkamal Embedded Systems, Architecture, Programming & Design, TMH.

**REFERENCE BOOKS:**
1. Real Time Systems, Jane W. S. Liu, Pearson Education
2. Embedded System Design, A Unified Hardware/Software Introduction, Frank Vahid, Tony Givargis, John Wiley & Sons P Ltd

**7IT09          PROJECT AND SEMINAR:**
Seminar should be preferably based on the proposed project to be covered in final year. The semester 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 session:-          10 marks

### SEMESTER: EIGHT

**8IT01     DIGITAL AND WIRELESS COMMUNICATION**

**Unit I**: Information Theory: Elements of digital communication system, ,Unit of information, Entropy, Rate of information, Joint entropy, Conditional entropy, Mutual information ,Channel Capacity ,Shenonanøs Thorem, Shenonan and Hartely Theorem, coding efficiency, Shananon-Fano coding Theorem.

**Unit II:** Error controlling and coding: Methods of controlling error, linear block codes, matrix description of linear block codes, error detection and error correction capabilities of linear block codes, single error correcting Hamming codes, Cyclic codes, syndromes calculation, error detection, Introduction to Convolution codes

**Unit III:** Spread Spectrum Signals: Model of spread spectrum communication system, direct sequence spread spectrum signals, generation of PN sequences, frequency hopping spread spectrum (slow frequency and high frequency hopping), comparison, basic principles of TDMA, FDMA, CDMA.

**Unit IV:** Cellular Telephone Concepts: Introduction, mobile telephone service, cellular telephone architecture, frequency reuse, cell splitting, sectoring, segmentation and dualization, cellular system topology, roaming and handoffs.

**Unit V :** GSM & CDMA Technologies : Introduction to GSM, GSM Network Architecture, Protocol Architecture, GSM Channels, Frame structure for GSM, Authentication & Security in GSM, Introduction to CDMA, Architecture of CDMA System, IS-95 CDMA Forward & Reverse channel, Soft handoff.

**Unit VI**: Wireless network technology: IEEE 802.11 WLAN technology, ETSI HIPERLAN Technology, IEEE 802.15 WPAN Technology, IEEE 802.16 WMAN Technology, Mobile Ad hoc Network (MANETs), Mobile IP and Mobility Management, Mobile TCP, Wireless Sensor Networks, RFID Technology, Security Requirements for Wireless Network

**TEXT BOOKS:-**
1. K.S.Shanmugam: Digital & Analog Communication Systems, Wiley
2. T.L.Singal Wireless communications Mc Graw Hill.

**REFERENCE BOOKS:-**.
1. R.P. Singh,S.D. Sapre:Communication System Mc Graw Hill.
2. William Stallings : õWireless Communication and Networksö, Pearson Education Asia .
3. J.G.Proakis: Digital Communication, Mc Graw Hill.
4. P. Ramakrishna Rao: Digital Communication, Mc Graw Hill.
5. Wayne Tomasi : Advanced Electronics Communication Systems, Pearson.
6. Theodore S. Rappaport, õWireless Communications- Principles and Practice, Pearson.

**8IT02          NETWORK ADMINISTRATION AND SECURITY**

**UNIT I:** Introduction to network security, passive and active attacks, authentication, integrity, access control, The model of internetwork security, internet standards: the internet society and RFC publications (Request for comments.)

**UNIT II:** Cryptography: Encryption principles and various algorithms, standardization process, key distribution, public key cryptography and message authentication, digital signature.

**UNIT III:** Network security applications: Kerberos, X.509 directory authentication services, e-mail security PGP (Pretty Good Privacy) operational description. MIME (Multipurpose Internet Mail Extensions), S MIME (Security/Multipurpose internet mail extensions) functionality.

**UNIT IV:** IP Security: Overview, IP security architecture, Authentication header, Web Security: Web security requirements, secure socket layer SSL, Transport layer security TLS, Secure electronic transactions TES.

**UNIT V:** Network Management Security: Basic concepts of SNMP, Network management architecture and protocol architectures, proxies, services, SNMPv1 authentication service, access policy and proxy service, SNMPv2 architecture, message processing and user security model, view based access control.

**UNIT VI:** System Security: Intruders, Intrusion technologies, password protection, password selection strategies, Intrusion detection, viruses and related threats: Nature of viruses, types, micro viruses and various antivirus approaches. Firewall: Characteristics, types of fire walls, Firewall configuration, Trusted systems, data access control, the concept of the trusted systems.

