SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University)

Accredited with "A" Grade by NAAC

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.

SYLLABUS

SCHOOL OF ELECTRICAL AND ELECTRONICS

BACHELOR OF ENGINEERING IN ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATIONS 2015

SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM

Effective from academic year 2015-2016 and applicable to the students admitted to the Degree of Bachelor of Engineering/Technology (Eight Semesters)

1. NOMENCLATURE:

Programme	Refers to the Bachelor of Engineering / Technology Stream that a student has chosen for study. Eg. B.E in Mechanical Engineering
Course	Refers to the course (Subject) that a student would have to undergo during the study in the institution
Batch	Refers to the Starting and Completion year of a Programme of study. Eg. Batch of 2015–2019 refers to students belonging to a 4 year Degree Programme admitted in 2015 and completing in 2019
Faculty	Each Programme and Department of the Institution is grouped under various Faculty. Eg. Faculty of Computing consists of Departments of Computer Science, Information Technology and Computer Applications. This Faculty offers various Undergraduate and Postgraduate Programmes in Engineering like B.E (Computer Science), B.Tech (Information Technology),M.E (Computer Science), M.Tech (Information Technology)
Faculty Head	Refers to the Head of a Group of Departments under which various UG and PG Programmes are offered
HOD	Refers to the Head of a Group of Departments under which various UG and PG Programmes are offered

2. STRUCTURE OF PROGRAMME :

2.1. Every Programme will have a curriculum with syllabi consisting of theory and practicals such as:

a. General Foundation courses comprising English, Mathematics, Basic Sciences and Engineering Sciences
b. Core courses belonging to the Major Programme of study
c. Electives offered by the Faculty and the Department related to the Major programme of study
d. Electives to be chosen from a group of courses offered, which can be chosen by any student of any stream
e. Laboratory courses such as Workshop practice, Computer Practice, Engineering Graphics, etc
f. Professional Training Courses during the semester vacation
g. Project Work

2.2 Each semester curriculum shall normally have a blend of lecture courses not exceeding 6 and practical courses not exceeding 2.

2.3 Each course is normally assigned certain number of credits as follows:

Lecture Hours (Theory)	**:** 1 credit per lecture hour per week, 1 credit per tutorial hour per week.
Laboratory Hours	**:** 1 credit for 2 Practical hours, 2 credits for 3 or 4 hours of practicals per week.
Project Work	**:** 1 credit for 2 hours of project work per week
Professional Training	**:** 5 credits for minimum of 3 weeks of training during summer vacations

2.4 The medium of instruction, examinations and project report will be in English Language throughout the Programme

2.5 For the award of the degree, a student has to earn the total number of credits as specified in the curriculum of the relevant branch of study.

3. DURATION OF THE PROGRAMME

A student is normally expected to complete the B.E/B.Tech. Programme in 8 semesters but in any case not more than 12 consecutive semesters from the time of commencement of the course (not more than 10 semesters for those who join 3rd semester under Lateral entry system) The Head of the Department shall ensure that every teacher imparts instruction as per the number of hours specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

4. REQUIREMENTS FOR COMPLETION OF A SEMESTER

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester. He/She secures not less than 90% of overall attendance in that semester. Candidates who do not have the requisite attendance for the semester will not be permitted to write the semester Examinations.

5. FACULTY HEAD

Each Faculty is headed by a Faculty Head which comprises of many Departments and Courses offered by them. The Faculty Head is responsible for all activities taking place inside the Faculty in coordination with all Department Heads and all staff members belonging to the faculty. The Faculty Head will be appointed by the University on rotational basis. The Faculty Head shall act as a linkage between the HoD's, faculty members and the students. The Faculty Head makes a review of all the academic activities of Staff, Students and Research on a regular time interval and takes steps to improve the morale of all staff and students.

6. HEAD OF THE DEPARTMENT

Each Department offering various UG and PG Programmes is headed by a Head (HoD). The HoD is responsible for allotting courses to each staff member uniformly in consultation with other HoD's and Faculty Heads. The HoD is responsible for streamlined teaching of courses to students, improvement and Assessment of Teaching Quality within the Department on a continuous basis, Assessment of staff members, transparent conduct of Continuous Assessment Examinations, Interacting with Parents, ensuring that all academic and non academic activities of staff and students are monitored and steps taken for their improvement.

7. BATCH COORDINATOR

The Head of the Department shall appoint a Batch coordinator for each batch of students admitted in to a programme, throughout their period of study. The Batch coordinator shall act as a linkage between the HoD, faculty members and the students. The Batch coordinator gets information about the Syllabus coverage by the staff members, requirements of the students academically and otherwise, attendance and progress of the students from the respective Class Counselors. The Batch Coordinator also informs the students of the academic schedule including the dates of assessments and syllabus coverage for each assessment, Weightage for each assessment, their Continuous assessment Marks and attendance % details before the commencement of End Semester examinations.

8. CLASS COUNSELOR

There shall be a class counselor for each class. The class counselor will be one among the teachers of the Department. He / She will be appointed by the HoD of the department concerned. The responsibilities for the class Counselor shall be:

- To act as the channel of communication between the HoD, Faculty Head, Batch Coordinator, Course Coordinator, staff and students of the respective class
- To collect and maintain various statistical details of students
- To help the Batch Coordinator in planning and conduct of the Classes
- To monitor the academic performance of the students including attendance and to inform the Batch Coordinator
- To take care of the students' welfare activities like industrial visits, Seminars, awards etc.

9. COURSE COORDINATOR FOR EACH COURSE

- Each theory course offered to more than one class or branch or group of branches, shall have a "Course coordinator" comprising all the teachers teaching the course, with one of the senior staff amongst them normally nominated as course coordinator, by the faculty head in consultation with the respective HoD's.
- The "Course Coordinator" shall meet the teachers handling the course, as often as possible and ensure a Common Teaching Methodology is followed for the course, Study materials are prepared by the staff members and communicated to the students periodically, involving students in course based projects and assignments, common question paper for continuous assessment tests, uniform evaluation of continuous assessments Answer sheets by arriving at a common scheme of evaluation.
- The Course coordinator is responsible for evaluating the Performance of the students in the Continuous Assessments and End Semester exams and analyzes them to find suitable methodologies for improvement in the performance. The analysis should be submitted to the HoD and Faculty Head for suitable action.

10. EXAMINATIONS

- The end semester examinations shall normally be conducted between October and December during the odd semesters and between March and May in the even semesters. The maximum marks for each theory and a practical course (including the project work and Viva Voce examination in the final Semester) shall be 100 with the following breakup.
- Theory Courses
  Continuous Assessment: 50 Marks End Semester Exams: 50 Marks
- For Practical courses
  Continuous Assessment: 50 Marks End Semester Exams: 50 Marks

11. CONTINUOUS ASSESSMENT EXAMS

a. Theory Courses

There will be a Minimum of two Continuous Assessment Exams, for each Theory course. Each Assessment Exam will be conducted for a Maximum of 50 Marks. The total marks secured in the Two Assessment Exams out of 100, will be converted to 45 Marks. The % -of attendance secured by the candidate in a course in a semester will carry a Weightage of 5 Marks, which will be added to the Continuous Assessment Marks for each course.

The Continuous assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts, till the candidate secures a pass.

b. Practical Courses

- For Practical Courses, the student will be evaluated on a continuous basis for 25 Marks (which will include performing all experiments, submitting Observation and Record Note Book in scheduled Format and Time), 20 Marks for Model Exam at the end of the semester, 5 Marks for Attendance in the course.
- For Practical courses, if a student has been absent for some Practical Classes or has performed poorly, then the student will have to get permission from the Lab in charge and batch coordinator to do the experiments, so that he/she meets all the requirements for the course and thereby allowed to appear for Model and End Semester Exams.
- If a student has not done all the experiments assigned for that Lab, before the scheduled date or has attendance percentage less than 90%, the student will not be allowed to appear for the Model and end semester Practical Exam. Such students will have to redo the course again by doing all the experiments in the next semester when the course is offered.

12. ELECTIVE COURSES

Every student has the option of choosing four elective courses during the period of study. These electives will be offered in the Prefinal and Final year of study. The student has to select atleast two electives offered by the respective department. The student also has the choice of selecting the other two electives from electives offered by Departments within the faculty in that semester and / or from the electives which can be opted as elective by all undergraduate branches of the institution.

13. FINAL YEAR PROJECT WORK

- Project work is to be undergone by each student in the final year. The Project work has been divided in to two Phases (Phase 1 and 2). Project work Phase 1 is to be done in the Pre-final Semester and Phase 2 during the Final Semester.

- Project work may be allotted to a single or two students as a Group. In special cases, the number of students in a Project Group cannot exceed three, if it can be justified by the Project Supervisor and HoD, that the Project Work Content is large enough.

- For Project work, Assessment is done on a continuous basis by 3 Reviews for 50 Marks and Final Viva voce carries 50 Marks.

- There shall be three Project Reviews (Conducted during the Pre-final semester and Final Semester) to be conducted by a review committee. The student shall make presentation on the progress made, before the committee. The Head of the Department shall constitute the review committee for each branch in consultation with Faculty Head. The members of the review committee will evaluate the progress of the Project and award marks.

	PROJECT REVIEWS			FINAL PROJECT VIVA-VOCE
	1	2	3	
Max. Marks	5	15	30	50

- The total marks obtained in the three reviews, rounded to the nearest integer is the Continuous Assessment marks out of 50. There shall be a viva-voce examination for final Semester Examination conducted by one internal examiner, one external examiner and the supervisor concerned.

- A student is expected to attend all the Project Reviews conducted by the institution on the scheduled dates. It is mandatory for every student to attend the Reviews, even if they are working on a project in an industry based outside Chennai city. It is their duty to inform the organization about the project reviews and its importance, and get permission to attend the same. If a student does not attend any of the Project Reviews, he / she shall not be allowed for the successive reviews and thereby not allowed to appear for the Final viva voce.

- The final Project viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination. The external examiner shall be appointed by the Controller of Examinations. The Internal and External Examiner will evaluate the Project for 20 Marks each. The project report shall carry a maximum of 10 marks.

- The candidate is expected to submit the project report as per the guidelines of the institution on or before the last day of submission. If a candidate fails to submit the project report on or before the specified deadline, he / she can be granted an extension of time up to a maximum limit of 5 days for the submission of project work, by the Head of the Department.

- If he / she fails to submit the project report, even beyond the extended time, then he / she is deemed to have failed in the Project Work and shall register for the same in the subsequent semester and re-do the project after obtaining permission from the HoD and Faculty Head.

14. REQUIRMENTS FOR PASS

- A candidate should secure not less than 50% of total marks prescribed for the courses, subject to securing a minimum of 30% marks out of Max. Mark in End Semester Exams. Then he / she shall be declared to have passed in the Examination.

- If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that he / she should continue to register and reappear for the examination till he / she secures a pass.

15. AWARD OF GRADES

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

RANGE OF MARKS FOR GRADES

Range of Marks	Letter Grade	Grade Points (GP)
90-100	A++	10
80-89	A+	9
70-79	B++	8
60-69	B+	7
50-59	C	6
00-49	RA	0
Absent	AAA	0
Withdrawal	W	0
Authorized Break of Study	ABS	0

CALCULATION FOR GPA & CGPA

The GPA & CGPA calculation on a 10 scale basis is used to describe the overall performance of a student in all courses from first semester to the last semester. RA (Reappear), AAA, W and ABS will be excluded for calculating GPA and CGPA.

$$GPA = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_{i=1}^{n} C_i} \qquad CGPA = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_{i=1}^{n} C_i}$$

Where C_i - The Credits assigned to the course

GP_i - The point corresponding to the grade obtained for each course

n - Number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

Final Degree is awarded based on the following	
CGPA ≥ 9.00	First Class - Exemplary
CGPA ≥ 7.50 < 9.00	First Class with Distinction
CGPA ≥ 6.00< 7.50	First Class
CGPA ≥ 5.00 < 6.00	Second Class

Minimum requirements for award of Degree: A student should have obtained a minimum of 5.0 CGPA.

16. GRADE SHEET

After revaluation results are declared, Grade Sheets will be issued to each student which will contain the following details:

- Name of the Candidate with Date of Birth and Photograph
- The programme and degree in which the candidate has studied
- The list of courses enrolled during the semester and the grade secured
- The Grade Point Average (GPA) for the semester

17. ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the B.E/B.Tech. Degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations in all the 8 semesters within the maximum period specified in clause 3.

i) Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

ii) Successfully completed the programme requirements and has passed all the courses prescribed in all the semesters within a maximum period of 6 years (5 Years for Lateral Entry Candidates) reckoned from the commencement of the first semester to which the candidate was admitted.

iii) Successfully completed any additional courses prescribed by the institution.

iv) No disciplinary action pending against the student.

v) The award of Degree must have been approved by the Board of Management of the institution.

18. CLASSIFICATION OF THE DEGREE AWARDED

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the EIGHT semesters in his/her first appearance within a maximum of 8 consecutive semesters (maximum of 6 semesters for Lateral entry students who join the course in the third semester) securing a overall CGPA of not less than 7.5 (Calculated from 1s t semester) shall be declared to have passed the examination in First Class with Distinction. Authorized Break of Study vide Clause 20, will be considered as an Appearance for Examinations, for award of First Class with Distinction. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction.

2. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 8 consecutive semesters (maximum of 6 semesters for Lateral entry students who join the course in the third semester) after his/her commencement of study securing a overall CGPA of not less than 6.0 (Calculated from 1st semester), shall be declared to have passed the examination in First Class. Authorized break of study vide Clause 20 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations. For award of First class, the extra number of semesters than can be provided (in addition to four years for Normal B.E / B.Tech and 3 years for Lateral Entry)will be equal to the Number of semesters availed for Authorized Break of Study or Lack of Attendance. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class.

3. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the EIGHT semesters within a maximum period of 12 consecutive semesters (10 consecutive semesters for Lateral Entry students, who join the course in the third semester) after his/her commencement of study securing a overall CGPA of not less than 5.0, (Calculated from 1st semester) shall be declared to have passed the examination in Second Class.

4. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification.

5. A candidate can apply for revaluation of his/her semester examination answer paper in a theory course, immediately after the declaration of results, on payment of a prescribed fee along with application to the Controller of Examinations through the HoD. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

19. WITHDRAWAL FROM EXAMINATIONS

- A candidate may, for valid reasons, (medically unfit / unexpected family situations) be granted permission to withdraw from appearing for the examination in any course or courses in any one of the semester examination during the entire duration of the degree programme.

- Withdrawal application shall be valid only if the candidate is otherwise normally eligible (if he/she satisfies Attendance requirements and should not be involved in Disciplinary issues or Malpractice in Exams) to write the examination and if it is made within FIVE days before the commencement of the examination in that course or courses and also recommended by the Faculty Head through HoD.

- Notwithstanding the requirement of mandatory FIVE days notice, applications for withdrawal for special cases under extraordinary conditions will be considered based on the merit of the case.

- Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class – Exemplary, First Class with Distinction and First Class.

- Withdrawal is NOT permitted for arrears examinations of the previous semesters.

20. AUTHORIZED BREAK OF STUDY

- This shall be granted by the institution Management, only once during the full duration of study, for valid reasons for a maximum of one year during the entire period of study of the degree programme.

- A candidate is normally not permitted to temporarily break the period of study. However, if a candidate would like to discontinue the programme temporarily in the middle of duration of study for valid reasons (such as accident or hospitalization due to prolonged ill health), he / she shall apply through the Faculty Head in advance (Not later than the Reopening day of that semester) through the Head of the Department stating the reasons. He/She should also mention clearly, the Joining date and Semester for Continuation of Studies after completion of break of Study. In such cases, he/she will attend classes along with the Junior Batches. A student who availed break of study has to rejoin only in the same semester from where he left.

- The authorized break of study will not be counted towards the duration specified for passing all the courses for the purpose of classification only for First Class.

- The total period for completion of the programme shall not exceed more than 12 consecutive semesters from the time of commencement of the course (not more than 10 semesters for those who join 3rd semester under Lateral entry system) irrespective of the period of break of study in order that he / she may be eligible for the award of the degree.

- If any student is not allowed to appear for final Examinations for not satisfying Academic requirements and Disciplinary reasons, (Except due to Lack of Attendance), the period spent in that semester shall NOT be considered as permitted 'Break of Study' and is NOT applicable for Authorized Break of Study.

- In extraordinary situations, a candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. Such extended break of study shall be counted for the purpose of classification of First Class Degree.

- If the candidate has not reported back to the department, even after the extended Break of Study, the name of the candidate shall be deleted permanently from the institution enrollment. Such candidates are not entitled to seek readmission under any circumstances.

21. PROFESSIONAL TRAINING

- Every student is required to undergo Industrial Visits during every semester of the Programme. HoDs shall take efforts to send the students to industrial visits in every semester.

- The students will have to undergo Professional training for a Minimum period of 3 weeks during the semester Holidays at the end of second year and Third Year respectively.

- This could be internship in a industry approved by the Faculty Head or Professional Enrichment courses (like attending Summer Schools, Winter Schools, Workshops) offered on Campus or in Registered Off Campus recognized Training Centers approved by the Faculty Head for a minimum period of 3 weeks.

- A report on Training undergone by the student, duly attested by the Coordinator concerned from the industry / Organization, in which the student has undergone training and the Head of the Department concerned, shall be submitted after the completion of training. The evaluation of report and viva voce examination can be computed as per norms for the Semester examination.

- The evaluation of training will be made by a three member committee constituted by Head of the Department in consultation with Batch Coordinator and respective Training Coordinator. A presentation should be made by the student before the Committee, based on the Industrial Training or Professional Enrichment undergone.

22. NON CREDIT COURSES

- Every student has the opportunity to enroll in any of the following Non Credit Courses, during the programme. The student will have to register for the courses with the respective coordinator before the end of First Semester.
- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- Youth Red Cross (YRC)
- SPORTS CONTRIBUTION: The student is involved in any sport and represents the institution in Tournaments.
- PROFESSIONAL CLUBS: Any student can also involve in any of the Professional Clubs available in the institution.

The above contribution should be completed by the end of sixth Semester (end of Pre-final year) as per the requirements. The Contribution and the Performance of the candidate, will be Printed in the Final Semester Grade sheet and Consolidate Grade Sheet under the Category "NON CREDIT COURSES" indicated as SATISFACTORY or NOT SATISFACTORY.

23. OPPORTUNITY TO GAIN EXPOSURE OUTSIDE THE INSTITUTION

This is facilitated by the "Centre for Academic Partnerships" of Sathyabama Institute of Science and Technology consisting of a team of experienced faculty members involved in forging Partnerships with Leading Universities, Educational Institutions, Industrial and Research establishments in India and Abroad.

- A student can be selected, to get Professional Exposure in his/her area of Expertise in any Reputed Research Organization or Educational Institution of repute or any Universities in India and abroad.
- This is possible only with the List of Research Organizations, Educational Institutions in India and abroad approved by Sathyabama Institute of Science and Technology.
- A student should have got a minimum of 6 CGPA without outstanding arrears at the time of applying and at the time of undergoing such courses outside, to avail this facility.
- The student can have the option of spending not more than three to Six months in the Final year or Pre-final year of his/her Degree. During this period, the student can do his/her Project work or register for courses which will be approved by the Centre for Academic Partnerships (CAP), under the Guidance of a Project Supervisor who is employed in the Organization and Co-guided by a staff member from our institution.
- Applications for the above should be submitted by the students to the Centre for Academic Partnerships (CAP), in the required format, with complete details of institution, Courses and Equivalence Details and approved by the Faculty Head.
- The Centre will go through the applications and select the students based on their Academic Performance and enthusiasm to undergo such courses. This will be communicated to the Universities Concerned by the Centre.
- The performance of the student in the courses, registered in that Institute or University will be communicated officially to Centre for Academic Partnerships (CAP).
- The students who undergo training outside the institution (either in India or Abroad) is expected to abide by all Rules and Regulations to be followed as per Indian and the respective Country Laws, and also should take care of Financial, Travel and Accommodation expenses.

24. DISCIPLINE

Every student is required to observe disciplined and decorous behaviour both inside and outside the institution and not to indulge in any activity which will tend to bring down the prestige of the institution. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the institution from time to time.

25. REVISION OF REGULATIONS AND CURRICULUM

The institution may from time to time revise, amend or change the regulations, scheme of examinations and syllabi if found necessary.

B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATIONS 2015 – CURRICULUM

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SHS1101	English for Science and Technology	3	0	0	3	1
	SCH1101	Environmental Science and Engineering	3	0	0	3	13
2	SMT1101	Engineering Mathematics – I	3	1	0	4	2
3	SPH1101	Physics of Engineering Materials	3	0	0	3	3
4	SCY1101	Engineering Chemistry	3	0	0	3	4
5	SCS1102	Fundamentals of Programming	3	0	0	3	5
6	SEE1101	Electricity and Magnetism	3	0	0	3	6
PRACTICAL							
1	SPH4051	Engineering Physics Lab	0	0	2	1	7
2	SCY4051	Engineering Chemistry Lab	0	0	2	1	8
3	SCS4101	Programming in C Lab	0	0	4	2	9
		TOTAL CREDITS				**23**	

SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SMT1105	Engineering Mathematics – II	3	1	0	4	10
2	SPH1102	Physics for Electronic Devices	3	0	0	3	11
3	SCY1102	Chemistry of Electronic Materials	3	0	0	3	12
4	SHS1101	English for Science and Technology	3	0	0	3	1
	SCH1101	Environmental Science and Engineering	3	0	0	3	13
5	SEC1101	Electronic Devices	3	0	0	3	14
6	SEE1106	Circuit Theory and Network Analysis	3	1	0	4	15
PRACTICAL							
1	SME4053	Engineering Graphics	1	0	2	2	16
2	SEE4052	Electrical circuits and Electronic Devices lab	0	0	4	2	17
		TOTAL CREDITS				**24**	

L – Lecture hours; T – Tutorial hours; P – Practical hours; C - Credits

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SMT1201	Engineering Mathematics - III	3	1	0	4	18
2	SME1210	Solid and Fluid Mechanics	3	0	0	3	19
3	SEC1203	Electronic Circuits	3	0	0	3	20
4	SEC1207	Digital Logic Circuits	3	0	0	3	21
5	SEE1202	Electromagnetic Theory	3	0	0	3	22
6	SEE1204	DC Machines & Transformers	3	0	0	3	23
PRACTICAL							
1	SEC4052	Electronic Circuits Lab	0	0	4	2	24
2	SEE4053	DC Machines and Transformers lab	0	0	4	2	25
		TOTAL CREDITS				**23**	

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SMT1204	Engineering Mathematics – IV	3	1	0	4	26
2	SCS1202	Object Oriented Programming	3	0	0	3	27
3	SME1208	Applied Thermal Engineering	3	0	0	3	28
4	SEE1203	Control Systems	3	1	0	4	29
5	SEE1206	Transmission and Distribution	3	1	0	4	30
6	SEE1205	AC Machines	3	0	0	3	31
PRACTICAL							
1	SCS4201	Object Oriented Programming lab	0	0	4	2	32
2	SEE4054	AC Machines Lab	0	0	4	2	33
3	S14PT1	Professional Training – 1	0	0	0	5	
		TOTAL CREDITS				**29**	

SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SEC1302	Analog Integrated Circuits	3	0	0	3	34
2	SIC1203	Measurements and Instrumentation	3	0	0	3	35
3	SEC1310	Microprocessor Interfacing and its Applications	3	0	0	3	36
4	SEE1301	Advanced Control Systems	3	1	0	4	37
5	SEE1302	Power System Analysis	3	1	0	4	38
6	SEE1304	Electrical Machine Design	3	1	0	4	39
PRACTICAL							
1	SEC4054	Integrated Circuits Lab	0	0	4	2	40
2	SEC4068	Microprocessor Lab	0	0	4	2	41
		TOTAL CREDITS				**25**	

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SEC1315	Digital Signal Processing & its Applications	3	0	0	3	42
2	SEE1305	Power Electronics	3	0	0	3	43
3	SEE1306	Electric Drives and Control	3	0	0	3	44
4	SEE1307	Special Electrical Machines	3	0	0	3	45
5	SEE1303	Power Generation and Utilization	3	0	0	3	46
6		Elective – I	3	0	0	3	
PRACTICAL							
1	SEE4055	Measurements and Controls Lab	0	0	4	2	47
2	SEE4056	Power Systems Lab	0	0	4	2	48
3	S14PT2	Professional Training – 2	0	0	0	5	
		TOTAL CREDITS				**27**	

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SEC1317	Principles of Embedded System	3	0	0	3	49
2	SEE1401	Power System Protection and Switchgear	3	0	0	3	50
3		Elective – 2	3	0	0	3	
4		Elective – 3	3	0	0	3	
PRACTICAL							
1	SEC4071	Embedded System Design Lab	0	0	4	2	51
2	SEE4057	Power Electronics Lab	0	0	4	2	52
3		Project Work – Phase 1					
		TOTAL CREDITS				**16**	

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SBA1101	Principles of Management and Professional Ethics	3	0	0	3	53
2	SEE1402	High Voltage Engineering	3	0	0	3	54
3		Elective – 4	3	0	0	3	
4		Project Work (Phase 1 & 2)	0	0	30	15	
		TOTAL CREDITS			:	**24**	
		TOTAL CREDITS FOR THE COURSE			:	**191**	

ELECTIVE COURSES

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
		GROUP A					
1	SEC1304	Fundamentals of Communication Engineering	3	0	0	3	55
2	SEC1316	CMOS VLSI Design	3	0	0	3	56
3	SEC1402	Programming in HDL	3	0	0	3	57
4	SEC1602	ASIC Design	3	0	0	3	58
5	SEE1601	Flexible AC Transmission System	3	0	0	3	59
6	SEE1602	Power System Dynamics	3	0	0	3	60
7	SEE1603	Power System Operation and Control	3	0	0	3	61
8	SEE1604	EHV AC and DC Transmission	3	0	0	3	62
9	SEE1605	Power System Restructuring and Deregulation	3	0	0	3	63
10	SEE1606	Static Relays	3	0	0	3	64
11	SEE1607	Renewable Energy Systems	3	0	0	3	65
12	SEE1608	Computer Aided Design	3	0	0	3	66
13	SEE1609	Computer Aided Design of Electrical Equipment	3	0	0	3	67
		Group B					
1	SEC1606	Digital Image Processing	3	0	0	3	68
2	SEC1609	Fundamentals of Fuzzy Logic and Artificial Neural Networks	3	0	0	3	69
3	SEC1617	Advanced Electronic Test Engineering	3	0	0	3	70
4	SEC1618	Programming in MATLAB	3	0	0	3	71
5	SIC1310	Theory of Robotics	3	0	0	3	72
6	SIC1311	Biomedical Instrumentation	3	0	0	3	73
7	SIC1605	Fiber Optics and Laser Instrumentation	3	0	0	3	74
8	SIC1608	Power Plant Instrumentation	3	0	0	3	75
9	SIC1611	Fundamentals of Mechatronics	3	0	0	3	76
10	SPR1307	Resource Management Techniques	3	0	0	3	77

SHS1101	ENGLISH FOR SCIENCE AND TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Read technical passages to do the following descriptive tasks and exercises: Listening for specific information, Self Introduction, Reading Comprehension, Kinds of Sentences, Parts of Speech, Tenses & its Types, Impersonal Passive, Elements of Effective Writing, Letter Writing, Concord, Prefixes & Suffixes

UNIT 2 **9 Hrs.**

Read technical passages to do the following descriptive tasks and exercises: Listening for inference, Describing a process,Cloze Readingand its types, Transcoding - Encoding & Decoding, Flow Chart, Bar chart, Pie Chart, Tabular Column, Tree Diagram - Connectives & Discourse Markers, Word Association- Connotations

UNIT 3 **9 Hrs.**

Read technical passages to do the following descriptive tasks and exercises: Listening and Note taking, Role-play, Reading and interpreting visual material (Pictures/newspapers) Essay Writing - Note Making - WH questions - Question Tags - Types of sentences - Compound Nouns, Technical Definitions

UNIT 4 **9 Hrs.**

Read technical passages to do the following descriptive tasks and exercises: Listening and Classifying information, Group discussion, Reading and identifying the topic sentence, - Writing a Project Proposal, Recommendations and Instructions - Manual Writing, Use of abbreviations and acronyms, Editing (Spelling, Grammar, Punctuation) Idioms & Phrases.