**TEXT BOOKS :**
Network Security Essentials - William Stallings (Pearson Edu. Asia)

**REFERENCE BOOKS :**
1.    Security for Telecommunication and Network management by Moshe Rozenbit (PHI)
2.    Internet Security Protocols - Protecting IP Traffic, by Uyless Black (Pearson Edu. Asia)

**8IT03          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. WSHH principle, critical practice.

**UNIT II:** Measures, Metrics & Indicators. Metrics in process & project domains-software measurment, Metrics for software quality, small organization. Software projects Planning : Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection,refinement & RMMM plan.

**UNIT III:** Project Scheduling : Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

**UNIT IV:** System engineering : Hierarchy, Business Process & Product engineering : Overviews. Requirement engineering, System

modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

**UNIT V:** Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User-interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation.

**UNIT VI:** Software testing fundamentals ; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.

**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)

**8IT04          PROFESSIONAL ELECTIVE - II**
**(1) DATA WAREHOUSING AND DATA MINING**

**UNIT I:** Introduction, Data mining, Data mining functions, classification and major issues. Data Preprocessing : Data cleaning, data integration and transformation, data reduction, discretisation & concept hierarchy generation.          (10 hours)

**UNIT II:** Data mining primitives : Data mining primitives, data mining query language. Concept description : concept description, data generalization, Analytical characterization, mining class comparison.          (8)

**UNIT III:** Application and trends in data mining : data mining applications, data mining systems and research prototypes, additional themes on data mining, trends in data mining          (8)

**UNIT IV:** Data ware house and OLAP Technology for data mining : What is data ware house, multidimensional data model, data ware house architecture, data ware house implementation.          (8)

**UNIT V:** Data Staging : overview, plan effectively, dimension table staging, fact table loads and ware house operations, data quality and cleansing, miscellaneous issues.          (8)

**UNIT VI:** Building end user applications : role of end user application, application specification, end user application development, maintaining and growing data ware house : manage the exisiting data ware house environment, prepare for growth and evaluation.

(8)

**TEXT BOOKS :**
1. J. Han and M.Kamber : Data Mining Concepts and Techniques, Elsevier Pub. Indian Reprint, 2004.
2. R. Kimball : The Data Ware House Life Cycle Tool Kit, Wiley Press,John Wiley and Sons (ASIA) Pvt. Ltd.

**REFERENCE BOOKS :**
1. Berson : Data Ware Housing, Data Mining and OLAP, Tata McGraw Hill.
2. Arun K. Pujari : Data Mining Techniques, University Press (Orient Longman)

**8IT04          PROFESSIONAL  ELECTIVE - II**
**(2) WEB COMMERCE**

**UNIT-I:** Basic web commerce concepts, electronic commerce environments,electronic marketplace technologies , commerce modes:overview, EDI, electronic commerce with www-internet,commerce net advocacy.

**UNIT-II:** Approach to safe E-commerce: overview , secure transport protocol and transaction, SEPP, SET, certificate for authentication, security on web server and enterprise network.

**UNIT-III:** Electronic cash and Electronic payment scheme:Internet monetary payment and  security requirements; Payment & purchase order process, Online Electronic cash.

**UNIT-IV:** Internet/Intranet Security issues and solutions: Needs for computer security, security strategies, Encryption. MasterCard/ visa secure Electronic Transaction: Introduction requirements and concepts, payment processing.

**UNIT-V:** Secure E-mail Technologies:Introduction, means of distribution, models for message handling, How does Email work? MIME, S/ MIME, moss comparisons of security methods, MIME and Related facilities for EDI over the internet

**UNIT-VI:** Internet & web site Establishment:Internet Resources for commerce: introduction, Web server Technologies, internet tools Relevant to commerce, internet applications for commerce, internet Access and Architecture,Internet searching.

**TEXT BOOK :**
Daniel Minoli & Emma Minoli : Web Commerce Technology Hand Book

**REFERENCE BOOKS :**
1. David Whiteley : E Commerce (TMH)
2. Kalakota Whinston ó frontiers of e Commerce (Pearson education)

**8IT04          PROFESSIONAL ELECTIVE - II**
**(3) CLOUD COMPUTING**

**UNIT I:** **Introduction:** Cloud Computing Defined, the SPI Framework for Cloud Computing: Relevant Technologies in Cloud Computing, the Cloud Services Delivery Model, Cloud Deployment Models, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Barriers to Cloud Computing Adoption in the Enterprise.

**UNIT II:** **Infrastructure Security:** The Network Level: Ensuring Data Confidentiality and Integrity, Ensuring Proper Access Control, The Host Level: SaaS and PaaS Host Security, IaaS Host Security, Virtual Server Security, The Application Level: SaaS Application Security, PaaS Application Security, IaaS Application Security, **Data Security and Storage:** Provider Data and Its Security.

**UNIT III:** **Identity and Access Management:** Need of IAM , IAM challenge and definition, IAM Architecture and Practice, **Security Management in the Cloud:** Security Management in the Cloud, Availability Management, SaaS, PaaS, IaaS Availability Management, Access control.

**UNIT IV:** **Privacy:** Key Privacy Concerns in the Cloud?, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing,  Legal and Regulatory Implications, International Laws and Regulations.

**UNIT V:** **Audit and Compliance:** Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Illustrative Control Objectives for Cloud Computing, Incremental CSP-Specific Control Objectives, Additional Key Management Control Objectives, Control Considerations for CSP Users, Regulatory/External Compliance.

**UNIT VI:** **The Impact of Cloud Computing on the Role of Corporate IT**: Why Cloud Computing Will Be Popular with Business Units, Potential Threats of Using CSPs, A Case Study Illustrating Potential Changes in the IT Profession Caused by Cloud Computing, Governance Factors to Consider When Using Cloud Computing.

**TEXT BOOK:**
1. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy, O¢Reilly.

**REFERENCES:**
1. George Reese, Cloud Application Architectures, O¢Reilly.
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing

**8IT04          PROFESSIONAL ELECTIVE - II**
  **(4) NEURAL NETWORK AND FUZZY LOGIC**

**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 Back propagation 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 Seepest Descent, Effect of Learning rate, Adding a momentum Term, Backpropogation Algorithm.
                    (08Hrs )

**UNIT III:** **Associative Memory:-** Autocorrelation, Hetro-correlation, Multiple training encoding strategy, Exponential BAM, Associate memory for Real coded pattern pairs, Character recognition application,                    (08 Hrs)

**UNIT IV:** **Adaptive Resonance Theory:-** Cluster structure, Vector quantization, classical ART network, simplifier ART architecture, ART1: architecture, special features and algorithm, ART2: architecture, special features and algorithm, character recognition using ART1.                    (08 Hrs)

**UNIT-V:** **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)

**UNIT VI:** **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)

**TEXT BOOK :**
S. Rajesekaran, G. A. Vijayalakshmi Pai: õNeural Network, Fuzzy logic, and Genetic algorithms Synthesis and Applicationsö PHI.

**REFERENCE BOOKS:**
1.    S. Hykin: õNeural Networksö Pearson Education.
2.    Jang,Sun and Mezutani: õ Neuro Fuzzy and Soft Computingö .
3.    Zurada: õArtificial Neural Neworksö.
4.    N.P.Pahey: õArtificial Intelligence and Intelligent Systemsö, Oxford University Press.

**8IT05    NETWORK ADMINISTRATION AND SECURITY - LAB:**
      Minimum 8 experiments based on the syllabus of 8IT02.

**8IT06    SOFTWARE ENGINEERING - LAB:**
Minimum 8 experiments based on the syllabus of 8IT03.

**8IT07    COMPUTER LAB-V (CONTENT MANAGEMENT SYSTEM):**
Practicals based on Content Management Systems:
A list of sample practicals can be as under:
1.    To Study Content Management System.
2.    To Study Different Types of Content Management System.
3.    Installation of Content Management System framework.
4.    Installation of Different Tool on Content Management System framework.
5.    To Study WAMP Server and there installation.
6.    To creating & Configuring Menus in Joomla
7.    To installing & Configuring Templates in Joomla.
8.    To design advance templates & CSS Tricks
9.    To Customise XML Templates in Joomla

**8IT08    PROJECT AND SEMINAR:**
The project shall be evaluated in three phases based on the progress of the project work.
Phase I: - Problem, Definition and Design
Phase II: - Problem Implementation and Testing
Phase III: - Project demonstration & report submission.
Each phase shall be internally evaluated for 25 marks.
      The external evaluation of the project shall be based on demonstration of the project and viva-voce
                    *****

SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
BIOMEDICAL ENGINEERING
SEMESTER PATTERN (CREDIT GRADE SYSTEM)

## SEMESTER : SEVENTH

**7 BM01          BIO SIGNAL PROCESSING**

**UNIT I :   Discrete-time Signals and Systems:-**
Characterization, classification and time-domain representation of discrete-time signals, Typical sequences and their representation, Classification of sequences, Basic operations on sequences, Discrete-time systems.

**UNIT II :  The discrete-time Fourier transform (DTFT):-**
The discrete Fourier Transform (DFT), Computation of the DFT. Theory of Z-Transform Mathematical derivation of the unilateral z-transform, Properties of the z-transform, the inverse z-transform, The bilateral z-transform, Power series, Region of convergence (ROC) and its impedance.

**UNIT III :  Neurological Signal Processing**:-
The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis, Linear prediction theory, The autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination ó the case of epileptic patients, Overall performance.