UNIT 5 **9 Hrs.**

Read technical passages to do the following descriptive tasks and exercises: Listening and summarizing, Making presentations on given topics – Giving impromptu talks Reading and Summarizing, E-mail writing, Rearranging the Jumbled sentences Reported Speech, Homophones/Homonyms, Creative Writing & Poster making using similes/metaphors

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Transform different forms of verb to appropriately use in sentences, change the voice, and edit errors related to subject verb agreement, Frame open ended questions to seek information with 70% accuracy.

CO2 - Identify the rhetorical functions involved and the inter-sequential relationships in reading passages and by summarizing identify and recognize main, relevant ideas in a text extract these ideas and reduce them to note form.

CO3 - Respond in written and oral form on issues presented in a given text as a individual/team, use cohesive devices appropriately in compare contrast and descriptive paragraph writing with 80% accuracy.

CO4 - Write emails and letters by responding to the situations

CO5 - Identify collocations, simile and metaphor, specific idioms and phrases while reading use them in paper pencil exercises - fill the blanks, choose apt option while completing the sentences.

CO6 - Categorize idioms and contextual guessing of words in reading passages, practice using homophones and connotations in given texts.

TEXT / REFERENCE BOOKS

1. Sangeetha Sharma &Meenakshi Raman Technical Communication: Principles and Practice.OxfordUniversity Press, New Delhi. 2011
2. Sanjay Kumar &PushpLata Communication Skills Oxford University Press, New Delhi 2011.
3. NiraKonar Communication Skills for Professionals PHI Publishers, New Delhi, Eastern Economy Edition (2nd Edition) 2011
4. Sharon J Gerson& Steven M Gerson Technical Communication: Process and Product, Orient, Longman (8th Edition) 2013
5. TyagiKavita and MisraPadma Basic Technical Communication PHI Publishers, New Delhi,Eastern Economy Edition 2011.

SMT1101	ENGINEERING MATHEMATICS I	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 **12 Hrs.**

Characteristic equation of a square matrix - Eigen values and Eigen vectors of a real matrix- properties of Eigen values- Cayley-Hamilton theorem (without proof) - verification , finding inverse and power of a matrix -Diagonalisation of a matrix using orthogonal transformation – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 **13 Hrs.**

Curvature–centre, radius and circle of curvature in Cartesian co- ordinate–Evolutes – Envelope of family of curves with one and two parameters. –Evolute as envelope of normals

UNIT 3 **11 Hrs.**

Introduction to partial derivatives-Jacobians- Taylor's expansion - Maxima and minima of functions of two variables – Constrained maxima and minima using Lagrange's multiplier method.

UNIT 4 **11 Hrs.**

First order exact differential equations – Second order linear differential equations with constant coefficients – Particular Integral for eax, sinax or cosax, xn,xneax, eaxsinbx or eaxcosbx - Equations reducible to linear equations with constant coefficients using x = et – Simultaneous first order linear equations with constant coefficients – Method of Variation of Parameters

UNIT 5 **13 Hrs.**

Direction cosines and ratios – Plane – Plane through intersection of two planes – Straight Line – Coplanar lines – Planes and Straight lines – Shortest distance between two Skew lines – Sphere –Plane section of a sphere – Great Circle.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Convert the quadratic form to canonical form by orthogonal transformation
CO2 - Construct the circle of curvature, evolutes and envelopes of any curve
CO3 - Analyze the maxima and minima of functions of several variables
CO4 - Solve any higher order linear ordinary differential equations
CO5 - Formulate equations of straight lines and planes.
CO6 - Create equations of spheres with various properties

TEXT / REFERENCE BOOKS

1. Veerarajan T, Engineering Mathematics for First Year, II Edition, Tata McGraw Hill Publishers, 2008.
2. Kandaswamy P & co., Engineering Mathematics for First Year, IX revised edition, S.Chand&Co Pub., 2010
3. Moorthy M.B.K, Senthilvadivu K ,Engineering mathematics-I, Revised Edition,VRB Pub., 2010
4. Arumugam S & co. Engineering Mathematics Vol-I , Revised Edition, SciTech Pub., 2010
5. VenkataramanM.K., Engineering Mathematics- First Year (2nd edition), National Publishing Co., 2000.
6. Kreyszig. E, Advanced Engineering Mathematics, 10th edition, John Wiley&Sons, Singapore, 2012.
7. Grewal B. S, Higher Engineering Mathematics, 41th Edition, Khanna Publications, Delhi,2011.

SPH1101	PHYSICS OF ENGINEERING MATERIALS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 CHARACTERIZATION OF MATERIALS **9 Hrs.**

Introduction, Structural characterization - X-ray diffraction, Bragg's law, Determination of crystal structure - powder X-ray diffractometer (Debye Scherrer camera) and Single crystal XRD with principle, construction and working, Microstructural characterization – Introduction, electromagnetic lens system, Determination of surface morphology by Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) and Atomic Force Microscope (AFM) with principle, construction and working. Microhardness testing –Determination of microhardness by Vickers hardness test, Knoop hardness test and Nanohardness test with principle, construction, and working.

UNIT 2 MAGNETIC MATERIALS **9 Hrs.**

Introduction, Origin of magnetic moment – orbital, spin and nuclear magnetic moments;Bohr magneton; Classification of magnetic materials based on spin– dia, para, ferro, antiferro and ferri- Curie temperature, Neel temperature.; Magnetic domains- Domain theory of Ferro magnetism (Weiss theory) – Observation of domain (bitter powder pattern), Energies involved in domain formation - magnetostatic energy, anisotropic energy, magnetostrictive energy and domain wall energy; Hysteresis Curve -based on domain theory; Types of magnetic materials– soft and hard magnetic materials; Magnetic bubbles – formation and propagation of magnetic bubbles-T-bar, read/write operation.

UNIT 3 SUPERCONDUCTING MATERIALS **9 Hrs.**

Introduction to superconductivity-Properties of superconductor - electrical resistance, Meissner Effect, effect of heavy magnetic field, effect of heavy current (Silsbee's rule), effect of high pressure , isotope effect, entropy, specific heat capacity, energy gap, London Penetration depth, Coherence Length, Ginzburg Landau Parameter, Flux Quantization and thermal conductivity. Theory of superconductivity- London Theory (Macroscopic), Bardeen, Cooper and Schrieffer Theory (Microscopic) - explanation based on formation of Cooper pairs and existence of energy gap. Types of superconductors - Type I and Type II superconductors, D.C. and A.C Josephson Effect, I-V Characteristics and applications of Josephson junction.Applications - cryotron, magnetic levitation train and SQUIDS.

UNIT 4 OPTICAL MATERIALS **9 Hrs.**

Introduction, refractive index, absorption and dispersion, reflections. Classification of optical materials, absorption in metals, semiconductors and insulators (dielectrics), Excitons- Frenkel and Mott-Wannier excitons, Point detects -Frankel and Schottky defects, Traps – trapping and recombination centres - Colour Centres –types - F-Centre, R-Centre, V-Centre (V1 and V2), M –Centre. Luminescence – Principle and classification – Mechanism and working of Photo luminescence (Fluorescence and Phosphorescence).

UNIT 5 SEMICONDUCTING MATERIAL **9 Hrs.**

Introduction – Band theory (qualitative), types of semiconductors- intrinsic semiconductor - carrier concentration and Fermi level in intrinsic semiconductor - extrinsic semiconductor - carrier concentration and Fermi level in extrinsic semiconductor (p type and n type) - Experimental determination Band gap of semiconductor -Hall Effect - experimental determination of Hall Voltage, Applications of Hall effect.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the mechanism of XRD, SEM, TEM, AFM and analyse the structure and hardness of the materials.
CO2 - Appreciate the role of quantum physics in the field of magnetic storage devices.
CO3 - Apply the concept of superconductivity in cryotron, maglev train and SQUID.
CO4 - Explain the interaction of light with conductors, semiconductors and insulators.
CO5 - Demonstrate the band theory and calculate the energy band gap of the semiconducting materials
CO6 - Analyse the different types of the semiconductors.

TEXT / REFERENCE BOOKS

1. Willam D Callister, Materials Science and Engineering an introduction, 6th Edition, john-Wiley and Sons, 2004.
2. Avadhanulu M.N.and Kshirsagar P.G., Engineering Physics, 2nd Edition, S.Chand and Company, 2007.
3. Rajendran.V, Marikani.A, Materials Science, 8th Reprint, Tata McGraw-Hill, 2008.
4. Sankar B.N. and Pillai S.O, A text book of Engineering Physics, 1st Edition, New Age international Publishers, 2007.
5. Arumugam.M, Semiconductor Physics and Optoelectronics, 1st Edition, Anuradha Publishers, 2003.
6. Wilson.J and Hawkes. J.F.B., Optoelectronics - An introduction, 2nd Edition, Prentice-Hall of India, 2001.
7. Gaur. R.K and Gupta. S.L., Engineering Physics, 8th Edition, Dhanbat Rai Publications, 2007.
8. Cullity B.D., Principles of X-ray diffraction, 3rd Edition, Prentice Hall, 2001.
9. Mott.W, Micro indentation Hardness Testing, Butterworth Scientific publication, London, 1965.

SCY1101	ENGINEERING CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 SYNTHESIS OF NANOMATERIALS **9 Hrs.**

Introduction: Nanomaterials: Definition - Classification based on dimensions - Size dependent properties.Types of nanomaterials: Nanoparticles: Synthesis by chemical reduction method. Nanoporous materials: Synthesis by sol-gel method. Nanowires: Synthesis by VLS mechanism. Carbon Nanotubes (CNTs): Single walled and multiwalled nanotubes - Mechanical and electrical properties of CNTs - Applications of CNTs - Synthesis of CNTs by electric arc discharge method and laser ablation method.

UNIT 2 WATER TECHNOLOGY **9 Hrs.**

Introduction: Water quality parameters - Contamination of water by arsenic, lead, fluoride, mercury and their removal. Hardness: Types - Expression - Units. Estimation of hardness of water by EDTA method - Problems. Estimation of iron, calcium and magnesium: AAS method. Water softening: Zeolite process – Demineralization process. Desalination: Reverse osmosis - Electrodialysis.

UNIT 3 ELECTROCHEMICAL POWER SOURCES **9 Hrs.**

Electrochemistry: Galvanic cell - Electrochemical cell representation - EMF series and its significance. Batteries: Terminology - Lead-acid accumulator - Nickel-cadmium batteries. Lithium batteries: Li/SOCl2 cell - Li/I2 cell - Lithium ion batteries. Fuel Cells: Hydrogen-oxygen fuel cells - Solid oxide fuel cell (SOFC).

UNIT 4 CORROSION SCIENCE **9 Hrs.**

Introduction: Definition. Types: Dry corrosion: Mechanism - Pilling-Bedworth rule - Wet Corrosion: Mechanism. Types: Galvanic corrosion and differential aeration cell corrosion. Galvanic series and its significance. Factors influencing corrosion. Corrosion prevention: Material selection and design - Cathodic protection. Protective coatings: Paints - Constituents. Mechanism of drying of drying oils.

UNIT 5 POLYMER CHEMISTRY **9 Hrs.**

Introduction to polymers: Nomenclature - Functionality. Types of polymerization. Mechanism of polymerization: Free radical mechanism - Cationic mechanism - Anionic mechanism. Plastics: Types - Thermoplastics and thermosetting plastics. Properties: Strength - Crystalline and amorphous state – Average molecular weight - Polydispersity. Compounding of plastics. Moulding of plastics: Compression moulding – Injection moulding - Extrusion moulding. Introduction to conducting polymers.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the various synthetic methods and properties of nano materials
CO2 - Analyse the hardness of water
CO3 - Illustrate the charging and discharging characteristics of secondary batteries
CO4 - Designing of materials for corrosion prevention.
CO5 - Discuss the moulding techniques and types of polymerization mechanism.
CO6 - Relate the basic chemistry concepts in science and technology

TEXT / REFERENCE BOOKS

1. Jain P.C. and Monica Jain, Engineering Chemistry, 15th Edition Dhanpat Rai Publishing Co., 2009.
2. Dara S.S., Text Book of Engineering Chemistry, S. Chand & Co, 2008.
3. Sheik Mideen A., Engineering Chemistry (I & II),13th Edition, Shruthi Publishers, 2010.
4. Kuriakose J.C. and Rajaram J., Chemistry in Engineering and Technology". Vol.1 & 2, 5th reprint, Tata McGraw Hill Publishing Company (P) Ltd., 2010.
5. Sharma B.K., Engineering Chemistry, 2nd Edition, Krishna Prakasam Media (P) Ltd., 2001.
6. Mars G Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw Hill, 2008.
7. David Linden, Thomas B Reddy, Handbook of Batteries, 4th Edition, McGraw-Hill, 2010.

SCS1102	FUNDAMENTALS OF PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Algorithms & flowcharts - Overview of C - Features of C - Structure of C program – Compilation & execution of C program - Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, and local and global variables – Operators: arithmetic, logical, relational, conditional and bitwise operators– Special operators: sizeof () & comma (,) operator – Precedence and associativity of operators & Type conversion in expressions – Input and output statements.

UNIT 2 **9 Hrs.**

Conditional statements – Looping statements – Functions: Library Functions – User Defined – Function Prototype - Function Definition – Types of Functions – Functions with and without Arguments Functions with no return and with Return Values - Nested Functions - Recursion.

UNIT 3 **9 Hrs.**

Arrays: Single and Multidimensional Arrays – Array Declaration and Initialization of Arrays – Array as Function Arguments.
Strings: Declaration – Initialization and String Handling Functions.
Structure and Union: Definition and Declaration – Nested Structures – Array of Structures – Structure as Function Argument – Function that Returns Structure – Union

UNIT 4 **9 Hrs.**

Storage Class Specifier: Auto, Extern, Static, & Register.
Pointers: The '&' and ' *' Operators – Pointers Expressions – Arrays Using Pointers – Structures Using Pointers – Functions Using Pointer – Function as Arguments – Command Line Arguments.

UNIT 5 **9 Hrs.**

DMA functions: malloc(), calloc(), sizeof(), free() and realloc(). Preprocessor directives.
File management: File operations - opening & closing a file, input and output statements, Control statements.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend fundamental concepts of programming, design algorithm and flowchart for any given problem and evaluate expressions based on precedence.
CO2 - Develop Modular Programming and formulate recursive solutions for given problems.
CO3 - Construct programs using array, structure and union data representations.
CO4 - Decide on suitable techniques like Storage Classes and Pointers for a relevant problem.
CO5 - Apply preprocessor directives for Memory Management.
CO6 - Create programs to implement File concept for various applications.

TEXT / REFERENCE BOOKS

1. ReemaThareja, "Programming in C", 2nd ed., Oxford University Press, 2016.
2. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.2. Yashavant P. Kanetkar, 'LET US C', Fifth Edition.
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.
4. Mahapatra, 'Thinking in C', PHI publications,2nd Edition.
5. C How to Program Plus MyLab Programming with Pearson eText - Access Card Package (8th Edition).
6. Subburaj. R, 'Programming in C', Vikas Publishing, First Edition, 2000.

SEE1101	ELECTRICITY AND MAGNETISM	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **10 Hrs.**

Electrical quantities, Ohm's Law, Resistors - Series and parallel combinations, Kirchhoff's laws, Node and Mesh Analysis, Star Delta Transformation.

UNIT 2 **7 Hrs.**

Definition of MMF, Flux and Reluctance - Leakage Factor - Reluctances in Series and Parallel (Series and Parallel Magnetic Circuits) - Analogy of Electric and Magnetic Circuits.

UNIT 3 **11 Hrs.**

Sinusoidal Functions - RMS(effective) and Average Values - Phasor Representation - J operator – Sinusoidal Excitation Applied to Purely Resistive - Inductive and Capacitive Circuits - RL - RC and RLC Series and Parallel Circuits- Power and Power Factor - Introduction to Three Phase Systems - Types of Connections, Relationship between Line and Phase Values.

UNIT 4 **10 Hrs.**

Time Domain Analysis - Transient response of RL, RC & RLC Networks with DC Input and Sinusoidal AC input- Series and Parallel resonance - Quality Factor and Bandwidth.

UNIT 5 **7 Hrs.**

Network Topology - Basic concepts of Graph Theory, Network Graph, Tree, Incidence & Reduced Incidence Matrices, Cut sets, Tie sets, Cut Set Schedule, Tie set Schedule - Duality and Dual Networks.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply basic principles to solve D.C Circuits.
CO2 - Analyze simple and composite magnetic circuits.
CO3 - Design a suitable AC circuit for a given problem.
CO4 - Solve Complex problems in Electrical networks using cutset and tieset techniques
CO5 - Examine the performance of electrical Circuit in Steady State and Transient Condition.
CO6 - Evaluate the performance of A.C Circuits under resonance conditions.

TEXT / REFERENCE BOOKS

1. Mittle B.N., Aravind Mittle, "Basic Electrical Engineering", Tata McGraw Hill", 2nd Edition, July 2017.
2. Theraja B.L., "Fundamentals of Electrical Engineering and Electronics", S.Chand & Co., First Multi colour Edition, 2006, (Reprint 2009).
3. Sudhakar & Shyammohan S Palli, "Electrical Circuits and Networks Analysis and Synthesis", Tata McGraw Hill, 5th Edition, 2015.
4. V.K.Metha & Rohit Metha," Principles of Electrical Engineering and Electronics", Chand Publications,2010.
5. Charles Alexander, Mathew Sadiku,"Fundamentals of Electric Circuits", Tata McGraw Hill, 6th Edition, 2017.
6. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI Learning Private Ltd, 2nd Edition, 2010.
7. Wadhwa C.L., "Basic Electrical Engineering", New Age International, 4th Edition, 2007, Reprint June 2010.
8. Abhijit Chakrabarti, Sudipta nath & Chandan Kumar Chanda, "Basic Electrical Engineering", Tata McGraw Hill, 1st Edition, 2010..
9. Thyagarajan T., "Fundamentals of Electrical and Electronics Engineering", Sci Tech Publications, 5th Edition, 2015.

SPH4051	ENGINEERING PHYSICS LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

SUGGESTED LIST OF EXPERIMENTS

(Any SIX)

1. Quincke's method – Determination of magnetic susceptibility of a liquid.
2. Semiconductor diode - Determination of the forbidden energy gap.
3. Optical Fibre – Determination of Numerical aperture and attenuation loss. .
4. Torsional pendulum – Determination of Moment of inertia and Rigidity modulus of the wire.
5. Young's modulus – non-uniform bending- Determination of Young's modulus of the material of beam. .
6. Spectrometer – Hollow prism – Determination of Refractive index of a liquid. .
7. Copper Voltameter – determination of electrochemical equivalent of copper.
8. Lees Disc – Determination of thermal conductivity of bad conductor.
9. LASER grating – Determination of wavelength of laser light.
10. Newton's Rings – Determination of Radius of Curvature of convex lens.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Calculate the magnetic susceptibility of a liquid by employing Quincke's Tube, electro-magnet and Travelling microscope.
CO2 - Verify the wavelength of LASER light by employing LASER light source and diffraction grating element.
CO3 - Evaluate the numerical aperture and attenuation loss of the optical fiber by employing LASER light source.
CO4 - Estimate the moment of inertia and rigidity modulus of the steel wire using Torsional pendulum.
CO5 - Determine the Young's modulus of the material of beam using non-uniform bending.
CO6 - Validate the refractive index of water using spectrometer.

SCY4051	ENGINEERING CHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

SUGGESTED LIST OF EXPERIMENTS

1. Estimation of total hardness of water sample by EDTA method
2. Estimation of mixture of acids by conductometric method.
3. Estimation of glycine by sorensen's method
4. Estimation of Ferrous ion by potentiometric method.
5. Determination of viscosity of polymers by using Ostwald's viscometer.
6. Estimation of Iron by photocolorimeter.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Estimate ionic conductance (Λc) in samples.
CO2 - Evaluate the amino acid content in samples.
CO3 - Construct the redox cell and measure emf (Ecell) of the cell.
CO4 - Analyse the hardness in water samples.
CO5 - Relate viscosity (η) in determining molecular weight of a polymer.
CO6 - Assess the iron content in samples by photocolorimetry.

TEXT / REFERENCE BOOKS

1. Jeffery G. H., Bassett J., Mendham J., and Denney R. C.,, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearsons Education, 2004.
2. Kolthoff I. M., and Sandell E. B., Text Book of Qualitative Inorganic Analysis, 3rd Edition, The Macmillan Company; 1956.

SCS4101	PROGRAMMING IN C LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Program to understand the basic data types and input/output functions.
2. Program for Looping and decision statements.
3. Program on Functions.
4. Program on Arrays.
5. Program on String Manipulations
6. Program on Structures and Union.
7. Program on Pointers.
8. Program to demonstrate the Command Line Arguments.
9. Program using Dynamic memory allocation.
10. Program to implement the Random Access in Files.
11. Program to implement math function.
12. Program to Implement sorting algorithms
13. Program to Implement searching algorithms
14. Programs to solve some of the Engineering applications.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Illustrate the flowchart and design the algorithm for a given problem.
CO2 - Develop programs for basic engineering application.
CO3 - Decide and employ suitable control statements for the given problem.
CO4 - Construct C programs for searching and sorting.
CO5 - Design programs implementing pointer concepts.
CO6 - Create applications demonstrating concepts of file operations.

TEXT / REFERENCE BOOKS

1. ReemaThareja, “Programming in C”, 2nd ed., Oxford University Press, 2016.
2. PradipDey and Manas Ghosh, “Computer Fundamentals and Programming in C”,2nd ed., Oxford University Press, 2013.
3. YashavantKanetkar, “Let us C”, 15th ed., BPB Publications, 2017.
4. Paul J. Deitel and Harvey Deitel, “C How to Program”, 7th ed., Pearson Education 2013

SMT1105	ENGINEERING MATHEMATICS II	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 MULTIPLE INTEGRALS **13 Hrs.**

Double integrals in cartesian and polar co-ordinates – Change the order of integration – Change of variables from cartesian to polar coordinates– Area of plane curves using double integrals- Triple integrals - Volume using triple integrals in cartesian co-ordinates (simple applications).

UNIT 2 BETA AND GAMMA INTEGRALS **11 Hrs.**

Properties of definite Integrals and problems-Beta and Gamma integrals- Relation between them – Properties of Beta and Gamma integrals with proofs –Evaluation of definite integrals in terms of Beta and Gamma function – Simple applications(evaluation of double integrals).

UNIT 3 VECTOR CALCULUS **12 Hrs.**

Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields - Vector Integration – Simple problems on line, surface and volume Integrals, Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (without proofs)– Simple applications involving cubes and rectangular parallelopipeds.

UNIT 4 LAPLACE TRANSFORM **14 Hrs.**

Laplace transform – Transforms of standard functions – properties– Transforms of derivatives and integrals – Transforms of the type eatf(t), tf(t),f(t)/t -Transform of periodic functions – Transform of unit step function and impulse function-Inverse Laplace transforms – Convolution theorem – Initial and final value theorems

UNIT 5 APPLICATIONS OF LAPLACE TRANSFORM **10 Hrs.**

Linear ordinary differential equation with constant co-efficients – Integral equations -Integral equations of convolution type - simultaneous linear differential equations with constant co-efficients.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Evaluate multiple integrals in various coordinate systems
CO2 - Analyse relationship between Beta and Gamma functions and its applications
CO3 - Apply various integral theorems on vector valued and scalar valued functions
CO4 - Use Laplace Transform and Inverse Laplace Transform of various types of functions and its properties
CO5 - Solve ordinary differential equations using Laplace Transform methods
CO6 - Solve Simultaneous differential equations and integral equations using Laplace Transform methods

TEXT / REFERENCE BOOKS

1. Kreyszig. E, Advanced Engineering Mathematics, 10th edition, John Wiley&Sons, Singapore, 2012.
2. Grewal B. S, Higher Engineering Mathematics, 41th Edition, Khanna Publications, Delhi,2011.
3. Bali N.P and Manish Goyal, A Text book of Engineering Mathematics, Eigth Edition, Laxmi Publications Pvt Ltd., 2011.
4. Venkatraman M.K, Engineering Mathematics, National Publishing Company, 2000.
5. NarayananS., ManicavachagomPillay T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I, 2nd Edition, S. Viswanathan Printers and Publishers, 1992.