**UNIT IV:  Cardiological Signal Processing:-**
Basic electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, the use of multiscale analysis for parameters estimation of ECG waveforms, Arrhythmia analysis monitoring, Long-term continuous ECG is recording.

**UNIT V:   ECG Data Reduction Techniques:-**
Direct data compression techniques, Direct ECG data compression techniques, Transformation compression technique, other data compression techniques, The PRD index.

**UNIT VI:  Data compression techniques:-**
ECG acquisition and transmission. Data reduction algorithms. Turning point. AZTEC, CORTES and the KL transform.

**TEXT BOOKS :-**
1. Biomedical Signal Processing, Principles and Techniques by D.C.Reddy, Tata McGraw Hill, 2005.
2. Biomedical signal processing. Vol-I, Time frequency analysis. Cohen A. CRC press.

3. Biomedical signal processing. Akay M. Academic Press.D.C.Reddy,öBiomedical Signal Processing ó Principles and Techniquesö, TMH
.
**REFERENCE BOOKS :**
1. Wills J. Tompkins, öBiomedical digital signal processingö, PrenticeHall of India Pvt. Ltd.
2. Digital biosignal processing. Weitkunat R, Elsevier.

**7 BM02    ARTIFICIAL ORGANS & REHABILITATION ENGINEERING**

**UNIT I :   Introduction to artificial organs**: Biomaterials used in artificial organs and prostheses, inflammation, rejection, correction.Rheological properties of blood, blood viscosity variation: effect of shear rate, hematocrit, and temperature and protein contents. Casson equation, flow properties of blood through the blood vessels, problems associated with extracorporeal blood low**:**Substitutive medicine, outlook for organ replacement, design consideration, evaluation process.

**UNIT II:   Audiometry:** air conduction, bone conduction, masking, functional diagram of an audiometer. Hearing aids: different types,receiver amplifiers. Opthalmoscope, retinoscope,I.A.B.P principle and application.
**Rehabilitation Engineering**: Impairments, disabilities and handicaps, Measurement and assessment. Characterizing engineering concepts in sensory and motor rehabilitation. Engineering concept in communication disorders. Rehabs for locomotion, visual, speech & hearing. Artificial limb and hands.

**UNIT III :  ARTIFICIAL HEART AND CIRCULATORY ASSIST DEVICES:**
Engineering design, Engg design of artificial heart and circulatory assist devices, blood interfacing implants ó introduction, total artificial hearts & ventricular assist devices,vascular prostheses, Non-blood interfacing implants for soft tissues- sutures and allied augmentation devices,percutaneous and skin implants, maxillofacial implants, eye and ear implants.

**UNIT IV:  CARDIAC VALVE PROSTHESES:** Mechanical valves, tissue valves, current types of prostheses, tissue versus mechanical, engineering concerns and hemodynamic assessment of prosthetic heart valves, implications for thrombus deposition, durability, current trends in valve design, vascular grafts-history, synthetic grafts, regional patency, thrombosis, neointimal hyperplasia, graft infections.

**UNIT V:   ARTIFICIAL KIDNEY:** Functions of the kidneys, kidney disease, renal failure, renal transplantation, artificial kidney, dialyzers,

membranes for haemodialysis, haemodialysis machine, peritoneal dialysis equipment-therapy format, fluid and solute removal.

**ARTIFICIAL BLOOD:** Artificial oxygen carriers, flurocarbons, hemoglobin for oxygen carrying plasma expanders, hemoglobin based artificial blood.

**UNITVI: ARTIFICIAL LUNGS:** liver Gas exchange systems, Cardiopulmonary bypass (heart-lung machine)-principle block diagram and working, artificial lung versus natural lung. Liver functions, hepatic failure, liver support systems, general replacement of functions.

**ARTIFICIAL PANCREAS:** Structure and functions of pancreas, endocrine pancreas and insulin secretion, diabetes, insulin, insulin therapy, insulin administration systems. Tracheal replacement devices, laryngeal replacement devices, Artificial esophagus Artificial Skin: Vital functions of skin, current treatment of massive skin loss, design principles for permanent skin replacement.

**TEXT BOOKS:**
1. Biomedical Engineering Handbook-Volume 1, 2nd Edition ó by J.D.Bronzino, CRC
2. Biomedical Engineering Handbook-Volume 2 (2nd Edition) - byJ.D.Bronzino, CRC

**REFERECNE BOOKS :**
1. Hand book of Biomedical Engineering. Bronzino. Joseph
2. Hand book of Biomedical Instrumentation. R.S.Khandpur
3. Artificial Organs. Erie.D.Blom, Howard.B.Rotham.
4. Biomedical Engineering Principles (Volume ó II). David O. Cooney.,Marcel Dekker Inc.