SPH1102	PHYSICS OF ELECTRONIC DEVICES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FIBRE OPTICS **9 Hrs.**

Introduction - principle of optical fibre transmission- fibre geometry - acceptance angle and numerical aperture - derivation, types of rays - Types of optical fibres -.Optical fibre materials – plastic and glass fibres- Manufacturing processes – Double crucible technique and vapour phase deposition technique. Transmission characteristics of optical fibres - attenuation and distortion. Fibre splicing – fusion and mechanical splicing. Fibre connectors – butt joint and expanded beam connectors. Optical fibre communication system (block diagram) - advantages and its general applications. **(Numerical Problems can be asked in Part-A).**

UNIT 2 DIGITAL ELECTRONICS **9 Hrs.**

Number systems - Binary, decimal, Hexadecimal and Octadecimal - Conversion from one number system to another. Binary addition, Subtraction - Subtraction by 1's & 2's complement,BCD addition, Excess 3 code and gray code, ASCII code

UNIT 3 SENSOR DEVICES **9 Hrs.**

Introduction - voltage and current sensors, Light Dependent Resistor (LDR), photodiode, strain gauges,thermistor, pressure sensor – Bourdon tube, temperaturesensor - thermocouple, magnetic sensor – Hall effect sensor, nanosensors and their applications.

UNIT 4 DISPLAY DEVICES **9 Hrs.**

Introduction, luminescence, electroluminescence, active display devices, cathode ray tube, light emitting diode, LED materials, passive display devices, liquid crystal displays-working, comparison LED and LCD, plasma display, dynamic scattering display, Touch screen.

UNIT 5 NANO DEVICES **9 Hrs.**

Definition, Fabrication-Top down approach and bottom up approach. Nanomagnets – Particulate Nanomagnets, Geometrical Nanomagnets, Magneto Resistance – Ordinary Magneto Resistance, Giant Magneto Resistance, Tunneling Magneto Resistance, Injection Laser – Quantum Cascade Laser – Optical Memories and Coulomb Blockade Devices.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the principles of light transmission to optical fibres communication system and analyse the transmission loss, coupling of light..

CO2 - Analyse the advantages of number system and 2's complement method among the existing systems.

CO3 - Illustrate the fundamental principles and working of various types of sensors such as thermal, magnetic, nano, strain, pressure and light sensors.

CO4 - Appreciate the science behind the working of LED, LCD, Plasma display, dynamic scattering display, Touch screen.

CO5 - Describe the quantum principles in advanced data storage techniques such as Giant Magneto Resistance (GMR), Tunneling Magneto resistance (TMR), Quantum lasers.

CO6 - Compare the mechanism of ILD with nano-structured lasers as optical memory through band theory.

TEXT / REFERENCE BOOKS

1. Gerd Keiser, Optical fibre communication, 4th Edition, Tata Mc Graw Hill, 2011.
2. John M. Senior, Optical fibre communications - Principle and Practice, 2nd Edition, Pearson Education, 2006.
3. Franz J.H, Jain V.K, Optical communication – Components and Systems, 1st Edition, Narosa Publications, 2001.
4. Rajagopal.K, Text book of Engineering Physics, Part-I, 1st Edition, Prentice Hall of India, 2008
5. Leach, Malvino and Goutam Saha, Digital Principles and applications, 7th Edition, McGraw Hill, 2011.
6. William H. Gothman, Digital electronics – An introduction to theory and practice, 2nd Edition, PHL of India, 2007.
7. Rajendran.V,.Marikani.A, Materials Science, 8th Reprint, Tata McGraw-Hill, 2008.
8. Avadhanulu. M.N. and. Kshirsagar. P.G, Engineering Physics, 2nd Edition, S. Chand & Company, 2007.

SCY1102	CHEMISTRY OF ELECTRONIC MATERIALS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO MOLECULAR ELECTRONICS 9 Hrs.

Introduction: Charge transport carriers: Soliton - Polaron and bipolaron. Conducting polymers: Polyacetylene - Polyaniline. Applications of conducting polymers. Polymer Structures for LEDs: Polyphenylenes - Polythiophene. Photoresists for electronics. Molecular devices based on conducting polymers.

UNIT 2 INSTRUMENTAL METHODS OF ANALYSIS 9 Hrs.

Introduction - Absorption of radiation. UV-Visible spectrophotometer: Instrumentation -Applications. IR spectrophotometer - Instrumentation - Applications. Thermal methods of analysis: Thermogravimetry (TGA) - Differential Thermal Analysis (DTA) - Differential Scanning Calorimetry (DSC). Sensors: Oxygen sensors – Glucose sensor. Cyclic Voltammetry for Redox systems.

UNIT 3 THIN FILM TECHNIQUES 9 Hrs.

Introduction: Lithography. Thin-film deposition: Chemical vapour deposition - Physical vapour deposition: Pulsed laser and atomic layer deposition. Epitaxy: Vapour phase epitaxy - Liquid phase epitaxy - Molecular beam epitaxy. Evaporation: Thermal vaporation and e-beam evaporation. Sputtering techniques: Direct current (DC) sputtering and radio frequency (RF) sputtering. Preparation of Si/Ge semiconductors - Czochralski crystal growth technique: Doping of semiconductors by Ion implantation.

UNIT 4 INSULATING MATERIALS 9 Hrs.

Electrical Insulating Materials: Introduction - Requirements. Classification based on substances: Gaseous, liquid and solid insulating materials. Preparation, properties and applications of SF6, Epoxy resin, ceramic products: white wares and glass - Transformer oil. Electrical resistivity: Factors influencing electrical resistivity of materials - Composition, properties and applications of high resistivity materials: Manganin - Constantan - Molybdenum disilicide - Nichrome.

UNIT 5 CHEMINFORMATICS 9 Hrs.

Introduction: Computer representation of chemical compounds: Line notations - Wiswesser line notation – ROSDAL notation - SMILES coding - Advantages and disadvantages of different types of notations. Standard structure exchange formats: Structure of Mol files and SD files. Chemical structure drawing softwares. Molecule editors: CACTVS molecule editor - Chemdraw - ChemSketch - Chemwindow. Searching chemical structure: Similarity search.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the conduction mechanism for molecular devices based on conducting polymers.
CO2 - Assess the principle and working of spectrophotometer and sensors.
CO3 - Elaborate the thin film techniques for the development of nanomaterials.
CO4 - Comprehend the electrical insulating materials and high electrical resistivity materials.
CO5 - Identifying the various chemical line notations and software for learning the structure of organic compounds.
CO6 - Relate the basic chemistry concepts in science and technology

TEXT / REFERENCE BOOKS

1. Ziaie B., “Introduction to Micro/Nanofabrication”, Springer, 2010.
2. Andrew Leach, “An Introduction to Cheminformatics”, Springer, 2009.
3. Johann Gasteiger and Thomas Engel (Ed.), “Cheminformatics: A Textbook”, Wiley-VCH, 2003.
4. Hagen Klauk, “Organic Electronics: Materials, Manufacturing and Applications”, Wiley, 2006.
5. Dara S.S., “Text Book of Engineering Chemistry”, S. Chand & Co, 2008.
6. Sheik Mideen A., “Engineering Chemistry (I & II)”, 13th Edition, Shruthi Publishers, 2010.
7. Douglas A. Skoog and Donald M. West, “Principles of Instrumental Analysis”, 6th Edition, Cengage Learning, 2006.

SCH1101	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **10 Hrs.**

Definition, scope and importance, need for public awareness, forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, floods, drought, conflicts over water, dams-benefits and problems, mineral resources: use effects on forests and tribal people. water resources: use and over-utilization of surface and ground water, exploitation, environmental effects of extracting and using mineral resources, case studies food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources: Case studies. Land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification, role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles.

UNIT 2 **10 Hrs.**

Concept of an ecosystem, structure and function of an cosystem - producers, consumers and decomposers - energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Introduction to biodiversity, definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, biodiversity at global, national and local levels. India as a mega-diversity nation, hot-spots of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, endangered and endemic species of India, conservation of biodiversity, in-situ and ex- situ conservation of biodiversity.

UNIT 3 **9 Hrs.**

Definition - causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards. Solid waste management: causes, effects and control measures of urban and industrial wastes, role of an individual in prevention of pollution, pollution case studies, disaster management: floods, earthquake, cyclone and landslides.

UNIT 4 **8 Hrs.**

From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns, case studies, environmental ethics: issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Wasteland reclamation, consumerism and waste products - environment protection act: air (prevention and control of pollution) act - water (prevention and control of pollution) act, wildlife protection act; forest conservation act. Issues involved in enforcement of environmental legislation, Key initiatives of Rio declaration, Vienna convention, Kyoto protocol, Johannesburg summit and public awareness.

UNIT 5 **8 Hrs.**

Population growth, variation among nations, population explosion, family welfare programme, environment and human health, human rights, value education, HIV / AIDS, women and child welfare, role of information technology in environment and human health, case studies. Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain. Visit to a local polluted site-urban/rural/ industrial/agricultural-study of common plants, insects, birds-study of simple ecosystems, pond, river, hill slopes etc.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Recognize the need of conservation of natural resources for the future generations
CO2 - Differentiate the uniqueness of each and every ecosystem and biodiversity
CO3 - Identify the environmental pollution and to control them in a sustainable way
CO4 - Execute the possible solutions to manage the natural and manmade disasters for the sustainable living
CO5 - Distinguish the reasons for over population and give awareness to people through media to control population growth
CO6 - Solve the environment related problems by conserving the natural resources for the future generations

TEXT / REFERENCE BOOKS

1. Meenakshi. P, “Elements of Environmental Science and Engineering”, 1st Edition, Prentice Hall of India, New Delhi, 2009.
2. Ravikrishnan. A, “Environmental Science & Engineering”, 3rd Edition, Sri Krishna Publications, Chennai, 2008.
3. Wrigh. R. T & Nebel B.J, “Environmental science-towards a sustainable future by Richard”, 8th edition, Prentice Hall of India, NewDelhi, 2006.
4. Erach Bharucha, “Text Book of Environmental Studies”, 2nd Edition, University Press, Chennai, 2006.
5. Suresh K. Dhameja, “Environmental Science and Engineering” S K Kataria and Sons; 2013
6. Tyler Miller, “Environmental Science” G Cengage Learning; 14 edition, 2014.
7. Erach Bharucha “Textbook of Environmental Studies for Undergraduate Courses” Orient BlackSwan; Second edition, 2013

SEC1101	ELECTRONIC DEVICES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Intrinsic and Extrinsic semiconductor - Charge density, Mobility and Conductivity in Semiconductor, Drift and diffusion current, Continuity equation, PN junction - Energy band diagram of PN junction, Current components in PN junction, Junction capacitance - Application of diode - Diode switch, Clipper, Clamper and Voltage multipliers - Zener diode - Zener voltage regulators.

UNIT 2 **9 Hrs.**

Construction and Operation of NPN and PNP transistor - Current components in a transistor, Eber moll's Equation- Characteristics of CE,CB,CC configuration - Base width modulation, Transistor breakdown, Transistor biasing - Bias Stabilization and Compensation, Thermal runaway problems, Heat sinks, Switching characteristics.

UNIT 3 **9 Hrs.**

JFET- Construction, Operation and Characteristics, Expression for pinch off voltage and drain current – MOSFET Enhancement and Depletion mode operation and characteristics, Handling precautions of MOSFET, Gate capacitance - FET as VVR - Comparison of MOSFET and JFET - Comparison of BJT and JFET.

UNIT 4 **9 Hrs.**

SCR- UJT- Diac - Triac - Schotty barrier diode- Varactor diode - PIN diode - Tunnel diode - Gunn diode - Laser diode- Operation, Characteristics and Applications.

UNIT 5 **9 Hrs.**

Force on charged particle in electric field and magnetic field - Motion of charged particle in electric and magnetic field - Oscilloscopes-Features and uses, Types and models- CRO, Dual beam oscilloscope, Analog Oscilloscope, Digital oscilloscope Principles of CRT - Deflection and focusing of electron beam in CRT -Orientation of electric and magnetic field in CRT - Applications of CRO

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the voltage–current characteristics of semiconductor devices
CO2 - Describe the functioning of various Bipolar Junction Transistors and its biasing
CO3 - Analyse theb transfer and drain characteristics of the Field Effect Transistors (like JFET,MOSFET)
CO4 - Justify the characteristics of thyristor family devices, special diodes and its applications
CO5 - Comprehend the different oscilloscopes
CO6 - Develop Electronic Circuits for real world problems.

TEXT / REFERENCE BOOKS

1. Millman and Halkias, "Electronic devices and circuits", 2nd Edition, McGraw Hill Publication, 2007.
2. G.K.Mithal, "Basic Electronic Devices and circuits", 2nd Edition, G.K.Publishers Pvt. Ltd., 1998.
3. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2008.
4. Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.
5. Theodre. F. Boghert, 'Electronic Devices & Circuits', Pearson Education, VI Edition, 2003.

SEE1106	CIRCUIT THEORY AND NETWORK ANALYSIS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 NETWORK THEOREMS (BOTH DC & AC) 12 Hrs.

Superposition Theorem - Reciprocity Theorem - Thevenin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem.

UNIT 2 NETWORK FUNCTION AND ITS PARAMETERS 12 Hrs.

Network Functions - Driving Point Impedance - Transfer Functions - Poles and Zeros, Significance of Poles and Zeros - Determination of Network Function of One Port and Two Port Network - Network Parameters - Z,Y, h and ABCD- Conditions for Reciprocity - Parameter Conversion.

UNIT 3 TWO PORT NETWORKS 12 Hrs.

Image Parameters - Iterative Parameter - Image and Iterative Parameters in terms of Open Circuit and Short Circuit Network - Parameters of Important Networks - Lattice Network - T Network ,π Network - Twin Network -Network Conversions - Bartlett's Bisection Theorem and its Application - Interconnection of Two Port Networks.

UNIT 4 SYNTHESIS OF LC, RL AND RC NETWORK 12 Hrs.

Hurwitz polynomial - Routh Criterion - Positive Real function - Elementary Synthesis Procedure - Properties of LC, RC, and RL Driving Point Functions - Synthesis of LC, RC, RL and RLC Network using Foster and Cauer Forms- Constant Resistance Network - Synthesis of Transfer Admittance and Transfer Impedance with a One ohm Termination

UNIT 5 FILTERS, ATTENUATORS AND EQUALIZERS 12 Hrs.

Filters - Constant K - Low Pass Filter - High Pass Filter - Band Pass Filter - Band Stop Filter - m-Derived Filters - eliminating Half Section - Composite Filter, Attenuators-Design of Attenuators, Equalizers -Design of Equalizers

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the basic theorems in both AC and DC analysis.
CO2 - Determine transfer/impedance/admittance function for two port network using mesh/nodal analysis.
CO3 - Analyze the two port networks using various network parameters
CO4 - Synthesis the network using foster/cauer method.
CO5 - Design constant K, M-derived and composite filter in T type and pi type.
CO6 - Design a two port network for real time applications.

TEXT / REFERENCE BOOKS

1. Sudhakar & Shyammohan S Palli, "Electrical Circuits and Networks Analysis and Synthesis", Tata McGraw Hill, 3rd Edition, 2009.
2. S.Sivanagaraju, G.Kishor & C.Srinivasa Rao, "Electrical Circuit Analysis", Cengage Learning, 1st Edition, 2010.
3. W.H.Hayt, J.E.Kemmerly & S.M.Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 6th Edition, 2006.
4. Soni Gupta, "Electrical Circuit Analysis", Dhanpat Rai publications, 6th Edition, 1997 (Reprint 2007)
5. M.Arumugam & N.Premkumaran, "Electric Circuit Theroy", Khanna Publications, 4th Edition, 1989 (Reprint 2008).

SME4053	ENGINEERING GRAPHICS	L	T	P	Credits	Total Marks
		1	0	2	2	100

UNIT 1 **9 Hrs.**

Use of drafting instruments – BIS – Letttering – Vertical and Inclined – Dimensioning – Aligned and Unidirectional systems – Scaling – Importance of graphics in engineering applications ,Dividing a given straight line into any number of equal parts – Bisecting a given angle – Trisecting a right angle – Drawing a regular pentagon and hexagon given one side – Conic sections – Construction of ellipse, parabola and hyperbola by Eccentricity method.

UNIT 2 **9 Hrs.**

Types of projection - Introduction to orthographic projection – Orthographic projection of points lying in four quadrants – Projection of rectangular, square and circular planes.

UNIT 3 **9 Hrs.**

Orthographic projection of lines in first quadrant - Parallel to both the planes – Perpendicular to one plane – parallel to one plane and inclined to other plane – Inclined to both the planes - Orthographic projection of prisms, pyramids, cone and cylinder in first quadrant – Axis perpendicular to HP – Axis perpendicular to VP – Axis inclined to only one plane of projection – Change of position method only.

UNIT 4 **9 Hrs.**

Sectioning of prisms, pyramids, cylinder and cone in simple vertical positions with cutting planes perpendicular to one plane and parallel or inclined to other plane - Need for development of surfaces – Development of prisms, pyramids, cylindrical and conical surfaces

UNIT 5 **9 Hrs.**

Isometric scale – Isometric View and Isometric Projection of simple solids and combination of solids - Drawing orthographic views (plan, elevation and profile) of objects from their isometric views.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the fundamentals of engineering drawings, drawing instruments, drawing standards and practices to address the engineering problems.
CO2 - Apply the eccentricity method to develop the conic sections.
CO3 - Construct the orthographic projection for points lying in four quadrants and Develop the orthographic projections for planes.
CO4 - Develop the orthographic projections for solids and lines lying in the first quadrant.
CO5 - Analyze and construct the section of solids in simple positions and Construct the development of surfaces for frustum and truncated solids
CO6 - Develop the isometric projection for solids and combination of solids and orthographic projection from the isometric projection.

TEXT / REFERENCE BOOKS

1. Natarajan, K.V., “A text book of Engineering Graphics”, Dhalakshmi Publishers, 2006
2. Bhatt, N.D. and Panchal, V.M., “Engineering Drawing”, Charotar Publishing House, 2010
3. Venugopal, K. and Prabhu Raja, V., “Engineering Drawing and Graphics + AutoCAD”, New Age International, 2009.
4. SP 46: “Engineering Drawing Practice for schools and colleges”, Bureau of Indian Standards.

SEE4052	ELECTRICAL CIRCUITS AND ELECTRONIC DEVICES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

Electrical circuits Lab

1. Verification of Kirchoff's Law.
2. Verification of Theorems.
3. Series and Parallel A.C circuits.
4. R-L and R-C transients with DC transients.
5. Series and Parallel Resonance.
6. Clippers and Clampers.

Electronic Devices Lab

1. Characteristics of Semiconductor diode and Zener diode to find static and dynamic resistance from the characteristics.
2. Characteristics of CB configuration.
3. Characteristics of CE configuration.
4. Drain and transfer characteristics of JFET. To obtain gain, transconductance and amplification factor.
5. Characteristics of SCR, find holding current, break over voltage and holding voltage.
6. Characteristics of UJT, find intrinsic stand off ratio, Peak voltage and valley voltage.
7. Characteristics of LDR with illumination and without illumination.
8. Voltage multipliers.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the basic Electrical Laws and Verify them by feeding different excitation for the circuit.
CO2 - Solve the electrical networks by implementing network theorems and also obtain the characteristics of Light Dependant Resistor.
CO3 - Determine the bandwidth, selectivity, Q-factor for a series and parallel resonance circuits and initial conditions for RL and RC Transients.
CO4 - Analyze the characteristics of Current controlled and voltage controlled transistors.
CO5 - Evaluate various parameters from the characteristics of SCR, UJT.
CO6 - Develop the hardwired circuit for real time applications by using semiconductor diodes.

SMT1201	ENGINEERING MATHEMATICS III	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 COMPLEX VARIABLES **11 Hrs.**

Analytic functions – Cauchy- Riemann equations in cartesian and polar form – Harmonic functions - properties of analytic functions – Construction of analytic functions using Milne – Thompson method – Bilinear transformation.

UNIT 2 COMPLEX INTEGRATION **12 Hrs.**

Cauchy's integral theorem – Cauchy's integral formula – problems - Taylor's and Laurent's series – Singularities – Poles and Residues – Cauchy's residue theorem and problems.

UNIT 3 FOURIER TRANSFORMS **12 Hrs.**

The infinite Fourier transform – Sine and Cosine transform – Properties – Inversion theorem – Convolution theorem – Parseval's identity – Finite Fourier sine and cosine transform.

UNIT 4 PARTIAL DIFFERENTIAL EQUATIONS **13 Hrs.**

Formation of equations by elimination of arbitrary constants and arbitrary functions – Solutions of PDE – general, particular and complete integrals – Solutions of First order Linear PDE (Lagrange's linear equation) – Solution of Linear Homogeneous PDE of higher order with constant coefficients.

UNIT 5 THEORY OF SAMPLING AND TESTING OF HYPOTHESIS **12 Hrs.**

Test of Hypothesis – test of significance – Large samples – Z test - single proportion – difference of proportions – Single mean – difference of means - Small samples – Student's t test – single mean – difference of means –Test of variance – Fisher's test – Chi square test – goodness of fit – independence of attributes..

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Create analytic function, bilinear transformation with its properties
CO2 - Evaluate complex integrals using Cauchy integral and residue theorems
CO3 - Analyze Fourier Transform with its properties
CO4 - Solve different types of first order PDE's and homogeneous higher order PDE's
CO5 - Apply the concept of testing of hypothesis in small, large samples
CO6 - Use Chi-Square Test for goodness of fit and independence of attributes

TEXT / REFERENCE BOOKS

1. Kreyszig, E., Advanced Engineering Mathematics (8th Edition), John Wiley and Sons (Asia)Pvt. Ltd., Singapore, 2001.
2. Grewal,B.S., Higher Engineering Mathematics, Tata Mcgraw Hill Publishing Co., New Delhi, 1999.
3. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., Engineering Mathematics, (4th Revised Edition),
4. S.Chand&Co., New Delhi, 2001.
5. Veerarajan,T., Engineering Mathematics Tata Mcgraw Hill Publishing Co., NewDelhi, 1999.

S. C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics,S.Chand& Company, 2012.

SME1210	SOLID AND FLUID MECHANICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Rigid bodies and deformable solids - stability, strength, stiffness - tension, compression and shear stresses - strain, elasticity, Hooke's law, limit of proportionately, modules of elasticity, stress-strain curve, lateral strain - temperature stresses deformation of simple and compound bars - shear modulus, bulk modulus, relationship between elastic constants - bi axial state of stress - stress at a point - stress on inclined plane - principal stresses and principal planes - Mohr's circle of stresses

UNIT 2 **9 Hrs.**

Stresses in Beams - Simple bending theory - Composite Beams - Combined bending and Direct stress - Shear stress distribution for Rectangular and I section - Simple Torsion theory - Stresses and deformations in Solid and Hollow circular shafts- Double integration method - Macaulay's method - Moment area method - Conjugate method for simply supported and cantilever beams, (only point loads & Uniformly distributed loads.).

UNIT 3 **9 Hrs.**

Flow through orifices: Classification - Hydraulic co-efficient - Flow through rectangular orifice, Notches and weirs. Laminar and Turbulent flow: Reynolds experiment - Major and minor losses in pipes - Darcy Weisbach's equation, Chezy's formula - pipes in series and pipes in parallel - total energy line - hydraulic gradient line - Equivalent pipe

UNIT 4 **9 Hrs.**

Fluid Properties: Density - Specific Weight - Specific Gravity - Viscosity - Surface tension - Capillarity - compressibility. Fluid Statics: Hydrostatic Law - Pressure Variation in static fluid - Hydrostatic force on a submerged plane-surfaces - Location of hydrostatic force. Manometers - Simple U tube and differential manometers - Buoyancy - Meta-centric height - determination of stability of floating bodies and submerged bodies- Basic equations of motion: Types of fluid flow - Continuity, momentum and energy equations - Euler's and Bernoulli's Equation and its applications.-Flow Measurement: Orifice meter, Venturi meter, Piezometer, Pitot Tube.

UNIT 5 **9 Hrs.**

Centrifugal Pumps: Definition - Operations - Velocity Triangles - Performance curves - Cavitations - Multistaging. Reciprocating Pumps: Operation - Slip - indicator Diagram - Separation - Air vessels. Hydraulic Turbines: Classification of hydraulic turbines - Working principle of Pelton wheel, Francis and Kaplan turbines - velocity triangles - draft tube - hydraulic turbine characteristics. Dimensional Analysis: Buckingham's Theorem, NonDimension Numbers, Similarities of Flow- Model studies

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Determine the stress-strain relations for uniform and varying composite sections.
CO2 - Calculate the stresses in beams, the shear force and bending moment for the cantilever, simply supported and overhanging beams, and draw the shear force and bending moment diagrams
CO3 - Determine the various losses in the pipes and types of flow like laminar and turbulent
CO4 - Inspect the equation of motion of fluids relevant to flow measurement devices
CO5 - Estimate the performance and characteristics of centrifugal and reciprocating pumps..
CO6 - Interpret the performance and characteristics of hydraulic turbines.