## 7BM03          MEDICAL EXPERT SYSTEMS

**UNIT–I:** General issues and overview of AI, AI Techniques, AL problems, AI Techniques, importance and areas of AI, problem solving state space search-DLF, BFS Production system, problem haracteristics.
Heuristic Search Techniques: Generate and Test, Hill Climbing, Best First Search, Problem reduction, Constraint satisfaction-Cryptarithmetic and problems.

**UNIT-II:** Knowledge representation & mapping, approaches to knowledge to representation, issues in knowledge representation, Representing simple facts in logic, representing instance and relationships, Resolution and natural deduction Representing knowledge using rules, Procedural v/s Declarative knowledge,

Logic programming, Forward v/s Backward chaining, Matching & control knowledge.

**UNIT III:** AI programming language: Prolog- objects, relationships, facts, rules and variables, Prolog: Syntax and data structures, representing objects & relationships by using õtreesö and õlistsö, use of cut, I/O of characters and structures.

**UNIT-IV:** Symbolic reasoning under uncertainty: Introduction to monotonic reasoning, Logics for Nonmonotonic reasoning, implementation issues, implementation: DFS & BFS. Architecture of the expert system ó problem selection ó formalization -implementation ó evaluation.

**UNIT–V:** Slot and filler structures: Semantic nets, frames, conceptual dependency, scripts, CYC Natural languages and NLP, Syntactic processing parsing techniques, semantic analysis case grammar, augmented transition net, discourse & pragmatic processing, translation.

**UNIT-VI:** Definition and characteristics of Expert System, representing and using domain knowledge, Expert system shells Knowledge Engineering, knowledge acquisition, expert system life cycle & expert system tools, MYCIN & DENDRAL examples of expert system

## TEXT  BOOKS:

1. Introduction to AI & Expert System ó D. W. Patterson, Prentice hall of India
2. Principles of Artificial Intelligence& Expert Systems Development ó David W.Rolston, Tata McGraw Hill

**REFERECNE BOOKS :**
1. Artificial Intelligence ó Elaine Rich, McGraw Hill
2. Principles of Artificial Intelligence ó Nils J. Nilsson, Springer Verlag
3. Introduction to Artificial Intelligence ó Charnaik & McDermott, Addison Wesley

## 7 BM 04          HOSPITAL ENGINEERING & MANAGEMENT

**UNIT I : Classification of hospital & architecture:** General hospital, specialized hospital, primary health care ó their role and functions. Aspects of hospital services óinpatient, outpatient and mergency. Location and environment of hospital.

**UNIT II : Hierarchy of medical and paramedical staff & their functions and responsibilities:-** Modern Hospital Architecture- space in a

hospital building, design of ward, intensive care units, air conditioning, plumbing & sanitation, gas supply, waste disposal, cleaning, dietary, sterilizing, laundry, storage and operation theatre systems, Radiology, Central labs, Blood banks, OPD, Causality, etc.

**UNIT III : Electrical power systems in hospitals**: Safety of electrical systems, Protective systems ó interference of patientøs protection grounding. Design of sub stations, breakers, Surge protectors, EMI filters, voltage stabilizers, generator sets and UPS. Uninterrupted power supply for ICU and computerized monitoring units. Specification & estimation for hospital wiring.

**UNIT IV: Air conditioning & gas supply systems:**
Air conditioning and refrigeration systems for small and large areas. Air changes, filtering and sterility. Deodorizations, disinfection, Dehumidification and cryogenic systems. Centralized supply of air, oxygen, nitrous oxide & vacuum -Principle of production of liquid oxygen. Management lifts fire fighting equipments.

**UNIT V: Hospital engineering & Management:**
Definition of biomedical Engineering, clinical engineering & hospital engineering. Importance of BME department óservicing and maintenance, testing, acceptance &maintenance protocols, Computerized preventive maintenance planning, MROs. Training of men for medical equipments preventive and periodical maintenance procedures. Preparation of estimates, specifications, tender details etc. Importance of ISO 9000 Certificates ó Obtaining ISO certificates in hospitals. Proposed protocols.

**UNIT VI: Hospital Information system:** Role of database in HIS. Need of Networking in HIS. Overview of Networking, topologies and its configuration. Structuring medical records to carry out functions like admissions, discharges, treatment history etc. Computerization in pharmacy & billing. Automated clinical laboratory systems & radiology information system.

**REFERENCE BOOKS:**

1. Harold E. Smalley, õHospital Management Engineering ó A guide to the improvement of hospital management systemö, PHI.
2. C. A. Caceras ,öClinical Engineeringö
3. L. C. Redstone ,öHospital and Health Care Facilitiesö Ward ,öAnesthetic Equipmentsö. IS, õISO Certification detailsö
4. Bhaumick and Bhattachary,ö EHV Substation equipmentsö
5. Alexander Kusko,ö Emergency and Standby Power Systemsö

6. Balagune Swamy ,öReliability Engineeringö
7. Anantha Narayanan ,öBasic Refrigeration and Air Conditioningö

**PROFESSIONAL ELECTIVE-I**

**7 BM 05          (1) TISSUE ENGINEERING**

**UNIT I :  Introduction**:
Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

**UNIT II : Cell culture**:
Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization, Bioreactors.

**UNIT III:  Molecular biology aspects**:
Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

**UNIT IV:  Scaffold and transplant**:
Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation.

**UNIT V:** Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology stems cells: introduction, hepatopoiesis.

**UNIT VI:  Case study and regulatory issues**:
Case study of multiple approaches: cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

**TEXT / REFERENCE BOOKS:**

1. Principles of tissue engineering, Robert. P.Lanza, Robert Langer & William L..
2. The Biomedical Engineering óHandbook, Joseph D. Bronzino,
3. Introduction to Biomedical Engg. , Endarle, Blanchard & Bronzino,Academic
4. Tissue Engineering, B. Palsson, J.A. Hubbell, R.Plonsey & J.D.Bronzino

## PROFESSIONAL ELECTIVE-I

**7 BM0 5          (2)  BIO-INFORMATICS**

**UNIT I :  Introduction to genomics**:
Information flow in biology, DNA sequence data, experimental approach to genome sequence data genome information resources.

**UNIT II : Functional proteomics**:
Protein sequence and structural data, protein information resources and secondary data bases. NBFR-PIR, SWISSPROT

**UNIT III : Introduction to Genomic data and Data Organization**:
Sequence Data Banks ó Introduction to sequence date banks ó , Signal peptide data bank, Nucleic acid sequence data bank ó GenBank, EMBL nucleotide sequence data bank, and AIDS virus sequence data bank. RRNA data bank, structural data Bank

**UNIT IV: Computation genomics**:
Internet basics, biological data analysis and application, sequence and data bases, NCBI model, file format, Perl programming, bioperl, introduction and overview of human genomic project.

**UNIT V:  Sequence alignment and data base search**:
Protein primary sequence analysis, DNA sequence analysis, pair wise sequence alignment, FASTA algorithm, BLAST, multiple sequence alignment, DATA base searching using BLAST and FASTA.

**UNIT VI: Structural data bases**:
Small molecules data bases, protein information resources, protein data bank, genebank, swissport, enterz..

**TEXT / REFERENCE BOOKS**:

1.   Introduction to bioinformatics, Atwood, Pearson education.
2.   Introduction to bioinformatics, Arther M.Lesk-OUP
3.   Bioinformatics sequences and genome analysis, David W.Mount,2nd. Edn. CBS publishers.
4.   Introduction to bioinformatics computer skills, Cynthia Gibas and Per Jambeck, 2001 SPD.

**7BM 06   BIOMEDICAL SIGNAL PROCESSING -LAB**:-
List of Practicals :
1.   Sine wave generation using C.
2.   Designing an FIR filter using MATLAB and DSP Kit.
3.   Designing an IIR filter using MATLAB and DSP Kit.
4.   Fourier analysis of periodic signal.

5.   Time frequency domain properties of different windows using MATLAB.
6.   Implementation of the Double-Precision Complex FFT for ECG signal.
7.   Design of Notch filter for elimination of 50Hz from ECG signal.
8.   EMG processing using MATLAB óRectification and Signal Averaging.

**7BM07   MEDICAL EXPERT SYSTEMS - LAB**

Practicals : Minimum eight practicals based on syllabus

**7 BM08   HOSPITAL ENGINEERING & MANAGEMENT - LAB**

**Laboratory Work:-**
Minimum 8 Case Study based on syllabus to be conducted in Hospitals

**7BM09                PROJECT AND SEMINAR**

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## SEMESTER-EIGHTH

**8 BM01   PROFESSIONAL  ETHICS AND VALUES**

**UNIT I :**  Science, Technology and Engineering as knowledge and as Social and Professional Activities Effects of Technological Growth: Rapid Technological growth and depletion of resources, Reports of the Club of Rome.

**UNIT II : Limits of growth**: sustainable development. Energy Crisis: Renewable Energy Resources. Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics. Appropriate Technology Movement of Schumacher; later developments. Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

**UNIT III:  Ethics of Profession**:
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

**UNIT IV: Profession and Human Values**:
Values Crisis in contemporary society. Nature of values: Value Spectrum of a good life.