TEXT / REFERENCE BOOKS

1. Rajput.R.K. "Strength of Materials"4th Edition, S.Chand & co, New Delhi, 2002.
2. Khurmi, R.S, "Strength of Materials", 23rd Edition,S.Chand & Co, 2008
3. Bansal.R.K,. "Fluid Mechanics & Hydraulics Machines", 9th Edition,Laxmi Publications, 2005.
4. Kumar K. L., "Engineering Fluid Mechanics", 8th Edition, Eurasia Publication.2009

SEC1203	ELECTRONIC CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Rectifiers and Power Supplies: Half Wave Rectifier - Full Wave Rectifier - Bridge Rectifier - Performance of Rectifiers - Filters - Types of Filters - L, C, LC and π Filters - Ripple Factor Calculation for C, L, LC and π Filter - Regulators - Shunt and Series Voltage Regulator - SMPS.

UNIT 2 **9 Hrs.**

Small Signal Amplifiers: Biasing circuit of BJT, DC equivalent circuit of BJT,DC and AC Load Lines, Stability factor analysis, Two port devices and hybrid model - transistor hybrid model and h parameters - determination of h-parameters from the characteristics - Analysis of transistor amplifier using h-parameters - Low frequency FET model -Common Source and Common drain amplifiers.

UNIT 3 **9 Hrs.**

Multi Stage Amplifiers and Large Signal Amplifiers: Cascading amplifiers - direct coupled and capacitor coupled two stage CE amplifiers - Darlington Pair – Cascode Amplifier- Bootstrap amplifier- Classification of Power amplifiers - Class A Power Amplifier- direct and Transformer coupled amplifiers - Class B Push-pull arrangements and Complementary symmetry amplifiers - efficiency calculations, Amplifier distortion, power dissipation - Class AB amplifier - Power transistor heat sinking - Class C and D amplifiers.

UNIT 4 **9 Hrs.**

Feedback amplifiers and oscillators: Feedback Amplifiers: Feedback concept - General characteristics of negative feedback amplifiers - Four basic types of feedback topologies - Voltage and current feedback amplifiers. Oscillators: Barkhausen criterion - LC oscillators - Analysis of Hartley, colpitts - RC oscillators - Phase shift and wein bridge types and analysis - Crystal oscillators and frequency stability.

UNIT 5 **9 Hrs.**

Tuned Amplifiers and Multi Vibrators: Tuned Amplifiers - single tuned -double tuned -stagger tuned amplifiers - Instability of Tuned Amplifier - Neutralization and Unilateralization - Multivibrators - Collector coupled Astable, Monostable and Bistable Multivibrators.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the various rectifier, filter and regulators.
CO2 - Analyze the small signal amplifiers using AC, DC load lines and hybrid parameters.
CO3 - Determine the performance of multi stage amplifiers and power amplifiers.
CO4 - Determine the characteristics of feedback amplifiers and oscillators.
CO5 - Examine the performance of Tuned amplifiers.
CO6 - Construct various Multi vibrator circuits for real world problem.

TEXT / REFERENCE BOOKS

1. S Millman and Halkias, “Integrated Electronics”, Tata McGraw Hill International,2008.
2. R.L. Boylestad and L. Nashelsky, “Electronic Devices and Circuit Theory”, PHI Learning Pvt. Ltd, India, 9th edition, 2008
3. D.Roy Choudhury &Shail B Jain, “Linear Integrated Circuits”, 3rd edition. 2007.
4. David. A. Bell, “Electronic Devices and Circuits”, PHI Learning Private Ltd, India, 4th edition 2008.
5. R.A. Gayakwad, “Op-Amps and Linear integrated circuits”, PHI, 2008.

SEC1207	DIGITAL LOGIC CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Review of number systems - Binary arithmetic - Binary codes - Boolean algebra and theorems - Boolean functions - Minimization of Boolean functions-Sum of Products(SOP)-Product of Sums(POS)-Simplifications of Boolean functions using Karnaugh map and tabulation methods - Logic gates- NAND and NOR implementation.

UNIT 2 **9 Hrs.**

Introduction to Combinational circuits - Analysis and design procedures - Half Adder, Full Adder-Half Subtractor, Full Subtractor- Parallel binary Adder, Parallel binary Subtractor- Carry look ahead Adder- BCD Adder-Decoders- Encoders- Priority Encoder- Multiplexers- MUX as universal combinational modules- DemultiplexersCode convertors- Magnitude Comparator.

UNIT 3 **9 Hrs.**

Introduction to Sequential circuits - Flip flops - SR, JK, D and T flip flops, Master Characteristic and excitation table - Realization of one flip flop with other flip flops - Registers - Counters - Synchronous and Asynchronous counters - Modulus counters, Up/Down counters Johnson Counter - State diagram, State table, State minimization - Hazards.

UNIT 4 **9 Hrs.**

Classification and characteristics of logic family - Bipolar logic family - Saturated logic family - RTL, DTL,DCTL, I 2L,TTL, HTL - Non saturated family - Schottky TTL, ECL - Unipolar family - MOS, CMOS logic families. Tristate logic. Interfacing of CMOS and TTL families. Comparison of logic families.

UNIT 5 **9 Hrs.**

Classification of memories - ROM - ROM organization - PROM - EPROM - EEPROM - RAM - RAM organization - Write operation - Read operation - Memory decoding - Memory expansion - Static RAM - Dynamic RAM - Programmable Logic Devices - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the Number systems, binary codes, binary arithmetic, Boolean algebra and Logic gates
CO2 - Apply the concepts of Combinational circuits for their implementation
CO3 - Design the various types of sequential logic circuits
CO4 - Analyze the different types of Digital Logic families
CO5 - Investigate the behavior and characteristics of digital logic families, PLDs
CO6 - Create the structures of SRAM and DRAM

TEXT / REFERENCE BOOKS

1. Milos Ercegovac, Jomas Lang, “Introduction to Digital Systems”, Wiley publications, 1998.
2. John M. Yarbrough, “Digital logic: Applications and Design”, Thomas - Vikas Publishing House, 2002.
3. R.P.Jain, “Modern digital Electronics”,3rd Edition, TMH, 2003.
4. William H. Gothmann, “Digital Electronics”, Prentice Hall, 2001.
5. Morris Mano, “Digital design”, 3rd Edition, Prentice Hall of India, 2008

SEE1202	ELECTROMAGNETIC THEORY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Introduction - Concepts of Different Co-Ordinate Systems - Coulomb's Law, Electric Field Intensity, Electric Field due to Point Charge, Line Charge, Surface Charge and Volume Charge Distributions - Electric Flux Density - Gauss Law - Application of Gauss Law - Electric Potential - Potential Gradient - Divergence and Divergence Theorem - Poisson's and Laplace equation.

UNIT 2 **9 Hrs.**

Field due to Dipoles - Dipole Moment - Boundary Conditions at Dielectric and Conductor Surfaces - Capacitor and Capacitance of a System of Conductors - Energy Stored and Energy Density - Capacitance due to Spherical Shell, Coaxial cable and Two Wire Transmission Line - Electrostatic Potential Energy Associated with Different Charges.

UNIT 3 **9 Hrs.**

Current and Current Density - Conduction and Convection Current - Force on a Current Element - Biot- Savart's law - Force between Current Carrying Conductors - Torque on Closed Conductors - Ampere's Law- Magnetic Flux Density - Curl and Stokes Theorem - Magnetic Vector Potential - Boundary Condition at the Magnetic surfaces.

UNIT 4 **9 Hrs.**

Faradays' Laws - Self and Mutual Inductance - Inductance of Solenoids, Toroids, Transmission Lines and Cables - Energy Stored and Density in Magnetic Circuits.

UNIT 5 **9 Hrs.**

Concept of Displacement and Conduction Current - Modified Ampere's Circuital Law - Maxwell's Equations in point and Integral Forms - Wave Equations - Plane Waves in Free Space - Polarization - Poynting's Theorem and Poynting Vector and its Significance - Energy in Electromagnetic Field.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the various laws used in electromagnetic fields.
CO2 - Comprehend the concepts of capacitance in cables and transmission lines.
CO3 - Apply the concepts of basic theorems and laws relating to magnetic field.
CO4 - Analyze self and mutual inductance in solenoid, toroid, transmission lines and cables.
CO5 - Evaluate the interaction of electric and magnetic fields in various media.
CO6 - Design electrical system using Maxwell's equation.

TEXT / REFERENCE BOOKS

1. K.A. Gangadhar, "Electromagnetic Field Theory (Including Antenna Wave Propagation", Khanna Publisher New Delhi, 2009.
2. Karl.E.Lonngren, Sava.V.Savov, "Fundamentals of Electromagnetics with MATLAB", PHI, 2005.
3. William Hayt, "Engineering Electromagnetics", Tata McGraw - Hill, New York, 7th Edition, 2006,
4. R.Meenakumari & R.Subasri, "Electromagnetic Felds", New Age International Publishers, 2nd Edition, 2007.
5. E.C.Jordan & K.G.Balmain, "Electromagnetic Waves & Radiating Systems", Prentice- Hall, 2006.

SEE1204	DC MACHINES AND TRANSFORMERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Introduction - Principles of Energy Conversion - Field Energy and Co-energy in Linear Systems - Energy Flow - Losses and Efficiency - Singly and Multiply Excited Magnetic Field Systems - Torque Production in Rotating Machines - General Analysis of Electromechanical system

UNIT 2 **9 Hrs.**

Constructional Details - Principle of Operation - E.M.F Equation - Methods of Excitation - Types - No load & Load characteristics of Series, Shunt & Compound generators - Armature Reaction, Effects, Methods of Compensation - Commutation : Methods of Improving Commutation - Applications.

UNIT 3 **9 Hrs.**

Principle of Operation - Back E.M.F & Torque Equation - Characteristics of Series, Shunt & Compound Motors - Starters - Speed Control of DC Series & Shunt Motors - Electrical Braking - Testing of DC Machines - Brake Test, Swinburne's Test & Hopkinson's Test.

UNIT 4 **9 Hrs.**

Principle of Operation - Constructional Details - E.M.F. Equation - Transformation Ratio - Transformer on No Load - Parameters Referred to HV / LV Windings - Equivalent Circuit - Transformer On Load - Phasor diagram - Regulation - Testing of Transformer - Open Circuit and Short Circuit Test - All day Efficiency - Sumpner's Test.

UNIT 5 **9 Hrs.**

Auto Transformer - Saving of copper in comparison with Two winding Transformer - Parallel Operation of Single Phase Transformers - Construction of Three Phase Transformer - Transformer Connections – Scott connection - Three Phase to Single Phase Transformer conversion - Elementary Ideas on Instrument Transformers and Toroidal Transformer.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the energy conversion concept to electrical machines.
CO2 - Examine the performance of DC generator.
CO3 - Determine the winding resistance required to control the speed of DC motor.
CO4 - Evaluate the performance of a single phase transformer..
CO5 - Evaluate the amount of copper saved in auto transformer
CO6 - Justify the transformer connection for various applications.

TEXT / REFERENCE BOOKS

1. A K Theraja & B L Thereja, "A Text book of Electrical Technology (Vol II)", S Chand & Co- 23 rd Edition 2008.
2. I J Nagrath and D P Kothari , "Electrical Machines", Tata McGraw Hill Publishing Company Limited New Delhi, 3rd Edition, 2007.
3. R.K.Rajput, "Electrical Machine", Laxmi Publications, 5th Edition 2008.
4. J.B. Gupta, "Theory and Performance of Electrical Machines", S.K.Kataria and Sons, Reprint 2010.
5. S K Sen, "Electrical Machinery", Khanna Publishers, New Delhi, Reprint 2002.
6. Theodore Wildi, Electrical Machines, Drives and Power Systems, Pearson, 6th Ed, 2007.
7. Irving Kosow, Electric Machinery and Transformers, Pearson, 2nd Ed, 2007.
8. Albert E. Clayton and NN Hancock, "The performance and Design of Direct Current Machines", Oxford and IBH.Publishing Co. Pvt.Ltd., New Delhi, 1990.

SEC4052	ELECTRONIC CIRCUITS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Determination of Ripple factor, % Regulation of HWR with and without filter.
2. Determination of Ripple factor, % Regulation of FWR with and without filter.
3. Design of series voltage regulator and perform line and load regulation.
4. Design of various Biasing techniques for CE amplifier.
5. Design and construct BJT Common Emitter Amplifier using voltage divider bias (self-bias) with and without bypassed emitter resistor.
6. Darlington Amplifier using BJT.
7. Differential amplifier using BJT
8. Design of RC Phase shift oscillator for a specified frequency.

Simulation Using PSPICE

1. Frequency response of BJT Common Emitter Amplifier
2. Frequency response of BJT Common Base Amplifier
3. Frequency response of JFET Common Source Amplifier
4. Time response of Astable Multivibrator, Mono stable Multivibrator and Bistable Multivibrator
5. Frequency response of Class A Power Amplifier
6. Frequency response of Series and Shunt Feedback amplifier
7. Time response of Hartley, Colpitts Oscillator
8. Time and frequency response of Single Tuned Amplifier

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the principle of rectifier and regulator and observe its performance.
CO2 - Analyze the characteristics of transistor using different biasing techniques and verify using PSPICE
CO3 - Examine the performance of Darlington and differential Amplifiers.
CO4 - Obtain time response characteristics of multi vibrators and single tuned amplifiers.
CO5 - Simulate frequency response characteristics of feedback and power amplifier circuits using PSPICE.
CO6 - Design and develop Hartley, Colpitts and RC Phase Shift oscillator circuits and verify using PSPICE.

SEE4053	DC MACHINES AND TRANSFORMERS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. OCC and load characteristics of self excited dc shunt generator
2. OCC and load characteristics of separately excited dc shunt generator
3. Load characteristics of DC series generator
4. Load characteristics of DC compound generator (Differential and Cumulative)
5. Load characteristics of DC shunt motor
6. Load characteristics of DC series motor
7. Load characteristics of DC compound motor (Differential and Cumulative)
8. Speed control of DC shunt motor
9. Swinburne's test on DC shunt motor
10. Hopkinson's test.
11. OC and SC test on single phase transformer
12. Load test on single phase transformer
13. Parallel Operation of Single Phase Transformer
14. Sumpner's Test on Single Phase Transformer

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the no load and load characteristics of DC Generators
CO2 - Examine the electrical and mechanical characteristics of various motors.
CO3 - Evaluate the performance characteristics on constant flux machine and adapt various speed control techniques on DC shunt motor.
CO4 - Determine the performance characteristics of a DC machine when operating as motor and as generator.
CO5 - Investigate the performance, regulation and losses on single phase transformer.
CO6 - Investigate performance indices of transformer using standard analytical as well as graphical methods.

SMT1204	ENGINEERING MATHEMATICS IV	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 FOURIER SERIES **13 Hrs.**

Definition- Dirichlets conditions- coefficients- Fourier series for the function defined in [c, c+2π],[c, c+2l] – Parseval's identity (without proof) – Half range cosine series and sine series of f(x) defined in [0,π],[0,l] - simple problems – Harmonic Analysis.

UNIT 2 APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **13 Hrs.**

One dimensional wave equation – Transverse vibrating of finite elastic string with fixed ends- Boundary and initial value problems – Fourier solution – one dimensional heat equation – steady state problems with zero boundary conditions- Two dimensional heat equation – steady state heat flow in two dimensions- Laplace equation in Cartesian form (No derivations required).

UNIT 3 ALGEBRAIC AND TRANSCENDENTAL EQUATIONS **11 Hrs.**

Solution of Algebraic equation by RegulaFalsi Method, Newton Raphson Method – Solution of simultaneous linear algebraic equations – Gauss Elimination Method , Gauss Jacobi & Gauss Seidel Method.

UNIT 4 INTERPOLATION, NUMERICAL DIFFERENTATION &INTEGRATION **11 Hrs.**

Interpolation- Newton forward and backward interpolation formula- Lagranges formula for unequal intervals- Numerical differentiation- Newton's forward and backward differences to compute first and second derivatives- Numerical integration – Trapezoidal rule – Simpson's one third rule and three eighth rule.

UNIT 5 NUMERICAL SOLUTIONS OF ORDINARYDIFFERENTIAL EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS **12 Hrs.**

Ordinary differential equations – Taylor series method – RungeKutta method for fourth order- Partial differential equations – Finite differences – Laplace equation and its solutions by Liebmann's process- Solution of Poisson equation – Solutions of parabolic equations by Bender Schmidt Method – Solution of hyperbolic equations.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Develop Fourier series for different types of functions
CO2 - Derive and obtain the solutions of wave and heat equations
CO3 - Formulate numerical solution of algebraic, transcendental and simultaneous linear equations
CO4 - Solve Interpolation, numerical differentiation and integration problems
CO5 - Analyze various numerical methods for the solution of partial differential equations
CO6 - Apply numerical techniques to solve ordinary differential equations

TEXT / REFERENCE BOOKS

1. Kreyszig, E., Advanced Engineering Mathematics, (8th Edition), John Wiley and Sons (Asia)Pte Ltd., Singapore, 2001.
2. Grewal,B.S., Higher Engineering Mathematics, Tata Mcgraw Hill Publishing Co., New Delhi, 1999.
3. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., Engineering Mathematics, (4th Revised Edition), S.Chand&Co., New Delhi, 2001.
4. Veerarajan,T., Engineering Mathematics, Tata Mcgraw Hill Publishing Co., NewDelhi, 1999

SCS1202	OBJECT ORIENTED PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Object Oriented Programming Paradigms - Comparison of Programming Paradigms - Basic Object Oriented Programming concepts - Comparison with C - Overview of C++ - Pointers - Functions - Scope and Namespaces - Source files and programs.

UNIT 2 **9 Hrs.**

Working with classes - Classes and objects - Class specification - Defining class members – Objects Accessing member functions - Inline Functions - Data hiding - Class member accessibility - Empty classes.

UNIT 3 **9 Hrs.**

Default constructors - Parameterized constructors - Constructor overloading - Copy constructors - new, delete operators- ”this” pointer - friend classes and friend functions - Function overloading- Unary Operator overloading - Binary Operator overloading.

UNIT 4 **9 Hrs.**

Base class and derived class relationship - Derived class declaration - Forms of inheritance - Inheritance and member accessibility - Constructors in derived class - Destructors in derived class - Multiple inheritance - Multi level inheritance - Hybrid inheritance - Virtual base classes - Member function overriding - Virtual functions – Abstract classes - Pure Virtual functions.

UNIT 5 **9 Hrs.**

I/O Stream - File I/O - Exception Handling - Templates - STL - Library Organization and Containers – Standard Containers - Overview of Standard Algorithms - Iterators and Allocators.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the concept of Procedure Oriented and Object Oriented Programming.
CO2 - Apply data hiding and inline functions in object oriented programming..
CO3 - Analyze the concept of constructors, overloading and friend functions
CO4 - Develop programs for code reusability using inheritance, virtual functions and Abstract class
CO5 - Create an application using C++ for implementing Exception Handling and Files.
CO6 - Develop programs using advanced features of C++ specifically templates STL, iterators and allocators for real world problems.

TEXT / REFERENCE BOOKS

1. Balagurusamy, ”Object Oriented Programming with C++”, Tata McGraw Hill,4th Edition,2010.
2. Venu Gopal K.R, Ravishankar.T, and Raj kumar, ”Mastering C++”, Tata McGraw Hill,1999.
3. Bjarne Stroustrup, ”The C++ programming language”, Addision Wesley, 3rd Edition,1998.

SME1208	APPLIED THERMAL ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of Basic thermodynamics - concept of temperature and heat. Concept of ideal gas. First law of thermodynamics - application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT 2 **9 Hrs.**

Second law of thermodynamics - Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed Carnot cycle, efficiency, COP, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy

UNIT 3 **9 Hrs.**

Air standard cycles - Otto, Diesel and Dual cycles. Derivation of expression for air standard efficiency and mean effective pressure.IC Engines- Introduction-Classification, Comparison between four stroke and two stroke, Performance Testing on internal combustion engines, Performance curves.

UNIT 4 **9 Hrs.**

Positive displacement compressor - reciprocating air compressor, work done, volumetric efficiency, Effect of clearance volume For qualitative treatment- rotary compressors - vane type, roots blower-centrifugal compressor

UNIT 5 **9 Hrs.**

Heat transfer-Modes of heat transfer- Fourier law of conduction, one dimensional steady state conduction heat transfer in composite walls. For qualitative treatment- Convection and Radiation Vapour compression refrigeration cycle, Calculation of coefficient of performance

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the concepts of first law of thermodynamics to closed and open system and to calculate internal energy, specific heat capacity and enthalpy
CO2 - Analyze the performance of heat engine, heat pump and refrigerator and also can apply the concept of entropy to determine the change in entropy
CO3 - Evaluate the air standard efficiency of Otto, Diesel and Dual cycle and to analyze the performance of an internal combustion engine
CO4 - Calculate workdone ,Volumetric efficiency and isothermal efficiency of a compressor with and without effect of clearance volume and to explain the working of rotary compressor.
CO5 - Calculate heat transfer coefficient in composite walls with one dimensional steady state heat Conduction
CO6 - Calculate the coefficient of performance of vapour refrigeration cycle

TEXT / REFERENCE BOOKS

1. Nag P.K, "Engineering Thermodynamics", 4th Edition, Tata McGraw Hill, 2008
2. Rajput R.K, "Thermal Engineering", 8th Edition, Lakshmi publications Ltd. New Delhi,2010
3. Rogers and Mayhew, "Engineering Thermodynamics", 4th Edition, Addison Wesley 1999.
4. Manohar Prasad, "Refrigeration and Air Conditioning", 2nd Edition, New Age International (P) Ltd, 2003.
5. Domkundwar S, Arora S.C, "A Course in Heat and Mass Transfer, Dhanpat Rai & Sons,2005
6. Ganesan.V., "Internal combustion Engines", 3rd Edition, Tata McGraw Hill, 2007

SEE1203	CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 SYSTEM CONCEPTS **14 Hrs.**

Types of System - Open Loop Systems, Closed Loop Systems, Basic Elements in Control System - Mathematical Models of Physical System: Differential Equation- Transfer Functions of Single Input, Single Output and Multi Variable Systems - Simple Electrical Networks, Electrical Analogous of Mechanical Translational and Rotational System - D.C and A.C Servomotor - Mechanical System- Translational and Rotational System - Block Diagram Reduction Techniques - Signal Flow Graphs - Mason's Gain Formula.

UNIT 2 TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS **10 Hrs.**

Standard Test Signals -Time Response of First and Second Order System, Time Domain- Specifications - Generalized Error Series - Steady State Error - Static and Dynamic Error Constants.

UNIT 3 STABILITY OF CONTROL SYSTEM **12 Hrs.**

Characteristics Equation - Location of Roots in S Plane for Stability - Routh Hurwitz Criterion - Root Locus Analysis - Effect of Pole Zero Additions on Root Locus - Nyquist Stability Criterion.

UNIT 4 FREQUENCY RESPONSE ANALYSIS **12 Hrs.**

Frequency Response of the System - Correlation between Time and Frequency Response - Gain and Phase Margin - Bode Plot - Nyquist Plot (Polar Plot).

UNIT 5 COMPENSATION AND CONTROLLERS **12 Hrs.**

Introduction to compensation networks - Lag, Lead and Lag Lead networks - Effect of providing Lag, Lead and Lag-Lead compensation on system performance and design using bode plot - P, PI, PID Controllers design.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Determine the transfer function for a electromechanical system
CO2 - Analyze the response of any linear time invariant system
CO3 - Examine the stability of a system using root locus, Routh Hurtwitz criterion .
CO4 - Analyze the frequency response for linear time invariant system using bode plot
CO5 - Design a P,PI,PID controller in real world problem.
CO6 - Design a Lag, Lead, Lag-Lead compensator network for real world problem

TEXT / REFERENCE BOOKS

1. I.J.Nagarath and M.Gopal, "Control System Engineering" New Age International (p) Limited Publishers, 2nd edition, 2009.
2. Kausuhio Ogata, "Modern Control Engineering", Prentice Hall of India PVT. Ltd, 5th edition.
3. Richard Dorf, "Modern Control Systems", Pearson Education Ltd, 11th Edition 2009.
4. M.N. Bandyo padhyay, "Control Engineering, Theory and Practice" PHI, 4th print, 2006.
5. N.K.Sinha, "Control Systems", New Age International Private Limited Publishers, 3rd Edition, 1998, reprint 2004.
6. A.Nagoorkani, "Control System", RBA Publications, 3rd edition, reprint 2012.
7. U.A.Bakshi and S.C.Goyal, "Control System Engineering", Technical Publication, 2nd Revised reprint 2007.

SEE1206	TRANSMISSION AND DISTRIBUTION	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 STRUCTURE OF ELECTRIC POWER SYSTEM 12 Hrs.

Single Line Diagram - Distributors with Concentrated and Uniform Loading - DC Two Wire and Three Wire Systems - AC Distributors - Radial and Ring Distributors - Interconnectors - Electrical Layout & Bus Bar Arrangement in Generating Sub Stations and Bulk Power Substation - Kelvin's Law for the Design of Feeders and its Limitations.

UNIT 2 TRANSMISSION LINE PARAMETERS 12 Hrs.

Resistance, Inductance and Capacitance of Single Phase and Three Phase (Including Double Circuits) Transmission Lines - Stranded and Bundled Conductors - Symmetrical and Unsymmetrical Spacing - Transposition - Application of Self and Mutual GMD - Skin and Proximity Effect - Inductive Interference with Neighboring Circuits - Corona - Factors Affecting Corona - Advantages and Disadvantages of Corona - Methods of Reducing Corona Effect.

UNIT 3 PERFORMANCE OF TRANSMISSION LINES 12 Hrs.

Equivalent Circuits for Short, Medium (π and T circuits) and Long Lines - Efficiency and Regulation - Attenuation Constant, Phase Constant, Surge Impedance and Surge Impedance Loading - Real and Reactive Power Flows in Lines - Power Circle Diagrams for Receiving and Sending Ends - Voltage Control of Lines - Ferranti Effect

UNIT 4 INSULATORS, CABLES AND OVERHEAD LINES 12 Hrs.