**UNIT V:  Psychological values**: Integrated personality; mental health. Societal values: The modern search for a good society, justice,

democracy,secularism, rule of law, values in Indian Constitution.Aesthetic values: Perception and enjoyment of beauty,simplicity, clarity.

**UNIT VI: Moral and ethical values**:

Nature of moral judgements; canons of ethics; ethics of virtue;ethics of duty; ethics of responsibility.

**Reference Books:**

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)

2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall,Englewood Cliffs, New Jersey 1991.

3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

**8BM02        BIO MEDICAL IMAGING SYSTEMS**

**UNIT I :  Digital image fundamentals:** Image digitization, sampling and quantization, neighbour of pixels, connectivity, relations, equivalence and transitive closure, distance measures, arithmetic / logic operations, discrete transform, fast Fourier transform,2-D Fourier transform, inverse Fourier transform.

**UNIT II : Image enhancement fundamentals**: Spatial domain method, frequency domain method, contrast enhancement, histogram processing, image smoothing, image averaging, asking, image sharpening, removing of blur caused by uniform linear motion, enhancement in the frequency domain ó low pass, high pass, mean and band-pass filtering.

**UNIT III : Image restoration fundamentals:** Degradation model, discrete formulation, algebraic approach to restoration óunconstrained & constrained.

**UNIT IV: Image compression and segmentation fundamentals**: Fidelity criteria, image compression models, loss and lossless compression technique.

**UNIT V : Image segmentation:** point detection, line detection, edge detection, edge linking and boundary detection.

**UNIT VI: Algorithms used in medical image processing:** Brief of reconstruction techniques ó algebraic, simultaneous iterative and simultaneous algebraic. Reconstruction algorithm for parallel projections, fan beam projection and back projection. Introduction to various approaches of pattern recognition.

**Text books:**
1. Digital image processing by Gonzalez and Woods, 2nd ed., Pearson
2. Digital image processing and analysis by Chanda & Majumdar, PHI
3. Fundamental of digital image processing by Jain, PHI
4. Pattern recognition by Tou and Gonzalez

**PROFESSIONAL ELECTIVE -II**
**8BM03        (1) BIO - INSPIRED ALGORITHM**

**Unit I:    Introduction to Biologically inspired Algorithms:** Artificial neural network , Evolutionary computation , Social systems , Artificial Immune systems.

**Unit II:   Neural Network Methodologies:** A taxonomy of NNs, the multilayer perceptron , training MLP , Practical issues in training MLP , Radial basis function network , Self organizing Maps , Implementation of a SOM

**Unit III:  Evolutionary Methodologies:** Genetic algorithm , canonical GA , Example of GA , Extending the canonical GA , Schema and building blocks , Differential Evolution , DE Algorithm , Genetic programming , More Complex GP architectures , Combining EA and MLP methodologies .

**Unit IV:  Grammatical Evolution :** Biological analogy , Mapping process , mapping example , mutation and crossover in GE , recent development in GE , Search engine, meta ógrammars , ð GE , applications and alternative.

**Unit V:    Particle Swarm model :** PSO algorithm , constriction coefficient Ver , Parameter setting for PSO , Discrete PSO , comparing PSO and the GA , MLP swarm hybrids , grammatical swarm.

**Unit VI:   Ant colony models:** Ant óforaging models , Ant- foraging algorithm , Ant inspired classification algorithms
Artificial Immune Systems: Overview of natural immune systems , Innate Vs Adaptive Immunity , Component of the Immune systems , Designing  artificial Immune algorithm, Negative selection algorithm , Clonal Expansion and selection algorithm.

**TEXT BOOKS:**
1. Handbook of Bioinspired Algorithms and Applications Stephan Olariu, Hardcover
2. Hanbook of Bioinspired Algorithms and Applications, Stephan Olariu and Albert Zomaya, Chapman and Hall, 2006
3. Biologically inspired algorithms for financial modelling ,Anthony Brabazon, Michael OøNeill

### PROFESSIONAL ELECTIVE -II
**8BM03          (2) BIOFLUIDS & DYNAMICS**

**UNIT I:** Fluids and non-fluids, continuum coordinate systems, force and moments, stress at a point, rate of strain, properties of fluids, classification of fluids.

**UNIT II:** Different types of fluid flows, laminar and turbulent flow, transition from laminar to turbulent flow, laminar flow-annulus, laminar flow between parallel plates, measurement of viscosity.

**UNIT III:** Development of boundary layer, estimates of boundary layer thickness, boundary layer equation, nature of turbulence, smooth and rough surface, boundary layer separation.