Insulators - Types and Construction - Voltage Distribution in String Insulator - string Efficiency - Methods of Improving String Efficiency - Cables - types - Capacitance of Cables - Insulation Resistance - Dielectric Stress and Grading - Dielectric Loss - Thermal Characteristics - capacitance of Three Core Cables - Stress and Sag Calculations - Effect of Wind and Ice - Supports at Different Levels - stinging Chart.

UNIT 5 RECENT TRENDS IN TRANSMISSION 12 Hrs.

Extra High Voltage AC (EHVAC) Transmission - Need, Advantages, Limitations -High Voltage Direct current Transmission (HVDC) - Terminal Equipment for HVDC Systems - Classifications, Advantages, Limitations - Economic Distance for HVDC - Comparison of EHVAC and HVDC Transmission -Interconnection of HVDC & AC Systems - Introduction to FACTS Technology -SVC,TCSC,STATCOM ,UPFC.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply basic circuit knowledge on calculating voltage-current for transmission and distribution system
CO2 - Evaluate transmission line parameters for single and three phase system.
CO3 - Analyze the performance of over head transmission line
CO4 - Design the overhead transmission line on mechanical aspect and estimate the performance parameters of line insulator and cables
CO5 - Develop compensation techniques for transmission line using FACTS devices.
CO6 - Examine the economic aspects of high voltage transmission (AC and DC).

TEXT / REFERENCE BOOKS

1. C. L . Wadhwa, "Electrical Power Sytems", 6th edition, New Age International (P) Limited, New Delhi, 2010.
2. V. K. Metha & Rohit Metha,"Principles of Power System", S. Chand, 3rd edition, 2006.
3. S. L. Uppal, Electrical Power, Khanna Publishers, New Delhi, 2006.
4. Chakrabarti. A, Soni M I, Gupta P V, "Textbook on power system engineering", Dhanpat Rai & Co,2008.
5. S.N.Singh, "Electric Power Generation, Transmission & Distribution", Prentice Hall of India, New Edition, New Delhi, 2008.
6. Soni, Bhatnagar and Gupta," Electrical Power", Dhanpat Rai & Sons, New Delhi, 2006.

SEE1205	AC MACHINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **10 Hrs.**

Constructional features - EMF Equation - Armature Reaction - Synchronous Reactance - Voltage Regulation -Synchronous Impedance Method - MMF and Potier Methods - Synchronising & Parallel Operation - Two Reaction Theory - Determination of Xd and Xq (Slip test).

UNIT 2 **9 Hrs.**

Principle of Operation - Starting Methods - Effect of Increased Load with Constant Excitation - Effect of Changing Excitation on Constant Load - Different Torque - Power flow equation - Phasor diagram - V and inverted V curves - Hunting and suppression methods.

UNIT 3 **9 Hrs.**

Construction - Types of 3- Phase Induction Motors - Rotating Magnetic Fields - Torque Equation – Condition for Maximum Torque - Slip, Torque Slip Characteristics - Power Stages in Induction Motors - Losses and Efficiency - Plugging - Cogging and Crawling - Concept of Induction Generator.

UNIT 4 **9 Hrs.**

No load and Blocked rotor tests - Equivalent circuit - Construction of Circle diagram - Starting methods - Speed control - Double cage Induction motor.

UNIT 5 **8 Hrs.**

Double Field Revolving Theory - Types of Single Phase Induction Motor - Equivalent Circuit (Qualitative) - Repulsion Motor - Series Motor - Universal motor, AC Servomotor, Linear Induction Motor, Hysteresis motor.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply a suitable methodology to identify the voltage regulation of a Synchronous Generator
CO2 - Analyze the operation of synchronous motor under various excitation conditions
CO3 - Design motor parameters to obtain maximum efficiency of the three phase induction motor
CO4 - Investigate the motor parameters to control the speed of three phase induction motor
CO5 - Categorize various types of single phase induction motor with equivalent circuit
CO6 - Select a suitable AC motor for Real World Problems

TEXT / REFERENCE BOOKS

1. A K Theraja & B L Thereja, “A Text book of Electrical Technology (Vol II)”, S Chand & Co- 23rd Edition 2008.
2. D.P. Kothari and I.J. Nagrath, ‘Electric Machines’, Tata McGraw Hill Publishing Company Ltd, 2002.
3. A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, ‘Electric Machinery’, Tata Mc Graw Hill publishing Company Ltd, 2003.
4. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
5. Charless A. Gross, “Electric /Machines, “CRC Press, 2010.

SCS4201	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Develop a C++ program to implement a class, object creation, member function invocation concept.
2. Develop a C++ program to implement the various constructors and destructor concept
3. Develop a C++ program to implement a friend function, Inline function.
4. Develop a C++ program to implement an operator (Unary & Binary) overloading concept.
5. Develop a C++ program to implement a function overloading concept.
6. Develop a C++ program to implement a run time polymorphism.
7. Develop a C++ program to implement the following inheritance types:
   a. Single
   b. Multiple
   c. Multilevel
   d. Hierarchical
   e. Hybrid
8. Develop a C++ program to implement an Abstract class concept.
9. Develop a C++ program to implement a Virtual function.
10. Develop a C++ program to find the number of characters in a file
11. Develop a C++ program to handle the exceptions.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Design object-oriented paradigm with concepts of streams, classes, functions, data and objects.
CO2 - Develop a Program to initialize and destroy objects using Constructor, destructor function.
CO3 - Build a program using the concepts of function overloading and operator overloading.
CO4 - Implement Inheritance concept in real time applications..
CO5 - Construct programs using Abstract Class and Virtual function.
CO6 - Create an application using C++ for implementing File and Exceptional Handling

SEE4054	AC MACHINES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Regulation of Alternator by EMF and MMF method
2. Regulation of Alternator by Potier method
3. Regulation of salient pole Alternator by slip test
4. Load test on 3 phase Alternator
5. Synchronizing and parallel operation of three phase Alternator with infinite bus bar
6. V curve and inverted V curves of synchronous motor
7. Brake load test on Three phase squirrel cage induction motor
8. Load test on Three phase slip ring induction motor
9. Load test of Single phase induction motor
10. Equivalent circuit of Single phase induction motor
11. Circle diagram and performance of Three phase induction motor
12. Study on Characteristics of induction generator

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Evaluate the voltage regulation of alternator with different indirect method
CO2 - Analyze the voltage regulation of alternator with various load.
CO3 - Develop the synchronization circuit for alternator
CO4 - Analyze the performance characteristics of Induction motor.
CO5 - Examine performance characteristics of single phase induction motor
CO6 - Analyze the characteristics of asynchronous machine.

SEC1302	ANALOG INTEGRATED CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO OP- AMP AND ITS APPLICATIONS 9 Hrs.

OP-AMP– DC and AC Characteristics- Input offset voltage- Input bias current-Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger

UNIT 2 FILTERS AND SIGNAL GENERATORS 9 Hrs.

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters –RC phase shift, Wein's bridge oscillator- Astable and Monostablemultivibrator-Precision half wave and full wave rectifiers.

UNIT 3 A/D AND D/A CONVERTERS 9 Hrs.

Sample and Hold circuit – Digital to analog converters: R-2R ladder network and Binary weighted – Characteristics of D/A converters – Analog to digital converters: Flash converter – Successive approximation converter – Dual slope ADC.

UNIT 4 PLL AND TIMER CIRCUITS 9 Hrs.

Phase Locked Loop IC 565– Block schematic – Applications of PLL: FM demodulator and Frequency synthesizer-FSK Demodulator- VCO IC LM 566 – Timer IC LM 555 and its applications: Astable and Monostable multivibrator

UNIT 5 SPECIAL FUNCTION ICs 9 Hrs.

Integrated circuit Tuned amplifier, Instrumentation Amplifier, Series and shunt voltage regulator, Opto coupler, CMOS Operational Amplifier- Dc analysis- small signal analysis- specifications of IC MC 14573.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Interpret the DC-AC Characteristics and applications of Operational Amplifier
CO2 - Design the Active filters using OP-AMP
CO3 - Develop a voltage controlled oscillator for PLL application.
CO4 - Examine the applications of special function IC's namely voltage Regulator and 555 timer
CO5 - Analyze ADC and DAC for Real time Implementation
CO6 - Implement a research oriented application using OPAMP

TEXT / REFERENCE BOOKS

1. Ramakant A.Gayakwad, OP-AMP and Linear ICs, 4th Edition, Prentice Hall / Pearson Education, 1994.
2. D.Roy Choudary, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000.
3. Grey and Meyer, Analysis and Design of Analog Integrated Circuits, 4th Edition, Wiley International, 2001.
4. Michael Jacob, Applications and Design with Analog Integrated Circuits, 2nd Edition, Prentice Hall of India, 1993.
5. S. Salivahanan, V.S. KanchanaBhaaskaran, linear integrated circuits, 3rd Edition, McGraw-Hill, 2011.
6. William D.Stanely, Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2004.

SIC1203	MEASUREMENTS AND INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 BASIC MEASUREMENTS **9 Hrs.**

Methods of Measurement, Measurement System, Classification of instrument system, Functional Elements of measurement system - Examples - Characteristics of instruments: Static characteristics - Dynamic characteristic Types of errors - sources of errors - methods of elimination - Analysis of data - Limiting errors - Relative limiting error - Combination of Quantities with limiting errors - Statistical treatment of data: Histogram, Mean, Measure of dispersion from the mean, Range, Deviation, Average deviation, Standard Deviation, Variance - Calibration and Standards - Process of Calibration.

UNIT 2 ELECTRICAL MEASUREMENTS **9 Hrs.**

Units of voltage and current - principle of operation of D'Arsonval Galvanometer - principle, operation, constructional details and comparison of the following: permanent magnet moving coil, permanent magnet moving iron, Dynamometer, Induction, thermal and rectifier type instruments, Power measurement - Voltmeter ammeter method, Ammeter voltmeter method, Electro-dynamic wattmeter - Low power factor wattmeter

UNIT 3 MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE **9 Hrs.**

Low Resistance: Kelvin's double bridge - Medium Resistance: Voltmeter Ammeter method - Substitution method - Wheatstone bridge method. High Resistance: Megger - Direct deflection method - Megohm bridge method, Loss of Charge method - Earth resistance measurement. Introduction to A.C bridges Sources and Detectors in A.C. bridges. Measurement of Self Inductance: Maxwell's bridge - Hay's bridge, and Anderson's bridge. Measurement of Mutual Inductance: Heavy side M.I bridge - Measurement of Capacitance: Schering's bridge - Sauty's bridge, Measurement of frequency using Wien's bridge.

UNIT 4 ELECTRONIC MEASUREMENTS **9 Hrs.**

Fundamentals of Cathode Ray Oscilloscope: Block diagram, CRO probes, Delay line, types of Oscilloscopes. Measurement of: Signal voltage, Current, Phase & Frequency using Lissajous patterns, Industrial applications of CRO. DC and AC voltmeter and Ammeter, Ohmmeter, Range Extension, Electronic Multimeters, Types of Voltmeters - Differential type, true RMS type, Vector voltmeter - Wave Analyzer, Spectrum Analyzer and Distortion Analyzer

UNIT 5 DATA ACQUISITION **9 Hrs.**

Introduction to ADC / DAC - Specifications, ADC Quantization Error, Types of ADC - Flash, Counter, Successive Approximation, Dual-Slope types and Introduction to Delta-Sigma, Types of DAC - Weighted-Resistor, 2R ladder and PWM type, ADC and DAC Problems - Smart sensors.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the concepts of measurement systems and characteristics of instruments
CO2 - Describe the construction and working of various types of instruments
CO3 - Choose an appropriate instrument for the required measurement.
CO4 - Analyze the various characteristics of signals
CO5 - Design a suitable conversion circuit for an application
CO6 - Design an instrument to measure electrical and electronic parameters

TEXT / REFERENCE BOOKS

1. Sawhney A.K., "A Course in Electrical, Electronic measurement & Instrumentation", Dhanpat Rai & sons,1 8th Edition, Reprint 2010
2. Doeblin E.O. "Measurement System Applications and Design", McGraw Hill, 5th Edition, 2004.
3. Albert D. Helfrick & William. D. Cooper, "Modern Electronic Instrumentation & Measurement Techniques", PHI, 2003.
4. Chris Nadovich, 'Synthetic Instruments Concepts and Applications', Elsevier, 2005.
5. Rick Bitter, Taqi Mohiuddin and Matt Nawrocki, 'Labview Advanced Programming Techniques', CRC Press, Second Edition, 2007.
6. Rahman Jamal and Herbert Picklik, "LabVIEW - Applications and Solutions", National Instruments Release ISBN 0130964239.
7. Gupta J.B., "A course in Electrical and Electronic Measurement and Instrumentation", 12th Edition, Katson Publishing House, 2003.

SEC1310	MICROPROCESSOR INTERFACING AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

8085 Architecture- Timing Diagram- Interrupts-Addressing Modes- Instruction Formats- Instruction Set Programming of 8085.

UNIT 2 **9 Hrs.**

8086 Architecture- Maximum and Minimum Mode- Memory Banks- Memory Segmentation- Programming Model - Instruction Set- Programming of 8086.

UNIT 3 **9 Hrs.**

Introduction, memory and I/O interfacing, data transfer schemes, programmable peripheral interface (8255), programmable DMA controller (8257), programmable interrupt controller (8259), Universal synchronous asynchronous receiver transmitter (USART) (8251), and programmable counter/interval timer (8254).

UNIT 4 **9 Hrs.**

Switches- Matrix Keyboard- interfacing LED, 7 segment LED, LCD, Analog to Digital Converter (ADC), Digital to Analog Converter (DAC), Memory Interfacing (RAM and ROM)

UNIT 5 **9 Hrs.**

Stepper motor interfacing with ULN2003- specific angle rotation, Motor speed control, Temperature control system, Traffic light control- 6V relay to control AC Bulb- PWM generation for Single phase controlled rectifier with specific firing angle

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Develop Assembly Language Program using Intel 8085 mnemonics for arithmetic logical and statistical formulae
CO2 - Develop Assembly Language Program using Intel 8086 mnemonics for arithmetic logical and statistical formulae
CO3 - Comprehend interfacing IC's for 8085 and 8086 Microprocessor
CO4 - Develop Assembly Language Program for seven segment LED, ADC and DAC
CO5 - Develop Assembly Language Program for real time applications using interfacing circuits
CO6 - Compute the computational complexity of Assembly Language Program

TEXT / REFERENCE BOOKS

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming and applications with 8085", 6th Edition, Penram International Publishing Pvt Ltd, 2014.
2. Douglas V. Hall, "Microprocessor and its Interfacing", Tata McGraw Hill, Edited second Version.
3. Nagoor Kani A, "Microprocessor (8085) and its Applications", 2nd Edition, RBA publications.
4. Mathur A.P, "Introduction to Microprocessor", Tata McGraw Hill, 3rd Edition 2002.

SEE1301	ADVANCED CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 STATE SPACE MODEL **11 Hrs.**

Introduction to State Space, State Variables, Physical Variables, Phase Variables-Matrices, Eigen Values and Eigen vectors - Diagonalization, Canonical and Jordan forms - State Space Models from Differential Equations - Conversion of State Variable Models to Transfer Function

UNIT 2 MATHEMATICAL ANALYSIS **9 Hrs.**

Computation of State Transition Matrix - Laplace Transformation Method, Canonical Transformation - Cayley Hamilton Theorem-Solution of State Equation.

UNIT 3 STATE FEEDBACK AND OBSERVERS **10 Hrs.**

Concepts of Controllability and Observability - Design of State Space Feedback using Pole Placement Technique-State Observers.

UNIT 4 SAMPLED DATA SYSTEMS **15 Hrs.**

Introduction to Digital Control - Discrete Time Signals - Sampling Process - Analysis of Sampling Process in the Frequency Domain - Spectral Representation - Analyzing - Shannon's Sampling Theorem - Reconstruction of Sampled Signals using Hold Circuits - Zero Order Hold - its Representation - Bode Plot of Hold Circuit - Z - Transform of Sampled Signals - Theorems on Z- Transform - Inverse Z-transform - Mapping between s and z Planes - Pulse Transfer Function Impulse Response - Closed Loop Operation - Characteristic Equations - Jury's Stability Criterion.

UNIT 5 NONLINEAR SYSTEMS **15 Hrs.**

General Properties of Non-Linear Systems - Describing Function Method - On / Off, Dead Zone, Saturation and Hysteresis Non Linearities - Determination of Limit Cycle by Describing Function - Stability of Limit Cycle - System Stability in the Sense of Lyapunov - Lyapunov's Direct Method - Stability and Instability Theorems - Application of Lyapunov Method for Linear Systems - Basic Concepts of Phase Plane Method.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Develop state model for any linear time invariant system..
CO2 - Analyse the state transition matrices and their solutions for linear time invariant systems.
CO3 - Design a state observer using pole placement technique.
CO4 - Investigate the stability of LTI system in discrete domain.
CO5 - Develop the describing function of non linear systems
CO6 - Determine the stability of linear systems using lyapunov

TEXT / REFERENCE BOOKS

1. K.Ogata, "Modern control Engineering", 5th Edition. Prentice Hall India, New Delhi. 2010.
2. B.C.Kuo, "Automatic Control Systems", Phi learning Pvt Ltd, 9th Edition, 2009.
3. Philips C.L., & John Parr "Feedback Control Systems" 5th Edition, Prentice Hall International.
1. 2010.
4. Naresh K. Sinha, "Control Systems'', New Age International Ltd., Reprint 2004.
5. Stanley M.Shinners, "Modern Control System Theory and Design", 2nd Edition, John Wiley
2. & Sons. 1998.
6. M.Gopal, "Digital Control and State Variable Methods", 4th Edition, Tata McGraw Hill Ltd., New Delhi, 2012.
7. Roy Choudhry, "Modern Control Engineering" Phi Learning, 2009

SEE1302	POWER SYSTEM ANALYSIS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 **14 Hrs.**

Need for system analysis in planning and operation of power system - per phase analysis of symmetrical three-phase system. General aspects relating to power flow, short circuit and stability analysis - Modeling of generator, load, shunt capacitor, transmission line, shunt reactor for short circuit, power flow and stability studies -per unit representation - bus admittance by analytical method and direct inspection method.

UNIT 2 **10 Hrs.**

Problem definition - bus classification - derivation of power flow equation - solution by Gauss Seidel and Newton Raphson methods by polar form - P V bus adjustments for both methods - computation of slack bus power, line flow and transmission loss.

UNIT 3 **12 Hrs.**

Need for short circuit study - Bus impedance matrix formation - Symmetrical short circuit analysis using Z-bus. - computations of short circuit capacity, post fault voltage and current.

UNIT 4 **12 Hrs.**

Symmetrical component transformation - sequence impedances.- Sequence Networks - unsymmetrical short circuit analysis for single line fault, line to line fault and double line to ground fault using Z-bus - computations of short circuit capacity, post fault voltage and current.

UNIT 5 **12 Hrs.**

Distinction between steady state and transient state - Concepts of Stability & Security - Swing equation-solution to swing equation - step by step method - power angle equation - equal area criterion - critical clearing angle and time. Stability analysis of single machine connected to infinite bus by modified Euler's method - Multi-machine stability analysis using Runge Kutta method.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Model Impedance, Reactance networks and develop bus admittance matrix.
CO2 - Examine load flow in a power grid using bus admittance matrix.
CO3 - Examine fault currents and post fault voltages in symmetrical short circuit using bus impedance matrix.
CO4 - Estimate fault currents and post fault voltages in unsymmetrical short circuit using symmetrical components.
CO5 - Evaluate the stability conditions in power grid for minor and major disturbances.
CO6 - Develop the mathematical solution for achieving stability in power grid during transient state.

TEXT / REFERENCE BOOKS

1. John J. Grainger and Stevenson Jr. W.D., "Power System Analysis", Tata McGraw Hill, 2017.
3. Kothari .D.P and Nagarath .I.J,, "Power system Engineering", 2nd Edition, Tata McGraw Hill, 2011.
4. Stagg, G.W. and El-Abaid, A. H. "Computer Methods in Power System Analysis", McGraw-Hill International Book Company, 1994.
5. Nagarath, I.J., and Kothari, D.P., "Modern Power System Analysis", 4th Edition, Tata McGraw Hill Publishing Company, 2011.
6. Hadi Saadat, "Power system Analysis", Tata McGraw Hill Publishing Company,3rd Edition, 2011.

SEE1304	ELECTRICAL MACHINE DESIGN	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 **12 Hrs.**

Major considerations in Machine design - Limitations in design - Standard specifications - Electrical Engineering materials - High conductivity materials - Insulating materials - Magnetic circuit calculations - mmf for airgap and iron path - real and apparent flux densities in rotating machines - Choice of specific electric and magnetic loadings.

UNIT 2 **14 Hrs.**

Output equation - Main Dimensions - Choice of number of poles - Armature design - Estimation of number of conductors / turns - Coils armature slots- Conductor dimensions - Slot dimension - Design of field poles and field coil (shunt field) - Design of Commutators and Brushes

UNIT 3 **12 Hrs.**

Output equation - Design of core and winding of single phase shell and core type transformer and three phase transformers -Temperature rise in transformers - Design of tank, cooling tubes and Ducts

UNIT 4 **12 Hrs.**

Output equation, Main dimensions, Design of stator, Choice of L/D ratio - Air gap length - Design of rotor - squirrel cage and slip ring rotor.

UNIT 5 **10 Hrs.**

Output equation - Design of salient pole rotor machine - Dimensions - Short circuit ratio - Effect of Short Circuit ratio - Air gap length - Armature design - Slot dimensions - Rotor design - Design of damper winding - Design of cylindrical rotors

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the magnetic circuits for rotating machines based on the major design considerations
CO2 - Design a DC machine for the given specific loadings.
CO3 - Design the dimensions of core, winding and cooling tubes in a transformer
CO4 - Design the dimensions of stator and rotor of induction machine
CO5 - Design the dimensions of stator core and winding of synchronous machines.
CO6 - Design the salient and cylindrical rotor of synchronous machines.

TEXT / REFERENCE BOOKS

1. A.K.Sawhney, A.Chakrabarti, “A course in Electrical machine Design”, Dhanpat Rai and Sons, New Delhi, 6th Edition, 2010.
2. Albert E. Clayton and NN Hancock, “The performance and Design of Direct Current Machines”, Oxford and IBH Publishing Co. Pvt.Ltd., New Delhi, Edition 2004.
3. A.Nagoorkani, “Electrical Machine Design”, RBA Publications, 2nd Edition, 2014.
4. R.K.Agarval, “Principles of Electrical Machine Design”, Fifth edition, S.K.Kataria & Sons.. 2014.

SEC4054	INTEGRATED CIRCUITS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

ANALOG INTEGRATED CIRCUITS

1. Design and construct using IC741
   a). Inverting
   b). Non-inverting
   c). Adder
   d). Schmitt Trigger
   e). Differentiator
2. Waveform Generators using IC741
   a). Triangular wave generator
   b). Square wave generator
   c). Sine Wave generator
3. Design and construct PWM using IC 555 timer
4. Design a 3 bit DAC in R-2R ladder Configuration
5. Design, construct the filters using PSPICE
   (a) Low pass filter
   (b) High pass filter
   (c) Band pass filter
   (d) Band reject filter

DIGITAL CIRCUITS

1. Verify the Basic gates / Boolean function using logic gates.
2. To Construct and verify the full and half adder using logic gates.
3. To Verify 2x4 Decoder and 4x2 Encoder functionally.
4. To construct and study the working of RS flip-flop, D flip-flop, T flip-flop, JK flip-flop
5. To verify various shift register
   (a) SISO
   (b) SIPO
   (c) PISO
   (d) PIPO
6. Design a counter using suitable flip-flop
   (a) MOD Counter
   (b). Ripple Counter
   (c). Up- Down Counter

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Design the circuits for linear and nonlinear applications of Op amp.
CO2 - Build a data converter and pulse generator circuit.
CO3 - Simulate different types of filters using OrCAD Pspice..
CO4 - Verify the truth table of logic gates and state table of sequential circuits.
CO5 - Construct the combinational circuits using logic gates.
CO6 - Develop different types of counters by implementing flip-flops.

SEC4068	MICROPROCESSOR LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Programs for 8 bit Addition, Subtraction, Multiplication and Division.
2. Perform 32 bit Addition of two numbers.
3. Counting numbers of 1's in given word.
4. Arithmetic mean of Square of N Numbers.
5. Code Conversion – BCD to ASCII Conversion, ASCII to BCD Conversion.
6. Finding largest & smallest of given 16 bit Numbers.
7. To Sort given set of Numbers in Ascending & Descending Order.
8. Program using look up table Concept.
9. Matrix Manipulation – 16 bit addition.
10. Perform LCM of two 16 bit numbers, GCD of four 16 bit numbers.
11. Generate Fibonacci Series, Factorial of given Numbers.
12. Interfacing 8086 with Stepper motor. Use Step angle Calculation & rotate motor to a Specified angle.
13. Interface 8086 with DC motor & Control the Speed of the DC Motor using PWM.
14. Interface 8086 With ADC & display the digital input, Perform the resolution calculation and cross verify the result.
15. Interface 8086 With DAC & display the following waveform in CRO. a). Triangular b). Saw tooth c). Staircase.
16. Interface 8086 with 7 segment display to display numbers as Characters.
17. Interface 8086 with LCD to display the name of the person.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Select appropriate instruction set for solving arithmetic and logical operation using 8085 / 8086 microprocessor.
CO2 - Construct codes to perform array addition & sorting operations using 8086.
CO3 - Develop ALP to solve mathematical problems like GCD, LCM, Factorial and Fibonacci using 8086.
CO4 - Construct ALP to perform code conversion using 8086.
CO5 - Connect appropriate interfaces for controlling the drives using 8086.
CO6 - Develop ALP to interface the various digital displays.

SEC1315	DIGITAL SIGNAL PROCESSING & ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

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UNIT 1 SIGNALS, SYSTEMS & TRANSFORMS **9 Hrs.**

Sampling theorem- Aliasing-Classifications of Signals and Systems - Review of Z transform & Inverse Z Transform-ROC - Time and frequency response analysis using standard test signals (step and ramp) - Convolution- Correlation -DTFT- DFT- Properties of DFT- FFT computations using Decimation algorithms.

UNIT 2 DESIGN OF INFINITE IMPULSE RESPONSE FILTER (IIR) **9 Hrs.**

Design of IIR filters using Impulse invariant and Bilinear transformation method- Prewarping. Review of Butterworth and Chebyshev approximations- Frequency transformation in analog domain- Filter design using butterwoth and chebyshev- Realization of recursive structures-Direct form-I-Direct form-II-Cascaded-Parallel Form.

UNIT 3 DESIGN OF FINITE IMPULSE RESPONSE (FIR) FILTER **9 Hrs.**

Properties of IIR and FIR filters - Filter design using windowing techniques - Hamming, Hanning, Blackman, Rectangular, Triangular windows- Digital filter design using Frequency sampling technique- Realization of Structures for FIR and Linear phase FIR filter- Direct form-Transposed form- Cascaded form.

UNIT 4 FINITE WORDLENGTH EFFECTS **9 Hrs.**

Finite word length effect- Quantization- Truncation, Rounding-Quantization error- Input quantization error- Coefficient of quantization- Product quantization- Limit Cycle oscillations- Overflow- Signal scaling.

UNIT 5 TMS320C2407 DSP CONTROLLER & PROGRAMMING FOR POWER ELECTRONICS APPLICATIONS **9 Hrs.**

Nomenclature- TMS 320 family overview -Architectural Overview-Central Processing unit – Addressing modes- Event Manager- General purpose timers (GPR)- Full compare Unit (FCU)- Dead band unit- simple programs for PWM generation using GPR and FCU pertaining to Power electronic applications. **Max. 45 Hrs.**

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze Discrete time signal and systems using various transforms.
CO2 - Design IIR filter using Butterworth and Chebyshev approximation Techniques.
CO3 - Design FIR filter using windowing and frequency sampling techniques.
CO4 - Investigate the effects of finite word length effect on filters.
CO5 - Comprehend the architecture of digital signal processing controller (TMS320CX2407).
CO6 - Develop ALP for motor control application using TMS320CX2407.

TEXT / REFERENCE BOOKS

1. John G. Proakis & Dimitris G.Manolakis, “Digital Signal Processing - Principles, Algorithms & Applications”, Fourth edition,Pearson education / Prentice Hall, 2007
2. Emmanuel C..Ifeachor, & Barrie.W.Jervis, “Digital Signal Processing”, Second edition, Pearson Education / Prentice Hall,2002.
3. Alan V.Oppenheim, Ronald W. Schafer & Hohn. R.Back, “Discrete Time Signal Processing”, Pearson Education, 2nd edition,2005.
4. Andreas Antoniou, “Digital Signal Processing”, Tata McGraw Hill, 2001.

SEE1305	POWER ELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 POWER SEMICONDUCTOR DEVICES **9 Hrs.**

Overview of V-I characteristics of switching devices - Switching characteristics of Power Diode, BJT power MOSFETS, IGBT and Thyristor - SCR Protection circuits - Thyristor Turn-ON methods - firing circuits - Commutation techniques.

UNIT 2 PHASE CONTROLLED RECTIFIERS **10 Hrs.**

Principle of phase controlled converter operation - single phase half wave converter, semi converter & full converter with R, RL & RLE load - Freewheeling diode - Inverter operation of full converter - Three phase Semi converter & full converter with RL load.

UNIT 3 DC & AC CHOPPERS **9 Hrs.**

DC - DC Chopper: Principle of operation of Step down and step up choppers - Control Strategies - One, Two and Four quadrant operation. AC - AC Chopper: Single phase AC voltage controllers with R & RL load - Multistage sequence control. Single phase step up and step down cycloconverters.

UNIT 4 INVERTERS **9 Hrs.**

Principle of operation: Single phase half bridge & full bridge voltage source inverters - Three phase Voltage source inverters (120° and 180° mode) - Single phase current source inverter. PWM techniques: Single pulse PWM, Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM

UNIT 5 APPLICATIONS **8 Hrs.**

SMPS: Flyback and Push Pull - UPS: Redundant and Non-Redundant - HVDC Transmission systems -Single phase full converter fed DC drives - Inverters for standalone photovoltaic systems

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Identify the appropriate power semiconductor devices for Electrical power conversion.
CO2 - Analyze Phase Controlled Rectifiers for various Electrical Loads.
CO3 - Design DC chopper and AC voltage controllers for various Electrical loads.
CO4 - Evaluate the inverters based on the pulse width modulation techniques.
CO5 - Develop Power Electronic Converters to enhance the performance of Renewable Energy Sources.
CO6 - Design power electronics circuits for High Voltage applications..

TEXT / REFERENCE BOOKS

1. Rashid M.H., “Power Electronics circuits Devices and Applications”, Prentice Hall, 3rd Edition, New Delhi, 2013
2. P.S.Bimbhra, “Power Electronics”, Khanna Publishers, 4rd Edition, 2017
3. P.C.Sen, “Power Electronics”, Tata Mc Graw Hill Company, New Delhi, 2015.
4. M.D.Singh and K.B.Khanchandani, “Power Electronics” TMH, New Delhi, 2nd Edition, 2008.
5. Ned Mohan, “Power Electronics”, 3rd Edition, 2010

SEE1306	ELECTRIC DRIVES AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 DRIVES CHARACTERISTICS **9 Hrs.**

Electric drives - Advantages - choice of electric drive, Speed/Torque Characteristics of various types of loads and drive motors, Classes of motor duty- selection of power rating for drive motors with regard to duty. Thermal model of motor for heating and cooling, Overloading and load variation factors- load equalization.

UNIT 2 DC DRIVE **9 Hrs.**

Starting and braking operations of dc motor drive-Speed control of DC motors - Ward Leonard scheme - Drawbacks - Ward Leonard Ilgener scheme - Thyristor converter fed DC Drives: single, two and four quadrant operations. Chopper fed DC Drives: control strategies - single, two and four quadrant operation.

UNIT 3 THREE PHASE INDUCTION MOTOR DRIVES **9 Hrs.**

Starting and braking operations of dc motor drive-Speed control of DC motors - Ward Leonard scheme - Drawbacks - Ward Leonard Ilgener scheme - Thyristor converter fed DC Drives: single, two and four quadrant operations. Chopper fed DC Drives: control strategies - single, two and four quadrant operation.

UNIT 4 THREE PHASE SYNCHRONOUS MOTOR DRIVES **9 Hrs.**

Speed control of three phase synchronous motors - types of control , Voltage source and current source converter fed synchronous motors -Cycloconverter fed synchronous motors -Commutatorless DC motor- Effects of harmonics on the performance of AC motors -Closed loop control of drive motors, Marginal angle control and power factor control.

UNIT 5 DIGITAL CONTROL AND DRIVE APPLICATIONS **9 Hrs.**

Control of electric drives using microprocessor - Selection of drives and control schemes for steel rolling mills, Paper mills, textile mills and cranes.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply various types of loads to drive the motors.
CO2 - Apply various power electronic converters for controlling speed dc drives.
CO3 - Analyze torque, speed and position controller of induction motor drives.
CO4 - Analyze different type of converter for synchronous motor drives
CO5 - Examine the speed control of electrical machine in an industrial application.
CO6 - Develop the embedded controller for industrial drives

TEXT / REFERENCE BOOKS

1. Gopal K. Dubey, " Power Semiconductor Controlled Drives", Prentice Hall, 1989.
2. Gopal K. Dubey, "Fundamentals of Electrical Drives", Alpha Science International Ltd, 2010.
3. Vedam Subramanyam, "Thyristor control of Electric Drives", Tata Mc Graw Hill, New Delhi 1991.
4. S.K.Pillai, " A First Course on Electrical Drives", New age international Publishers Pvt Ltd,1989,Reprint 2012.
5. P.C.Sen, "Thyristor DC Drives", John Wiley & Sons New York 1991.
6. B.K.Bose, "Power Electronic & AC drives", Prentice Hall, 2006
7. S.K.Pillai, " A First Course on Electrical Drives", New age international Publishers Pvt Ltd,1989,Reprint 2012.
8. Rashid M.H., "Power Electronics circuits Devices and Applications", Prentice Hall, 3rd Edition, New Delhi, 2013.
9. http://ecmweb.com/power-quality/effects-harmonics-power- systems.

SEE1307	SPECIAL ELECTRICAL MACHINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 STEPPING MOTORS **9 Hrs.**

Constructional features, principle of operation, types, modes of excitation, Torque production in Variable Reluctance (VR) stepping motor, Static and Dynamic characteristics, Introduction to Drive circuits for stepper motor, suppressor circuits, Closed loop control of stepper motor- Applications.

UNIT 2 SWITCHED RELUCTANCE MOTORS **9 Hrs.**

Principle of Operation, Constructional features, Torque equation, Power Semi Conductor Switching Circuits, frequency of variation of inductance of each phase winding - Control circuits of SRM-Torque - Speed Characteristics, Microprocessor based control of SRM Drive, Applications.

UNIT 3 SYNCHRONOUS RELUCTANCE MOTORS **8 Hrs.**

Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque - Phasor diagram, Speed torque characteristics, Applications.

UNIT 4 PERMANENT MAGNET BRUSHLESS DC MOTORS **9 Hrs.**

Commutation in DC motors, Electronic Commutation- Difference between mechanical and electronic commutators Hall sensors, Optical sensors, Construction and principle of PMBL DC Motor, Torque and E.M.F equation, Torque-speed characteristics, Power Controllers-Drive Circuits, Applications.

UNIT 5 PERMANENT MAGNET SYNCHRONOUS MOTORS **10 Hrs.**

Construction and types, Principle of operation, EMF and Torque equation, Phasor diagram- Torque Speed Characteristics, Power controllers- Self control, Vector control, Microprocessor based Control, Applications.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the operation of various types of stepper motors.
CO2 - Analyze the operation and characteristics of switched reluctance motors.
CO3 - Evaluate the performance of synchronous reluctance motors..
CO4 - Identify power controllers and driver circuits for permanent magnet brushless DC motor.
CO5 - Justify best speed control for permanent magnet synchronous motor.
CO6 - Develop control methods for Permanent magnet synchronous motor on real time applications.

TEXT / REFERENCE BOOKS

1. Miller, T.J.E. “Brushless permanent magnet and reluctance motor drives”, Clarendon Press, Oxford, 1989.
2. Kenjo.T, “Stepping motors and their microprocessor control”, Oxford University Press, 1995.
3. R.Krishnan, “Electric Motor Drives - Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2015.
4. Kenjo.T and Naganori, S “Permanent Magnet and Brushless DC motors”, Clarendon Press, Oxford, 1989.
5. B.K. Bose, “Modern Power Electronics & AC drives”, Dorling Kindersley India, 2006.

SEE1303	POWER GENERATION AND UTILIZATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 CONVENTIONAL POWER PLANTS **10 Hrs.**

Layout and working of diesel, steam, low and high head power plants-pumped storage plants-principle of nuclear power generation - types and layouts of nuclear reactors- boiling water reactor- advanced gas cooled reactor- fast breeder reactor - reactor control - waste disposal.

UNIT 2 ECONOMICS OF GENERATION **8 Hrs.**

Introduction-Definitions-Load Duration Curve-Number and size of Generator Units-Base Load and Peak Load Plants-Cost of Electrical Energy-Fixed cost-Running Cost of Energy-Tariff or Charge to Consumer

UNIT 3 ILLUMINATION **10 Hrs.**

Nature of radiation - definition-laws-lighting calculations-polar curves-Rousseau construction- design of Illumination Systems-Flood Lighting and Calculations-Street Lighting-Classification of Light Sources-Incandescent lamps- gas discharge lamps- sodium vapour, mercury vapour, Fluorescent Lamps and LED lamps.

UNIT 4 HEATING AND WELDING **8 Hrs.**

Introduction - methods of heating - design of heating element- resistance, inductance, arc furnaces- high freq. dielectric heating- welding - types- resistance, arc welding- construction and its characteristics.

UNIT 5 ELECTRIC TRACTION **9 Hrs.**

Introduction - requirements of an ideal traction Train Movement-Speed-Time Curve- mechanics of train movement - tractive effort calculations- Power and energy output from driving axles-Traction motors and its Characteristics-Traction motor control-Electric braking-Current collection systems

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend conventional power plants for modern Power Generation..
CO2 - Analyze the economics of generation in terms of cost, number of generator, size of generator units and loads.
CO3 - Design of Illumination Systems for various lighting systems.
CO4 - Review the various methods of Heating and Welding used in power plants.
CO5 - Evaluate the various Characteristics of Traction motors.
CO6 - Develop the Electric Braking for Traction systems.

TEXT / REFERENCE BOOKS

1. C.L.Wadhwa, “Generation, Distribution & Utilisation of Electrical Energy”, Wiley Eastern Ltd, New Delhi, 1993.
2. Uppal.S.L. “Electrical Power”, Khanna Publishers, 9th Edition, 2001.
3. Starr A.T., “Generation, Transmission and Utilisation of Electric Power”, ELBS, 1978.
4. Soni Bhatnagar & Gupta, “ A Course in Electrical Power”, Dhanpat Rai & Sons 1996
5. Openshaw Taylor, “Utilisation of Electrical Energy”, Oriented Longmans Ltd, (Revised in SI Units) 1981, SI Edition.
6. Er.R.K.Rajput, “Utilization of Electrical power”, Laxmi Publications,2006.

SEE4055	MEASUREMENTS AND CONTROLS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Measurement of self inductance by Maxwell's inductance bridge
2. Calibration of Ammeter, Voltmeter and Wattmeter.
3. Calibration of Three phase energy meter.
4. Instrumentation Amplifier
5. Study of LVDT and Pressure Transducer.
6. Design of P,PI and PID controller
7. Study of temperature measuring transducers (Thermocouple)
8. Transfer function of DC generator
9. Transfer function of Field controlled DC motor.
10. Transfer function of Armature controlled DC motor
11. Speed Control of Ward Leonard system.
12. Transfer function of lag, lead and lag- lead network.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Design an instrumentation Amplifier and Maxwell's Bridge.
CO2 - Evaluate the basic meter and energy meter by calibrating the error.
CO3 - Examine the physical parameters by using various transducers.
CO4 - Design various controller and compensator for any applications.
CO5 - Analyze the transfer functions of DC Motor.
CO6 - Develop a method to vary the voltage and speed of DC motor.

SEE4056	POWER SYSTEMS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Computation of Power System Components in Per Units
2. Formulation of the bus admittance matrix by Direct Inspection method
3. Formulation of the bus admittance matrix by singular transformation method
4. Formation of bus impedance matrix
5. Analysis of Daily Load curve
6. Automatic Generation control
7. Determination of Transmission line parameters
8. Numerical Integration of swing equation
9. Load flow solution using Gauss – Seidel method
10. Load flow solution using Newton – Raphson method
11. Fault analysis
12. Characteristics of Microcontroller based frequency relay
13. Construction of simple ladder program for logic gates
14. Applications of Delay Timers in PLC
15. Applications of counters in PLC

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Model reactance network and develop bus impedance and bus admittance matrix.
CO2 - Estimate the various faults currents in power system and compute inductance in Transmission lines
CO3 - Solve the power flow analysis using Gauss seidel and N-R method
CO4 - Analyze the daily load curve and automatic generation control
CO5 - Determine the stability of system and characteristics of various relay
CO6 - Design ladder diagram for different automation problem using PLC

SEC1317	PRINCIPLES OF EMBEDDED SYSTEM DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 8051 MICROCONTROLLER ARCHITECTURE **9 Hrs.**

Comparison of microprocessors and microcontrollers - 8051 architecture - hardware, I/O pins, Ports, Memory, counters, timers, serial I/O interrupts.

UNIT 2 PROGRAMMING OF 8051 **9 Hrs.**

Addressing modes - instruction sets - simple programs with 8051 -I/O Programming.- Timer programmingSerial communication programs- Interrupt programming- Memory programming- Delay Programs.

UNIT 3 RISC EMBEDDED CONTROLLERS **9 Hrs.**

Comparison of CISC and RISC controllers - PIC 16F877 architecture - memory organization - addressing modes - assembly language instructions- ARM 7 Architecture-Register organization- Modes and states.

UNIT 4 DISTRIBUTED EMBEDDED SYSTEM DESIGN **9 Hrs.**

Distributed Embedded system - Embedded networking -RS 232 - RS485 - Inter-Integrated Circuit (I2C) - Serial Peripheral Interface (SPI) - Universal Serial Bus (USB) - Controller Area Network (CAN)- Ethernet.

UNIT 5 REAL TIME OPERATING SYSTEMS **9 Hrs.**

Introduction - Desktop OS versus RTOs - Task management - Task scheduling - Race conditions - Priority Inversion - ISRs and Scheduling - Intertask Communication.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the pin details, register configurations, signals and architecture for 8051 microcontroller.
CO2 - Develop an 8051 microcontroller based assembly language program to address engineering problems.
CO3 - Develop assembly language program using PIC 16F877A Microcontroller to address engineering problems.
CO4 - Select the suitability of various serial interfacing bus devices for applications.
CO5 - Comprehend the performance of Real time operating system (RTOS) and non real time desktop operating system.
CO6 - Develop an RTOS based real time embedded system.

TEXT / REFERENCE BOOKS

1. Kenneth. J. Ayala, “The 8051 Microcontroller Architecture, Programming and Apllications’, Penram International, 1996, 2nd Edition.
2. Sriram. V. Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, 2004 Tata Mc Graw Hill Publishing company limited, 2006.
3. D.P.Kothari, ShriramK. Vasudevan, Subashri.V, Sivaraman Ramachandran, “Analysis of Microcontrollers”, Scientific International Pvt Ltd, MEDTEC, ,1st Edition..
4. Frank Vahid, Tony Givargis, ‘Embedded system Design - A unified Hardware / software Introduction’, John Wiley and Sons,2002. .
5. Todd D Morton, ‘Embedded microcontrollers’, Reprint by 2005, Low Price Edition.
6. Muhammed Ali Mazidi, Janice Gillispie Mazidi, ‘The 8051 Microcontroller and Embedded Systems’, Low price Edition, Second Impression 2006.
7. Raj Kamal, ‘Embedded Systems-Architecture, Programming and Design’, Tata McGraw Hill Publishing company limited 2003.
8. Muhammed Ali Mazidi, rolin D.Mckinlay, Dannycauscy, “ PIC microcontrollers and embedded systems using assembly and C”, 1st edition, Pearson,2007.

SEE1401	POWER SYSTEM PROTECTION AND SWITCHGEAR	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION DRIVES **8 Hrs.**

Essential requirements of protection - nature and causes of faults - types of faults - effects of faults - zones of protection - protection schemes - CTs and PTs and their applications - Basic relay terminology.

UNIT 2 PROTECTIVE RELAYS **10 Hrs.**

Electromagnetic relays - operating principle - torque equation - relay characteristics - over current relay, directional relay, distance relay, differential relay, negative sequence relay, amplitude and phase comparator of over current static relays, duality between comparators. Microprocessor based over current relay.

UNIT 3 APPARATUS PROTECTION **9 Hrs.**

Protection of Generator- stator & rotor protection - Large Motor protection. Transformer protection - Bus bar Protection - Transmission line protection.

UNIT 4 THEORY OF ARC QUENCHING **9 Hrs.**

Arcing phenomena - theory and methods of arc quenching - recovery voltage - restriking voltage - RRRV - Resistance switching - current chopping - capacitive current breaking - Characteristics of fuses - HRC fuse.

UNIT 5 CIRCUIT BREAKERS **9 Hrs.**

Classification of circuit breakers - air circuit breakers - oil circuit breakers - vacuum circuit breaker - SF6 circuit Breakers - selection of circuit breakers - rating of circuit breakers - testing of circuit breakers.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Categorize various faults, their effects on power system and need of protection.
CO2 - Analyze the various electromagnetic and static relay used in power system.
CO3 - Design appropriate relay for various power system apparatus
CO4 - Investigate various Arc quenching technique for power system protection
CO5 - Evaluate the effectiveness of various circuit breakers with respect to Arc quenching
CO6 - Examine the characteristics, rating and testing of circuit breakers

TEXT / REFERENCE BOOKS

1. Sunil S.Rao “Switchgear and protection”, Khanna publishers, New Delhi, 2008.
2. Badri Ram and D.N.Vishwakarma “Power System Protection and Switchgear”, Tata McGraw Hill publishing, New Delhi, 2005.
3. S.L.Uppal, “Electrical Power”, Khanna publishers, New Delhi, 1995.
4. Soni, Gupta and Bhatnagar “A Course in Electrical power”, Dhanpat Rai&sons, New Delhi, 2010.
5. TSM Rao, “Digital Numerical Relays”, Tata McGraw Hill publishing, New Delhi, 2005.
6. B.Ravindranath and N.Chander, “ Power System Protection and Switchgear”, New age International (P) Ltd, 2005.
7. Dr.N.Veerappan and Dr.S.R.KrishnaMurthy, “Power System Switchgear and Protection”,S.Chand,2009.

SEC4071	EMBEDDED SYSTEM DESIGN LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

EMBEDDED –

1. Basic illustration programs using arithmetic, Logical and bit oriented instructions for AT89C51
2. Interfacing light bulb using relay
3. Interfacing LCD display in static display
4. Interfacing stepper motor with ULN2003 to rotate in specific angle
5. Interfacing DC motor with H-bridge to make it rotate in front, back, left, right
6. Illustration of interrupts using LED on/off using timer delay
7. Illustration of serial communication to transfer data from one microcontroller to other

PROGRAMS USING MATLAB –

1. Generation of Standard Signals
2. Design of FIR filters using Windowing technique
3. Design of IIR Filters using Butterworth filters

USING TMS320CX2407 DSP PROCESSOR -

1. Single pulse fixed PWM generation using general purpose Timers.
2. Two pulse fixed PWM generation using Timer 1 and Timer 2.
3. Six pulse fixed PWM generation using full compare unit.
4. Six pulse fixed PWM generation with dead band

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the statements of MATLAB and mnemonics of AT89C51.
CO2 - Develop the code for arithmetic, logical and data transfer operations using AT89C51.
CO3 - Develop the MATLAB program for signal generation/Processing applications.
CO4 - Develop the code to generate PWM pulse using DSP processor.
CO5 - Design IIR and FIR filter using MATLAB.
CO6 - Design of microcontroller based embedded systems.

SEE4057	POWER ELECTRONICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. SCR Triggering Circuits
2. Single Phase Half & Fully Controlled Bridge Rectifier
3. SCR based series and Parallel Inverter
4. AC Regulator-Phase Control Using DIAC &TRIAC
5. Single phase Cycloconverter
6. MOSFET Based Buck & Boost Converter
7. IGBT Based Single Phase PWM Inverter
8. Voltage Commutated Chopper
9. Current Commutated Chopper
10. Complementary Commutated Chopper

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Choose a suitable triggering method of SCR and experiment on various firing and conduction angles.

CO2 - Design rectifiers with R, RL and RLE loads for various firing angles.

CO3 - Analyze AC output for different frequencies with Series and parallel inverter circuits using SCR.

CO4 - Analyze ac voltage controller using SCR, DIAC,TRIAC

CO5 - Develop hard wired circuit on various switching devices to analyze the variations in performances depending on their duty cycle..

CO6 - Design different commutation circuits for real world problem.

SBA1101	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 MANAGEMENT FUNCTIONS & STRUCTURE **9 Hrs.**

Management - Definition -Role of managers- Levels of management-Basic Function - Contribution of Taylor & Fayol. Types of structures - Line, staff, Functional, Committee and Project & Matrix - Structures. Departmentalization - Centralization - Decentralization - Span of control. Management by Objectives (MBO)- Management by Exception (MBE).

UNIT 2 MANAGEMENT OF ORGINASATION **9 Hrs.**

Forms of Business / Industrial Ownership - Sole Trader, Partnership, Joint stock Company, Performance Appraisal.
Basic Principles - Pitfalls - Methods to Overcome. Industrial Safety - Causes of Accidents - Cost of Accidents - Measures to avoid Accidents. Plant Layout & Maintenance - Need, Types & Managerial Aspects

UNIT 3 ORGANISATIONAL BEHAVIOUR **9 Hrs.**

Organizational Behaviour - Definition - Nature & Scope - Contributing Disciplines - Importance of OB to Managers. Personality - Definition - Theories - Factors Influencing Personality. Motivation - Definition - Theories. Transactional Analysis. Morale & Job Satisfaction - Factors Influencing Job Satisfaction.

UNIT 4 GROUP DYNAMICS **9 Hrs.**

Group - Definition - Types - Determinants of Group Cohesiveness. Communication - Process - Barriers - Effective Communication. Leadership-Definition- leadership styles- Theories of leadership - Factors Contributing to Effective Leadership. Trade Unions- Role of Trade Union in Organizations - Types and Functions of Trade Unions

UNIT 5 PROFESSIONAL ETHICS **9 Hrs.**

Ethics in Workplace - Formulation of Ethics - Managerial Ethics - Managing Ethical Behaviour - Codes of Ethics - Encouraging Ethical Behaviour - Ethical Leadership - Ethical Decision making. Corporate Social Responsibility (CSR) - Intellectual Property Rights (IPR)- Meaning- Laws relating to Intellectual Property Rights (IPRs)

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend various management principles and practices followed in industries
CO2 - Analyze the types of business organization, plant layout and its safety measures.
CO3 - Develop appropriate behavior as an individual and as a team to excel in industries.
CO4 - Develop expertise knowledge on the impact of Leadership Communication and Group dynamics in industry
CO5 - Comprehend the basics of ethical behaviour and corporate social responsibility practiced in industries
CO6 - Investigate business cases by applying the ethical guidelines in industrial real life situations.