**UNIT IV:** Friction loss in flow in a tube, velocity distribution of aortic system, waveform of pressure and velocity in aorta,

**UNIT V:** Wave reflections and impedance in arterial segments, blood flow in veins and blood flow in capillaries.

**UNIT VI:** Control theory and system analysis, mechanical analysis of circulatory systems, basic concept of myocardial mechanics, index of contractibility, fluid dynamics of aortic and mitral valves.

**TEXT BOOKS :**

1. K.L.Kumar, õEngineering fluid mechanicsö, Eurasia Publishing House (P) Ltd., New Delhi, 1998. (UNITS I, II & III)
2. D.H.Bergel, õCardiovascular fluid dynamicsö- Vol. I, Academic press, London & New York, 1972. (UNITS IV, V)

**8 BM 04      BIO MEDICAL EMBEDDED SYSTEMS DESIGN**

**UNIT I:  MCS 51 Microcontroller family**
Introduction to MCS family, Comparison of microprocessor and microcontroller, Features, Architecture, functional pin description, SFRs, various resources of MCS-51 Hardware Review: Study of Port structure, Interrupt structure, Timer/ Counter, Serial port.

**UNIT II :  8051 Assembly Language Programming**
Addressing modes, Instruction set, Assembly Language Programming, CPU timings, 8051A as a Boolean Processor,Power Saving Options, 8051 I/O expansion using 8255, Typical MCS51 based system, Multiprocessor Communication in MCS-51, interfacing problems

**UNIT III :  Embedded Systems:**
Basic concepts, requirements, categories, design challenges Embedded operating system óTypes , Hardware architecture,

Software architecture, application software, communication software, process of generating executable image,development/ testing tools

**UNIT IV:  Embedded System Development**
The development process, requirements engineering, design, implementation, integration and testing, packaging, configuration management, management of development projects

**UNIT V :  The execution environment**
Memory organization, system space, code space, data space, unpopulated memory space, i/o space, system start up,interrupt response cycle, Functions Calls & Stack Frames,run time environment.

**UNIT VI:  Architecture of Kernel, Tasks and Task Scheduler –** Task States, Content Switching, Scheduling Algorithms, Rate Monotonic Analysis, Task management Function Calls. Interrupt Service Routines, Semaphores, mutex, mailboxes,message queues, event registers, pipes, signals, timers,memory management, Priority Inversion Problem Design methodologies and design flows, case studies- fetal heart rate monitor, versatile drop foot stimulator, myoelectric arm, telemonitoring system

**TEXT BOOKS**:

1. The 8051 microcontrollers-Kenneth J Ayala
2. Rajkamal, Embedded systems-architecture, programming and design,Tata McGraw Hill
3. Frank Vahid,Toney Givargi-Embedded System Design: A unified Hardware /Software Introduction John Wiley publication
4. David E. Simon -An Embedded Software Primer Pearson Education

**REFERENCE BOOKS:**

1. Muhammad A Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education
2. Sriram Iyer and Pankaj Gupta, Embedded Real-time systems programming, Tata McGraw Hill
3. Embedded Microcomputer Systems- Real time Interfacing óValvano
4. Arnold S. Berger, *An introduction to Processes, Tools and Techniques*, CMP books, 2005.
5. Dr.K.V.K.K.Prasad, *Embedded Real time Systems*, Dreamtech Press,2003.
6. Wayne wolf , õComputers as Components: Principles of Embedded Computer systems designö, Morgan Kaufmann Publishers,2000

**8BM 05      BIO MEDICAL IMAGING SYSTEMS - LAB**

[Students are required to perform at least Eight experiments]
1.    Maximum distance algorithm
2.    Image enhancement ó Histogram
3.    Image smoothing
4.    Image sharpening
5.    Algorithm for low pass filter, high pass filter, median filter
6.    Point detection
7.    Line detection
8.    Edge detection

**8 MB 06    BIO MEDICAL EMBEDDED SYSTEM DESIGN - LAB**
**Term work:**
Minimum 10 experiments on MCS 51
**List of Experiments**
1.    Interfacing with 8085 microprocessor and 8051 microcontroller
      a) Traffic light controller
      b) 7-segment display
      c) Analog to Digital Converter
      d) Matrix keyboard
      e) LCD display
      f) Digital to Analog Converter
      g) Stepper motor
      h) DC- motor
2.    Interfacing of matrix sensors to PIC microcontroller
      a) Heart rate monitor
      b) ECG sensor
      c) Carbon dioxide and oxygen sensors
      d) Ion selective sensors
      e) Analog interfacing of rabbit core modules
      f) OP 7200 LCD display controller

**8 BM 07    PROJECT AND SEMINAR**

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