TEXT / REFERENCE BOOKS

1. Gupta C.B., “Management Theory and Practice”, 14th Edition, Sultan Chand & Sons, 2009.
2. Dr. Prasad L.M., “Principle & Practice of Management”, 7th Edition, Sultan Chand & Sons, 2008.
3. Aswathappa, “Organisational Behaviour”, 8th Edition, Himalaya Publishing House, 2010.
4. Dr. Prasad L.M., “Organisational Behaviour”, 4th Edition, Sultan Chand & Sons, 2008.
5. Harold Koontz, “Principles of Management”, 1st Edition, Tata McGraw Hill, 2004.

SEE1402	HIGH VOLTAGE ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 OVERVOLTAGES IN ELECTRICAL POWER SYSTEMS 9 Hrs.

Causes of Over voltages Theory and Mechanism of Lightning phenomenon - Overvoltage due to Switching Surges - Protection against over voltages - Reflection and Refraction of Travelling waves - Insulation Coordination.

UNIT 2 CONDUCTION AND BREAKDOWN IN DIELECTRICS 9 Hrs.

Ionization of gases and current growth - Townsend's criterion for breakdown -Streamer theory of breakdown in gases. Paschen's Law - Vaccum breakdown - Various mechanisms of breakdown in liquid dielectrics -Various processes of breakdown in solid dielectrics.

UNIT 3 GENERATION OF HIGH VOLTAGES AND CURRENTS 9 Hrs.

Generation of high DC voltages: Rectifier, Voltage doubler circuits, Cockroft Walton voltage multiplier circuit, Van de Graffe generator - Generation of high AC voltage: cascaded transformers, resonant transformers- Generation of high frequency a.c. high voltage - Generation of impulse voltages: Standard impulse waveshapes, Marx Circuit - generation of switching surges - generation of impulse current - tripping and control of impulse generators.

UNIT 4 MEASUREMENT OF HIGH VOLTAGES AND CURRENTS 9 Hrs.

High Resistance with series ammeter -Potential Divider - Generating Voltmeters - Capacitance Voltage Transformer, Electrostatic Voltmeters - Sphere Gaps - Hall generator - Resistive Shunts -Rogowski coils - Cathode Ray Oscillographs for impulse measurement.

UNIT 5 TESTING OF ELECTRICAL APPARATUS 9 Hrs.

Testing of Insulators and Bushings - Testing of Isolators and Circuit Breakers - Testing of Cables - Testing of Transformers - Testing of Surge arresters - Radio Interference Measurements - Standards and Specifications.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Select a suitable protection for over voltage in electrical power system
CO2 - Justify the suitable dielectric for high voltage applications
CO3 - Evaluate the performance of high DC,AC voltages and currents generators
CO4 - Propose a suitable technique for measuring high voltages and currents
CO5 - Comprehend the testing procedure for isolators, circuit breakers, bushing and transformer
CO6 - Develop a procedure for testing high voltage devices by adhering to the standards

TEXT / REFERENCE BOOKS

1. M. S. Naidu and V. Kamaraju, 'High Voltage Engineering', 5thEdition Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2013.
2. E.Kuffel and M.Abdullah, "High Voltage Engineering" - Per gammon Press, Oxford, 1970.
3. C.L.WADHWA, "High Voltage Engineering" - New Age International (P) Ltd, Publishers, 2007.
4. E.Kuffel and W.s. Zaengal, "High Voltage Engineering Fundamentals", 2nd Edition, Butterworth Heinemann, 2000.
5. H.M.Ryam, "High voltage Engineering and testing", 2nd Edition, 2001, IEEE power and energy series 32.

SEC1304	FUNDAMENTALS OF COMMUNICATION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

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UNIT 1 BASICS AND AMPLITUDE MODULATION **9 Hrs.**

Electromagnetic Spectrum and communication applications-Elements of communication systems-baseband and pass band signals-need for modulation-amplitude modulation-modulation index of AM-frequency spectrum-AM power distribution in AM_DSB_ FC- generation of AM_DSB_SC using FET balanced modulator-Generation of AM_SSB using phase shift and filter method-AM VSB-Comparison of AM schemes. - AM demodulation-Envelope detector-significance of RC time constant in envelope detector

UNIT 2 ANGLE MODULATION **9 Hrs.**

Principle of angle modulation-Frequency modulation-modulation index of FM-frequency deviation-deviation ratio-Carson's rule for bandwidth of FM-Comparison of AM and FM-narrow band and wideband FM-comparison Generation of FM using varactor diode modulator (direct method)-Indirect method of FM generation. Phase modulation-Generation of PM using frequency modulator.FM demodulation-Principle of slope detection-balance slope detector-Foster Seely discriminator-ratio detector-amplitude limiting using ratio detector.

UNIT 3 PULSE MODULATION AND MULTIPLEXING **9 Hrs.**

Pulse modulation-Sampling process-sampling theorem- concepts of PAM-PWM-PPM-Generation and demodulation of PAM, PWM, PPM-comparison-PCM system-quantization-DPCM-Adaptive Delta Modulation-Digital modulation techniques-ASK-FSK-PSK-QPSK. Concept of multiplexing-frequency division multiplexing-time division multiplexing-code division multiplexing-space division multiplexing

UNIT 4 TRANSMITTERS AND RECEIVERS **9 Hrs.**

AM transmitter -low level modulator- high level collector and base modulator- FM transmitter-preemphasis concept- FM stereo broad cast transmitter. AM Receivers-super heterodyne receiver- AGC- choice of IF- tracking - alignment - receiver characteristics-FM receiver- Deemphasis concept-FM stereo broad cast receiver- AFC.

UNIT 5 BROAD BAND COMMUNICATION SYSTEM **9 Hrs.**

Facsimile system - optical communication system-fiber optic cable modes -mobile telephone communication cellular concept- satellite communication system-satellite frequency plans and allocations-frequency reuse-satellite system link models- computer communication - electronic mail- power line carrier communication-SCADA.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the characteristics of various amplitude modulation schemes.
CO2 - Analyze the characteristics of various frequency modulation schemes.
CO3 - Determine the generation of pulse modulation and multiplexing techniques..
CO4 - Analyze the transmitter and receiver circuits.
CO5 - Examine the process of fiber optic and mobile telephone communications.
CO6 - Determine the frequency allocation plans for satellite communication.

TEXT / REFERENCE BOOKS

1. George Kennedy, "Electronic Communication Systems", Third Edition, TMH, New Delhi,5th edition,2011
2. Anokh Singh, "Principles of Communication Engineering", S. Chand & Company Ltd, 2006
3. Taub and Schilling, "Principles of Communication Systems", Third Edition, TMH, New Delhi, 2008.
4. Louis Frenzel, "Communication Electronics", McGraw-Hill Companies,4th edition,2015.
5. Bruce Carlson, "Communication Systems", McGraw Hill, 2010.

SEC1316	CMOS VLSI DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 MOS TRANSISTOR THEORY **9 Hrs.**

The MOS transistor-Current Voltage Relations-Threshold Voltage-Second order effects-capacitances in MOSFET – DC characteristics — Dynamic behavior – Power consumption – Scaling of MOS circuits.

UNIT 2 COMBINATIONAL LOGIC DESIGN **9 Hrs.**

Static CMOS design – Determination of Pull-up and Pull-down ratio-Sizing of transistors – Ratioed logic-Pass transistor logic – Dynamic CMOS design – Noise consideration – Domino logic, np CMOS logic – Power consumption in CMOS gates – Multiplexers – Transmission gates design.

UNIT 3 SEQUENTIAL LOGIC DESIGN **9 Hrs.**

Introduction – Static sequential circuits- CMOS static flip-flop – Dynamic sequential circuits –Pseudo static latch - Dynamic two phase flip-flop – clocked CMOS logic – C2 MOS latch- Pipelining – NORA CMOS logic –True single phase clocked logic –Realization of D FF in TSPC logic.

UNIT 4 SUBSYSTEM DESIGN **9 Hrs.**

Introduction-Designing Static and Dynamic Adder circuits – The Array Multiplier – Multiplier structures Baugh-Wooly – Booth Multiplier – Barrel shifter – Memory structures – SRAM and DRAM design – Design approach of Programmable logic devices – PLA,PAL and FPGA.

UNIT 5 ASIC CONSTRUCTION **9 Hrs.**

Physical design – Goals and Objectives – Partitioning methods – Kernighan Lin algorithm – Hierarchical Floor planning – Floor planning tools –input, output and power planning –Min-cut placement, Force directed placement algorithm –Placement using simulated annealing – Greedy channel routing.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the mathematical methods and circuit analysis models in analysis of CMOS transistors and inverters
CO2 - Analyze the different styles of CMOS logic for design of combinational logic circuits
CO3 - Design the static and dynamic sequential logic circuits
CO4 - Evaluate the design of CMOS subsystems and memory structures
CO5 - Explain the design of programmable logic devices
CO6 - Construct a digital system using VLSI physical design flow

TEXT / REFERENCE BOOKS

1. Jan M.Rabaey ,“Digital Integrated Circuits” , 2nd edition, September 2000,PHI Ltd.
2. M.J.S.Smith ,“Application Specific Integrated Circuits “, Ist edition 1997,Pearson education.
3. Douglas A.Pucknell,”Basic VLSI design”, PHI Limited, 1998.
4. E.Fabricious, “Introduction to VLSI design”, Mc Graw Hill Limited, 1990.
5. Neil Weste , “Principles of CMOS VLSI design”, Addison Wesley 1998
6. Wayne Wolf,”Modern VLSI design ‘, 2nd Edition 2003, Pearson education
7. Sung-Mo Kang & Yusuf,”CMOS Digital Integrated Circuits- Analysis & Design”, 2nd Edition, MGH

SEC1402	PROGRAMMING IN HDL	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 BASIC CONCEPTS IN VHDL **9 Hrs.**

Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL - Data objects - Data types - Operators - Signal assignments - Inertial delay mechanism - Transport delay mechanism - Variable assignments - Concurrent and Sequential assignments- Delta delay.

UNIT 2 MODELING IN VHDL **9 Hrs.**

Data flow modeling - Concurrent Signal Assignment statements - Structural modeling – Component declaration - Component Instantiation - Behavioral modeling - Process statement - wait statement - Conditional and loop statements - Generics and configurations - Examples for modelings.

UNIT 3 INTRODUCTION TO VERILOG HDL **9 Hrs.**

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives - value set - data types - Parameters - Expressions - Operands - operators in verilog HDL.

UNIT 4 STYLES OF MODELING **9 Hrs.**

Gate level modeling -Primitive Gates- Multiple input and multiple output gates - User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs – procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT 5 FEATURES IN VERILOG HDL **9 Hrs.**

Tasks- Functions -systems tasks and functions - Verification - Modeling a test bench - timing and delays - Switch level modeling - state machine modeling - Moore FSM - Melay FSM - Design of memories - Design of microcontroller CPUs.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Identify the use of HDL language in constructing digital logic circuits.
CO2 - Analyze the combinational sequential logic circuit in gate and switch level modeling
CO3 - Conceptualize the system through design and modeling various architectures es.
CO4 - Develop any design based upon the system requirements for solving real time problems
CO5 - Validate and Verify the system design
CO6 - Design a test bench for any logic circuit

TEXT / REFERENCE BOOKS

1. J.Bhaskar, “A VHDL Primer”, , Prentice Hall of India Limited. 3rd edition 2004
2. Douglas L. Perry, "VHDL", McGraw Hill, 2002.
3. J.Bhaskar, “A Verilog HDL Primer”, Prentice Hall of India Limited. 3rd edition 2004
4. Stphen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill, 2008.

SEC1602	ASIC DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO ASIC **9 Hrs.**

Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort - Library cell design - Library architecture.

UNIT 2 FIELD PROGRAMMABLE LOGIC ARRAYS **9 Hrs.**

Organization of FPGAs - FPGA Programming Technologies-Programmable Logic Block Architectures-Programmable Interconnects - Programmable I/O blocks in FPGAs - Dedicated Specialized Components of FPGAs-Applications of FPGAs.

UNIT 3 PROGRAMMABLE ASIC **9 Hrs.**

Introduction-Programming Technology - Device Architecture -The Xilinx XC2000- XC3000 and XC4000 Architectures. The Actel ACT1 -ACT2 and ACT3 Architectures. Anti fuse - static RAM - EPROM and EEPROM technology - Altera FLEX - Altera MAX DC &AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT 4 ASIC FLOOR PLANNING, PLACEMENT AND ROUTING **9 Hrs.**

ASIC Construction: Physical Design - System Partitioning - FPGA Partitioning - Partitioning Methods. Floor-planning and Placement: Floor planning – Placement - Physical Design Flow. Routing: Global Routing – Detailed Routing- Special Routing - Design checks.

UNIT 5 OPTIMIZATION ALGORITHMS **9 Hrs.**

Planar subset problem(PSP) - Single layer global routing single layer detailed routing wire length and bend minimization technique - Over the cell (OTC) Routing - Multichip modules (MCM) - Programmable logic arrays-Transistor chaining - Weinberger Arrays - Gate Matrix Layout - 1 D compaction-2D compaction.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the various types of ASICs and procedure of the CMOS logic design
CO2 - Interpret the programmable logic cells and I/O cells
CO3 - Apply the practical design steps of Backend VLSI design for digital system.
CO4 - Analyze the fundamentals of SoC design and Software with Energy Management
CO5 - Evaluate the practical design steps of NoC and Methodology
CO6 - Construct Low Power NoC design

TEXT / REFERENCE BOOKS

1. Stephen M. Trimberger, “Field Programmable Gate Array Technology “, Springer International Edition, 1994
2. Charles H. Roth Jr, Lizy Kurian John , “Digital Systems Design “ , Cengage Learning,
3. M. J. S. Smith, "Application Specific Integrated Circuits”, Addison -Wesley Longman Inc., 1997.
4. Farzad Nekoogar and Faranak Nekoogar, “From ASICs to SOCs: A Practical Approach”, Prentice Hall PTR, 2003
5. John V. Oldfield, Richard C. Dorf , “ Field Programmable Gate Arrays”, Wiley India
6. Pak K. Chan, Samiha Mourad , “ Digital Design Using Field Programmable Gate Arrays”, Pearson Low Price Edition.
7. Ian Grout, “Digital Systems Design with FPGAs and CPLDs”, Elsevier, Newnes.
8. Wayne Wolf , “FPGA based System Design”, Prentice Hall Modern Semiconductor Design.

SEE1601	FLEXIBLE AC TRANSMISSION SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION **9 Hrs.**

Electrical Transmission Network – Emerging Transmission Network – Concept of Reactive Power – Load and System Compensation – Midpoint Voltage – Passive Compensation – Synchronous Condenser – Saturated Reactor – Classification of FACTS controllers.

UNIT 2 SHUNT COMPENSATION **9 Hrs.**

Thyristor Controlled Reactor (TCR) – Thyristor Switched Reactor (TSR) – Thyristor Switched Capacitor (TSC) – Fixed Capacitor- Thyristor Controlled Reactor (FC-TCR) – Thyristor Switched Capacitor-Thyristor Controlled Reactor (TSC -TCR) – V-I Characteristics of Static Var Compensator (SVC) – Advantages of slope in dynamic Characteristic – Voltage control by SVC.

UNIT 3 THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) **9 Hrs.**

Fixed Series Compensation – Need for Variable Series Compensation – TCSC: Basic principle – Modes of Operation – Advantages – Capability Characteristic – Variable Reactance Model – Application: Open loop & Closed loop Control.

UNIT 4 EMERGING FACTS CONTROLLER **9 Hrs.**

Static Synchronous Compensator (STATCOM): Introduction – Principle of Operation – V-I Characteristic. Multilevel VSC based STATCOM. SSSC: Principle of Operation. Unified Power Flow Controller (UPFC): Principle of Operation. Interline Power Flow Controller (IPFC): Principle of Operation.

UNIT 5 SUB SYNCHRONOUS RESONANCE (SSR) **9 Hrs.**

Concept of SSR – NGH-SSR Damping scheme: basic concept – design and operation aspect. Thyristor Controlled Braking Resistor (TCBR), Advanced Series Capacitor (ASC): Basic concept – design and operation aspect

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the level of system and load compensation to balance reactive power.
CO2 - Examine the performance of various Shunt Compensators
CO3 - Inspect the effect of Thyristor Controlled Series Capacitor in open loop and closed loop applications
CO4 - Identify Emerging FACTS controllers for various applications.
CO5 - Evaluate the performance of SSR in Power System network.
CO6 - Design the Advanced Series Capacitor for power control.

TEXT / REFERENCE BOOKS

1. R.Mohan Mathur and Rajiv K. Varma “Thyristor based FACTS controllers for electrical transmission systems”, IEEE Press John Wiley & Sons Inc. Publication, 2002.
2. Narin G.Hingorani and Laszlo Gyugi “Understanding FACTS”, IEEE Press Standard Publishers Distributors, 2001
3. K.R.Padiyar “FACTS controllers in power transmission and distribution”, New Age International Publishers, 2009.
4. M.Noroozian et.al, “ Use of UPFC for optimal power flow control”ll Transactions on Power Delivery, Vol.12, No.4, oct 1997, pp 1629-1634
5. Gyugyi.L, ―Unified Power Flow Control Concept for Flexible AC Transmission”, IEEE Proc-C Vol.139, N0.4, July 1992 6. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age International (P) Ltd., New Delhi, 2007.

SEE1602	POWER SYSTEM DYNAMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 SYNCHRONOUS MACHINE MODELING **9 Hrs.**

Mathematical description of a synchronous machine; Review of magnetic circuit equations, basic equations of a synchronous machine, per unit (pu) representation: pu system for the stator quantities, pu stator voltage equations, pu rotor voltage equations, stator flux linkage equations, rotor flux linkage equations, pu system for the rotor, pu power and torque, Alternative per unit systems and transformations-Equivalent circuits for direct and Quadrature axes-constant flux linkage model, classical model, constant flux linkage model including the effects of sub transient circuits.

UNIT 2 INDUCTION MOTOR AND SYNCHRONOUS MOTOR MODELING **9 Hrs.**

Modeling of Induction motors: Equations of an induction machine - steady state characteristics - Alternative rotor constructions-Representation of saturation - per unit Representation – Representation in stability studies - Synchronous motor model.

UNIT 3 EXCITATION SYSTEM **9 Hrs.**

Excitation system requirements - Elements of an excitation system - Types of excitation system: DC Excitation systems, AC excitation systems, static excitation systems - Control and protective functions: AC and DC regulators, Excitation system stabilizing circuits, power system stabilizer(PSS), load compensation, Under excitation limiter, over excitation limiter, volts-per-hertz limiter and protection, Field shorting systems - Modeling of excitation systems.

UNIT 4 SMALL-SIGNAL STABILITY **9 Hrs.**

Fundamental concept of stability of dynamic systems - small-signal stability of a single-machine infinite bus system - Effects of excitation system - power system stabilizer - small signal stability of multi machine systems.

UNIT 5 TRANSIENT STABILITY **9 Hrs.**

Elementary view of transient stability - Simulation of power system dynamic response - Direct method of transient stability analysis: Description of the transient energy function approach, Analysis of practical power systems - Limitations of the direct methods.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the basic equations for Synchronous Machine Modeling
CO2 - Analyze the per unit representation and characteristics of Induction motor
CO3 - Design the excitation model for AC and DC system
CO4 - Investigate the small signal stability of a single machine infinite bus system
CO5 - Evaluate the dynamic response of power system in transient stability analysis.
CO6 - Examine the transient energy function approach

TEXT / REFERENCE BOOKS

1. P.Kundur, “Power system stability and control”, McGraw Hill Inc:USA, 2006
2. R.Ramanujam, “ Power System Dynamics”,Phi learning, 2010.
3. M.A.Pai and W.Saueer, “ Power system dynamics and stabilities”, Pearson Education Asia,India,2002.
4. Edward Wilson kimbark, “ Power systems stability”, volume III, John Wiley &Sons,Inc,2004.
5. K.R.Padiyar, “Power System Dynamics”, Anshan Pvt Ltd, 2004.

SEE1603	POWER SYSTEM OPERATION AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION **9 Hrs.**

System Load Variation: System Load Characteristics, Load curves - Daily, Weekly and Annual, Load Duration Curve, Load Factor, Diversity Factor, Reserve Requirements: Installed reserves, Spinning Reserves, Cold Reserves, and Hot Reserves. Overview of system operation: Load Forecasting, Unit Commitment, Load Dispatching. Overview of system control: Governor Control, LFC, EDC, AVR, System Voltage Control, Security control.

UNIT 2 COMMITMENT AND ECONOMIC LOAD DISPATCH **9 Hrs.**

Statement of unit commitment (UC) problem-constraints in UC: Spinning Reserve, Thermal unit Constraints, Hydro Constraints, Fuel Constraints and other Constraints - UC solution methods: Priority -List Methods, Forward Dynamic Programming Approach, Langrange Relaxation Method. Economic Load Dispatch: Incremental Cost Curves – Equal Incremental Cost Rule – Loss Coefficient – Coordination Equation.

UNIT 3 COMPUTER CONTROL OF POWER SYSTEMS **9 Hrs.**

Energy control system: Function-monitoring, Data Acquisition and Control, System Hardware Configuration-Scada and Ems Function: Network Topology Determination, Steady State Estimate, Security Analysis and Control. Various operating states: normal, Alert, emergency: Extremely Emergency and Restorative- State Transition Diagram Showing Various State Transition and Control Strategies.

UNIT 4 ACTIVE POWER AND FREQUENCY CONTROL **9 Hrs.**

Fundamentals of Speed Governing - Control of Generating Unit Power Output - Composite Regulating Characteristics of Power Systems - Response rates of Turbine Governing Systems - Fundamentals of automatic generation control - Implementation of AGC - Under Frequency Load Shedding.

UNIT 5 REACTIVE POWER AND VOLTAGE CONTROL **9 Hrs.**

Production and Absorption of Reactive Power – Method Production and Absorption of Reactive Power - Methods of Voltage Control - shunt Reactors, Shunt Capacitors, Series Capacitors, Synchronous Condensers, Static var Systems-Principles of Transmission System Compensation – Modeling of Reactive Compensation Devices - Application of Tap-Changing Transformers to Transmission Systems - Distribution System Voltage Regulation - Modeling of Transformer ULTC Control System.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Interpret the day-to-day operation of electric power system.
CO2 - Analyze the Unit Commitment and Economic Dispatch Problem
CO3 - Design of SCADA for various applications in real time operation
CO4 - Construct the Speed Governing Mechanism and explain Load Shedding
CO5 - Categorize the various compensation device for voltage control
CO6 - Examine the performance of Tap Changing Transformer

TEXT / REFERENCE BOOKS

1. P.Kundur, “Power system stability & control”, Tata McGraw Hill publications, 5th reprint 2014.
2. Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheble, “Power generation, operation and control”, John Wiley & sons, Inc, 3rd Edition, 2013.
3. Olle.I.Elgerd, “Electric Energy Systems theory” – An Introduction, Tata Mc Graw Hill Publishing Copmpany Ltd, NewDelhi, 2nd Edition, 2014.
4. D. P. Kothari and I. J. Nagrath, “Modern power system analysis”, 4th Edition, Tata McGraw hill publishing company limited, NewDelhi, 2013.
5. Leonard L.Grigsby, “The Electric Power Engineering Handbook”, CRC press press, 3rd edition 2012

SEE1604	EHV AC AND DC TRANSMISSION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Transmission line trends – Standard transmission voltages – Power handling capacity and line losses – cost of transmission lines and equipments –Mechanical consideration – Transmission Engineering principles

UNIT 2 **9 Hrs.**

Calculation of line and ground parameters – Resistance, Capacitance and Inductance calculation – Bundle conductors – Modes of propagation – Effect of earth

UNIT 3 **9 Hrs.**

Power frequency and voltage control – Over voltages – Power circle diagram – voltage control using shunt and series compensation – Static VAR Compensation – Higher phase order system – Facts

UNIT 4 **9 Hrs.**

Design of EHV Lines based on steady state limits and transient over voltages – Design of extra HV cable transmission – XLPE cables – Gas insulated cables – Corona and RIV

UNIT 5 **9 Hrs.**

HVDC Transmission Principles – Comparison of HVAC and HVDC Transmission – Economics – Types of converters – HVDC rules – HVDC control – Harmonics – filters – Multi terminal DC system – HVDC cables and HVDC circuit breakers.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Estimate the cost of transmission lines and equipments
CO2 - Evaluate the Inductance and capacitance of two conductor and bundled conductor lines.
CO3 - Analyze the effect of shunt and series compensation.
CO4 - Design different types of EHV cables
CO5 - Analyze the performance of HVDC control.
CO6 - Describe the concept of HVDC cables and HVDC circuit breakers

TEXT / REFERENCE BOOKS

1. Padiyar, K.R., “HVDC Power Transmission System”, Wiley Eastern Limited, New Delhi 1990. 1st Edition.
2. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age International (P) Ltd., New Delhi, 2006.
3. Allan Greenwood, “Electrical Transients in Power system”, John Wiley & Sons, Newyork, 2010.
4. Arrillaga, J., “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1998.
5. Rao.S, “EHV-AC,HVDC Transmission & Distribution Engineering”, 3rd Edition, Khanna Publishers, 2001

SEE1605	POWER SYSTEM RESTRUCTURING AND DEREGULATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

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UNIT 1 **9 Hrs.**

Gencos, Transco, Discos, Customers, ISO, Market operators. Privatization, An overview of the Restructured Power System, Difference between Integrated Power System and Restructured Power System, Transmission Open Access, Wheeling, Power Systems Operation – Old Vs New, Key issues associated with the Restructuring of ESIs, Advantages of Competitive System.

UNIT 2 **9 Hrs.**

Separation of ownership and operation, Deregulated models – Pool Model, Pool and Bilateral Trade Model, Multilateral Trade Model.

UNIT 3 **9 Hrs.**

Independent System Operator activities in Pool Market, wholesale Electricity Market Characteristics, C Auction, Single Auction Power Pool, Double Auction Power Pool, Market Clearing And Pricing, Market Power a Mitigation Techniques, Bilateral Trading, Ancillary Services.

UNIT 4 **9 Hrs.**

Marginal pricing of Electricity, nodal pricing, zonal pricing, embedded cost, postage stamp method, control path method, boundary flow method, MW-mile method, MVA-mile method, comparison of different methods

UNIT 5 **9 Hrs.**

Total Transfer Capability – Limitations – Margins – Available Transfer Capability(ATC) – Procedure – methods to compute ATC – Static and Dynamic ATC – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling – Transmission Congestion Contracts.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the acquired knowledge in the need of restructured power systems.
CO2 - Analyze the different trade models of electricity market
CO3 - Discuss the various Market Clearing and Pricing techniques
CO4 - Investigate the transmission open access Marginal pricing issues
CO5 - Evaluate the performance of Static and Dynamic ATC
CO6 - Examine the Inter and Intra zonal congestion.

TEXT / REFERENCE BOOKS

1. Loi Lei Loi, " Power System Restructuring and Deregulation – Trading, performance& information technology", John Wiley sons,2001.
2. Kankar Bhattarcharya, et,al., "Operation of restructured power systems", Springer US, 2012.
3. S. A. Khaparde and A. R. Abhyankar, "Restructured Power Systems", Alpha Science Intl Ltd,2013.
4. Mohammad Shahidehpour, Hatim Yamin, Zuyi Li, "Market Operations in Electric Power Systems: Forecasting, Scheduling, and Risk Management", Wiley-Blackwell, March 2012.
5. Mohammad Shahidehpour and Muwaffaq Almoush, "Restructured Electrical Power Systems Operation, Trading and Volatility," Marcel Dekkar, Inc, 2012.

SEE1606	STATIC RELAYS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Phase and Amplitude Comparators – Duality between them – Types – Direct and Integrating Rectifier Bridge, Circulating Current Opposed Voltage Coincident type Phase Comparator, Direct or Block Spike Phase comparator, Phase Splitting Techniques, Integrating type Phase Comparator with Transistor AND Gate – Hybrid comparator – Hall Effect type and magneto resistivity type, Vector Product type – Zener Diode Phase Comparator – Multi Input – Three Input Coincident Comparator/Phase Sequence Detector.

UNIT 2 **9 Hrs.**

Static relay circuits using analog and digital ICs for over current, Differential and Directional Relays

UNIT 3 **9 Hrs.**

Static Relay Circuits for Generator Loss of Field, Under Frequency, Distance, Impedance, Reactance, Mho and Reverse power Relays - Static Relay Circuits for Carrier Current Protection.

UNIT 4 **9 Hrs.**

Steady State and Transient Behavior of Static Relays – Testing and Maintenance of Relays – Tripping Circuits Using thyristors

UNIT 5 **9 Hrs.**

Microprocessor Based Relays – Hardware and Software for the Measurement of Voltage, Current, Frequency and Phase Angle – Microprocessor Based Implementation of Over Current, Directional, Impedance and Mho Relays.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply various types of phase and amplitude comparators on static relay
CO2 - Identify static relay circuit using analog and digital ICs for different protection
CO3 - Analyse the usage of static relays for various fault conditions.
CO4 - Examine the behavior of static relay under steady state and transient conditions.
CO5 - Develop Hardware and software for different electrical parameter.
CO6 - Propose microprocessor based relay for over current, differential and distance relay.

TEXT / REFERENCE BOOKS

1. Van.C.Warington, “Protective Relays-their Theory and Practice”, Vol I & II, Champ Man and Hall Ltd, London, 2014.
2. T.S.Madhava Rao, “Power System Protection, Static Relays with Microprocessor Applications”, Tata Mc- Graw Hill, New Delhi, 2017.
3. Ram.B, “Fundamental of Microprocessors and Micro computers”, Reprint 2018.
4. Sunil S.Rao, “Switchgear Protection & Power Systems”, Khanna Publishers, New Delhi 2015.

SEE1607	RENEWABLE ELECTRIC SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Classification of Energy Resources - Importance of Non Conventional Energy Resources - Advantages and Disadvantages of Non-Conventional Energy Resources - Environmental Aspects of Energy - World Energy status - Energy scenario in India - Principles of Energy Conservation – Cogeneration.

UNIT 2 **9 Hrs.**

Theory of solar cells - VI and PV curves - Equivalent circuit. Concept of solar PV module, Panel, Array, Maximum Power Point tracking - Solar PV systems - Solar PV Applications. Solar Thermal Systems-Solar Collector's Classifications- Flat plate collectors - Focus type collectors – Solar Refrigeration and Air-Conditioning System - Solar Pond Power Plant - Solar Thermal Power Plant

UNIT 3 **9 Hrs.**

Wind Power and its Sources-Energy from Wind - Horizontal axis Wind Turbine - Vertical Axis Wind Turbine - Wind Energy Conversion Systems - Cp Vs Speed Curve.

UNIT 4 **9 Hrs.**

Geothermal Energy:-Resources of geothermal energy- environmental considerations. Bio-mass-Availability of bio-mass and its conversion technologies-Biogas production from Bio-mass. Tidal energy-tidal range power-ocean tidal energy conversion-Ocean Thermal Energy Conversion technology (OTEC)

UNIT 5 **9 Hrs.**

Fuel Cells - Principle of Working - Classification of Fuel Cells - Construction, Working and Performance of Phosphoric Acid Fuel Cell and Alkaline Fuel Cell - VI Characteristics of Fuel Cell - Fuel Cell Power Plant - MHD Power Conversion-Thermo Electric Power Conversion - Thermionic Power Conversion.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend the different types of conventional energy recourses. .
CO2 - Design a suitable solar energy conversion system for real world.
CO3 - Design the suitable Wind Energy conversion system for real world application.
CO4 - Design a smart grid for uninterrupted power supply from non conventional energy resources.
CO5 - Justify, the suitability of fuel cells for addressing the energy problems of the modern world
CO6 - Justify, the suitability of Thermo Electric and Thermionic Power Conversion system for addressing the energy problems of the modern world.

TEXT / REFERENCE BOOKS

1. B Khan ,"Non conventional Energy resources", Tata McGrawHill, 2 nd Edition 2009.
2. Mukund R. Patel ,Wind & Solar Power Systems- Design, Analysis and Operation, , Taylor and Francis, 2n d Edition 2005.
3. James Larminie & Andrew Dicks, "Fuel Cell Systems Explained", John Wiely & Sons, 2nd Edition.
4. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.

SEE1608	COMPUTER AIDED DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Description of Spice- Limitations- Circuit Descriptions- DC Circuit Analysis- Transient Analysis- AC Analysis-Parametric - Sub circuit - Fourier analysis - programs based on DC, AC and Transient Analysis.

UNIT 2 **9 Hrs.**

Analysis of Diode, Bipolar Junction transistor, Field Effect transistor - Op Amp Circuits - Spice AC and DC models – Parameters - Examples circuits

UNIT 3 **9 Hrs.**

Basic features – Script m files – Array and array operations – Data types – Cell array and structures – Relational and logical operations – Control flow – Functions – Plotting commands – Matlab toolbox – Simulink.

UNIT 4 **9 Hrs.**

DC Analysis – Nodal Analysis, Loop Analysis, Maximum power Transfer. Transient Analysis - RC, RL, RLC circuit, State Variable Approach. AC Analysis and Network Functions – Steady State AC Circuit, Single and Three Phase AC Circuit, Network Characteristics – Frequency Response. Two port Network – Z, Y, H Parameter Analysis, Transmission parameters.

UNIT 5 **9 Hrs.**

Characteristics Realization of Diodes – I-V curve, operating point, full wave rectifier. Characteristics realization of Op-Amps – open loop gain, closed loop gain, Transfer function, poles and zeros- Characteristic realization of transistor, BJT, MOSFET

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Evaluate the performance of electronic circuits using PSpice.
CO2 - Determine the parameters of various electronic devices using PSpice.
CO3 - Develop MATLAB codes for various array related relational, logical operations.
CO4 - Develop MATLAB codes for DC and AC analysis of various electronic circuits.
CO5 - Evaluate the characteristics of open loop and closed loop systems using MATLAB.
CO6 - Design an electronic circuit using MATLAB and Pspice.

TEXT / REFERENCE BOOKS

1. John Okyere Attia, "Electronic and Circuit Analysis Using MATLAB" CRC Press, 2004.
2. Muhammad H.Rashid, “Introduction to PSPICE using ORCAD for circuits and electronics”,3rd Edition, Prentice Hall of india Private Limited,2010.
3. Alok Jain, “Power Electronics: Devices, Circuits & Matlab Simulations”, Penram international Publication, 1st Edition
4. Mohammed Rashid, “Power Electronics circuits, Devices and Applications”,3rd edition, PHI publishing company,2010
5. Duane Hansel Man, “Mastering Matlab-7”,Bruce Little Field,Pearson education Ltd,Ist Edition,2009.
6. Cleve B.Moler, "Numerical Computing with Matlab, Society for Industrial & Applied Mathematics ", 2004.
7. John Okyere Attia, "PSPICE and MATLAB for Electronics" CRC Press, 2009.

SEE1609	COMPUTER AIDED DESIGN OF ELECTRICAL EQUIPMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 **9 Hrs.**

Conventional Design Procedures – Limitations – Need for Field Analysis Based Design.

UNIT 2 **9 Hrs.**

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored Energy in Field Problems – Inductance- Development of Torque/Force- Laplace and PoissonIls Equations – Energy Functional – Principle of Energy Conversion

UNIT 3 **9 Hrs.**

Mathematical Models – Differential/Integral Equations – Finite Difference Method – Finite Element Method – Energy Minimization – Variational Method - 2D Field Problems – Discretisation – Shape Functions – Stiffness Matrix – Solution Techniques.

UNIT 4 **9 Hrs.**

Elements of a CAD System – Pre-Processing – Modeling – Meshing – Material Properties- Boundary Conditions – Setting up Solution – Post Processing.

UNIT 5 **9 Hrs.**

Design of Solenoid Actuator – Induction Motor – Insulators – Power transformer.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Explain the concepts related to computer aided design of electrical equipments.
CO2 - Formulate optimum design problems with computers
CO3 - Design transformers, dc machines, induction motors using Finite Element Method.
CO4 - Develop computer aided program for design of transformers, dc machines, induction motors.
CO5 - Develop model of electrical machines using Computer aided Package
CO6 - Design of solenoid actuator, induction motor, insulators and power transformers.

TEXT / REFERENCE BOOKS

1. S.J Salon, “Finite Element Analysis of Electrical Machines.” Kluwer Academic Publishers, London, 1995.
2. S.R.H.Hoole, Computer – Aided, Analysis and Design of Electromagnetic Devices, Elsevier, New York, Amsterdam, London,1989.
3. P.P. Silvester and Ferrari, “Finite Elements for Electrical Engineers” Cambridge University press, 3rd Edition1983.
4. D.A.Lowther and P.P Silvester, “Computer Aided Design in Magnetics”, Springer verlag, 1st Edition New York, 1986.

SEC1606	DIGITAL IMAGE PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 DIGITAL IMAGE FUNDAMENTALS **9 Hrs.**

Elements of Visual Perception; Image Sensing and Acquisition; Image Sampling and Quantization; Basic Relationships between Pixels; Monochromatic Vision Models; Colour Vision Models; Colour Fundamentals; Colour Models

UNIT 2 IMAGE ENHANCEMENT **9 Hrs.**

Introduction; Point Processing - Image Negatives, Log transformations, Power Law Transformations, Piecewise-Linear Transformation Functions; Arithmetic/Logic Operations - Image Subtraction, Image Averaging; Histogram Processing - Histogram Equalization, Histogram Matching; Spatial filtering - Smoothing, Sharpening; Smoothing Frequency Domain Filters - Ideal Low Pass, Butterworth Low Pass, Gaussian Low Pass; Sharpening Frequency Domain Filters - Ideal High Pass, Butterworth High Pass, Gaussian High Pass

UNIT 3 IMAGE RESTORATION **9 Hrs.**

A Model of Image Degradation/Restoration Process; Noise Models; Inverse Filtering, Minimum Mean Square Error Filtering, Constrained Least Square Filtering; Geometric Mean Filter; Geometric Transformations - Spatial Transformations, Gray-Level Interpolation

UNIT 4 MORPHOLOGICAL PROCESSING & SEGMENTATION **9 Hrs.**

Morphological Image Processing - Logic Operations involving Binary Images; Dilation and Erosion; Opening and Closing; Basic Morphological Algorithms - Boundary Extraction, Region Filling, Thickening, Thinning; Image Segmentation - Detection of Discontinuities; Edge Linking; Boundary Detection; Thresholding - Global and Adaptive; Region based Segmentation.

UNIT 5 COLOUR IMAGE PROCESSING & APPLICATIONS **9 Hrs.**

Conversion of Colour Models; Basic of Full-Colour Image Processing; Colour Transformations; Smoothing; Sharpening; Segmentation; Applications of Image Processing - Motion Analysis, Image Fusion, Image Classification.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Demonstrate the concepts of image acquisition, sampling, quantization and color models
CO2 - Determine the various image transforms and filtering techniques
CO3 - Compare various restoration techniques
CO4 - Develop the various Morphological processing techniques
CO5 - Develop novel image denoising, segmentation methods
CO6 - Create new ideas for color image processing

TEXT / REFERENCE BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, 2 n d Edition, Pearson Education, Inc., 2004.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI Learning Private Limited, New Delhi, 2002.
3. William K. Pratt, “Digital Image Processing”, 3rd Edition, John Wiley & Sons, Inc., 2001.
4. Rafeal C.Gonzalez, Richard E.Woods and Steven L. Eddins, “Digital Image Processing using Matlab”, Pearson Education, Inc., 2004.
5. Bernd Jähne, “Digital Image Processing”, 5th Revised and Extended Edition, Springer, 2002.

SEC1609	FUNDAMENTALS OF FUZZY LOGIC AND ARTIFICIAL NEURAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF ANN **9 Hrs.**

Introduction - Biological Neuron structure, ANN - Definition – Topology - Models - Learning strategies. Characteristics of ANN - Different Learning Rules - Activation dynamics - Synaptic dynamics - Perceptron Model (Both Single & Multi-Layer) - Training Algorithm - Linear Separability Limitation and Its Over Comings, Problems in perceptron weight adjustments.

UNIT 2 MULTI LAYER NETWORKS **9 Hrs.**

BPN - Training - Architecture-Algorithm, Counter Propagation Network - Training - Architecture, BAM - Training-stability analysis, Adaptive Resonance Theory - ART1- ART2 – Architecture -Training, Hop Field Network - Energy Function - Discrete - Continuous - Algorithm - Application - TSP .

UNIT 3 SOM & SPECIAL NETWORKS **9 Hrs.**

SOM-Introduction - Kohonan SOM - Linear vector quantization, Probabilistic neural network ,Cascade correlation, General Regression neural network, Cognitron - Application of ANN - Texture classification - Character recognition.

UNIT 4 INTRODUCTION TO FUZZY LOGIC **9 Hrs.**

Classical set - Operations and properties - Fuzzy Set - Operations and properties - Problems, Classical Relations - Operations and Properties, Fuzzy Relations - Operations and Properties - Compositions Membership function -FLCS - Need for FLC- Fuzzification - Defuzzification.

UNIT 5 FLCS, CLASSIFICATION & APPLICATIONS **9 Hrs.**

Fuzzy decision making -Types, Fuzzy Rule Based System, Knowledge Based System, Non linear Fuzzy Control system - Fuzzy Classification - Hard C Means - Fuzzy C Means. Applications of fuzzy - Water level controller, Fuzzy image Classification, Speed control of motor.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend various topologies of artificial neural networks.
CO2 - Illustrate training and learning of neural systems using supervised and unsupervised methodologies
CO3 - Develop multi-layer and special networks for different case studies
CO4 - Appraise the behavior of Fuzzy logic control system
CO5 - Evaluate the Defuzzification and fuzzy decision systems for real time applications.
CO6 - Construct Fuzzy based controller for motor speed control, image processing etc

TEXT / REFERENCE BOOKS

1. Timothy Ross, “Fuzzy Logic with Engineering Application”, McGraw Hill, Edition 1997
2. James A. Freeman & Skapura, “Neural Networks”, Pearson Education, 2007.
3. B.Yegnanarayana, “Artificial Neural Networks” Prentice Hall, September 2007. 4. Simon Haykin, “Artificial Neural Networks”, Second Edition, Pearson Education.
4. Drainkov, H.Hallendoor and M.Reinfrank, “An Introduction to Fuzzy Control”, Edition 2001.

SEC1617	ADVANCED ELECTRONIC TEST ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO PCB TECHNOLOGY **9 Hrs.**

Printed Circuit Boards(PCB) - Construction - Types of PCB - Multilayer - Surface Mount technology – PCB Manufacturing process - PCB Inspection methods - Bare Board Testing - Optical and X-Ray Inspection - Electrical tests - Text fixtures - Bed of nails fixtures - Cross talk test - Mock up test - In circuit test – Burn-in-test - Fault diagnostic methods. Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems

UNIT 2 PCB TROUBLESHOOTING PROCESS **9 Hrs.**

Symptom Recognition - Bracketing Technique - Component failure Analysis - Fault types and causes in circuits - during manufacturing - Manual trouble shooting technique - Tools and Instruments DMM - CRO - PCO - Logic probes - Logic pulsar - Logic Analyzer

UNIT 3 AUTOMATED TROUBLE SHOOTING TECHNIQUES **9 Hrs.**

ATE Techniques - CPU Emulator technique - ROM amd ROM Emulators - In circuit Comparator - In Circuit Functional test - Trouble shooting digital gates - Testing Linear Integrated Circuits - Guarding Technique - VI trace Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics.

UNIT 4 ATE SYSTEM ARCHITECTURE **9 Hrs.**

ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway – Test Vector Generation - Creating test patterns - Fault Simulations.

UNIT 5 DESIGN FOR TESTABILITY (DFT) **9 Hrs.**

MDA test systems - Boundary scan test with I/O pin compatibility - Automatic optical inspection systems - Combinational ATE Systems - Design for testability - Observability and Controllability - Testing Flow diagram - Stuck at fault model - Fault simulation - Ad Hoc technique - Scan design technique - Basics of ATPG - BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing - Output response Analysis - Transition count syndrome checking - Signature Analysis - Circular BIST.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Identify various types of printed circuit boards and effectively use testing tools
CO2 - Comprehend the working of automated test equipment's
CO3 - Analyze the PCB for different test cases
CO4 - Design board fixtures to carry out customized board level testing.
CO5 - Develop test vectors and test patterns for fault identification in custom PCBs.
CO6 - Design electronic systems with Testability architectures

TEXT / REFERENCE BOOKS

1 Michael L.Bushnell et al., "Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit",1st edition, Academic Press, 2002.
2 Randall L Geiger, Pillip E Allen, "VLSI design techniques for analog and digital circuits", MGH, 1990.
3 Parag.K.lala, "Digital circuit Testing and Testability", 1st edition, Academic press, 2001.
4 Alfred L.Crouch, "Design for test for Digital ICs and Embedded core systems", 2nd edition, PHI, 1999
5 Sabapathy S.R., "Test Engineering for electronic hardware", Qmax publishers, 1st Edition, 2007.

SEC1618	PROGRAMMING IN MATLAB	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO MATLAB **9 Hrs.**

Menus & Tool bars, Variables - Matrices and Vectors - initializing vectors - Data types- Functions - User definedfunctions - passing arguments - writing data to a file-reading data from a file - using functions with vectors andmatrices- cell arrays & structures - Strings - 2D strings-String comparing - Concatenation - Input and Output statements - Script files

UNIT 2 LOOPS AND CONTROL STATEMENTS **9 Hrs.**

Introduction; Relational & Logical operations - Example programs - Operator precedence - Control & Decisionstatements- IF - IF ELSE - NESTED IF ELSE - SWITCH - TRY & CATCH - FOR -WHILE - NESTED FOR - FOR withIF statements, MATLAB program organization, Debugging methods - Error trapping using eval&lastern commands.

UNIT 3 PLOTS IN MATLAB AND GUI **9 Hrs.**

Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG-LOG, SEMILOG-POLAR-COMET, Gridaxis, labeling, fplot, ezplot, ezpolar, polyval, exporting figures, HOLD, STEM, BAR, HIST, Interactive plotting, BasicFitting Interface – Polyfit - 3D plots – Mesh - Contour - Example programs. GUI - Creation Fundamentals – Capturingmouse actions

UNIT 4 MISCELLANEOUS TOPICS **9 Hrs.**

File & Directory management - Native Data Files - Data import & Export - Low Level File I/O – Directorymanagement - FTP File Operations - Time Computations -Date & Time - Format Conversions - Date & Time Functions- Plot labels - Optimization - zero Finding - Minimization in one Dimension - Minimization in Higher Dimensions- Practical Issues. Differentiation & Integration using MATLAB, 1 D & 2D Data Interpolation

UNIT 5 SIMULINK AND APPLICATIONS **9 Hrs.**

How to create & run Simulink, Simulink Designing - Using SIMULINK Generating an AM signal & 2n d ordersystems - Designing of FWR & HWR using Simulink - Creating a subsystem in Simulink. Applications Programs -Frequency response of FIR & IIR filters. Open Loop gain of OPAMP, I/P characteristics of BJT, Plotting the graphbetween Breakdown voltage & Doping Concentration. PCM, DPCM

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Comprehend matrices, vectors and strings in MATLAB, operations in files
CO2 - Develop MATLAB programs using looping and control statements
CO3 - Develop 2D and 3D plots, Graphical User Interface for a given problem
CO4 - Develop file management system using MATLAB
CO5 - Design Simulink for electronic circuits and communication systems
CO6 - Develop MATLAB programming for real time applications

TEXT / REFERENCE BOOKS

1. RudraPratap, “Getting Started with MATLAB 6.0” ,1st Edition, Oxford University Press-2004.
2. Duane Hanselman ,Bruce LittleField, “Mastering MATLAB 7” , Pearson Education Inc, 2005
3. William J.Palm, “Introduction to MATLAB 6.0 for Engineers”, McGraw Hill & Co, 2001
4. M.Herniter, “Programming in MATLAB”, Thomson Learning, 2001
5. John OkyereAltla, “Electronics and circuit analysis using MATLAB” - CRC press, 1999
6. K.K.Sharma, “MATLAB Demustifyied” -Vikas Publishing House Pvt Ltd.
7. K.C.Ravindaranath, “Systems Modelling& Simulation”

SIC1310	THEORY OF ROBOTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

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UNIT 1 BASIC CONCEPTS **9 Hrs.**

Origin & various generation of Robots - Robot definition - Robotics system components - Robot classification Coordinate frames - Asimov's laws of robotics - degree of freedom - dynamic stabilization of robots.- work volume. Need for Automation - types of automation - fixed, programmable and flexible automation

UNIT 2 POWER SOURCES AND SENSORS **9 Hrs.**

Hydraulic, pneumatic and electric drives - determination of HP of motor and gearing ratio - variable speed arrangements - path determination - micro machines in robotics - machine vision - ranging - laser - acoustic - magnetic, fiber optic and tactile sensors.

UNIT 3 MANIPULATORS, ACTUATORS, GRIPPERS and ROBOT DYNAMICS **9 Hrs.**

Construction of manipulators - manipulator dynamics and force control -pneumatic electronic and manipulator control circuits - end effectors - various types of grippers- design considerations. Introduction to Robot Dynamics - Lagrange formulation - Newton Euler formulation - Properties of robot dynamic equations.

UNIT 4 KINEMATICS AND PATH PLANNING **9 Hrs.**

Forward Kinematics - Denavit Hartenberg Representation. multiple solution jacobian work envelop, Inverse Kinematics - Geometric approach. Hill climbing techniques.

UNIT 5 PROGRAMMING LANGUAGES AND APPLICATIONS **9 Hrs.**

Robot programming - Fixed instruction, sequence control, General programming language, programming languages. Robots for welding, painting and assembly - Remote Controlled robots - robots in manufacturing and non- manufacturing applications - Robots for nuclear and chemical plants. **Max. 45 Hrs.**

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Identify the types of robots and its coordinates
CO2 - Describe power sources and sensors used in robots
CO3 - Apply the Newton Euler formulation in deriving dynamics of robots.
CO4 - Analyze forward and inverse kinematics of robots.
CO5 - Build robot programming for various applications
CO6 - Design a robot for any application

TEXT / REFERENCE BOOKS

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill Singapore, 1996.
2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998.
3. Deb.S.R., "Robotics technology and flexible Automation", John Wiley, USA 1992.
4. Asfahl C.R., "Robots and Manufacturing Automation", John Wiley, USA 1992.
5. Klafter R.D., Chimielewski T.A., Negin M., "Robotic Engineering - An integrated approach", Prentice Hall of India, New Delhi, 1994.
6. Mc Kerrow P.J. "Introduction to Robotics", Addison Wesley, USA, 1991.

SIC1311	BIOMEDICAL INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 ELECTRO PHYSIOLOGY **8 Hrs.**

Cell and Its Structure - Electrical, Mechanical and Chemical Activities - Action and Resting Potential- Organization of Nervous System - CNS - PNS - Neurons - Axons- Synapse - Propagation of Electrical Impulses along the Nerve-Sodium Pump - Cardio Pulmonary System- Physiology of Heart, Lung, Kidney.

UNIT 2 BIO POTENTIAL ELECTRODES AND TRANSDUCERS **8 Hrs.**

Design of Medical Instruments - Components of Biomedical Instrument System - Electrodes: Micro Electrodes, Needle Electrodes, Surface Electrodes -Instrumentation amplifier - Biomedical Measurements Like pH, PCO2, PO2 of Blood, Isolation Amplifier, Preamplifier, Current Amplifier, Chopper Amplifier.

UNIT 3 INSTRUMENTS USED FOR DIAGNOSIS **10 Hrs.**

ECG, Einthoven Triangle, Leads, Electrodes, Vector Cardiograph, Measurement of Cardiac Output, EEG, EMG ,Plethysmography, Blood Flow Measurements, Holter Monitor- Respiratory Rate Measurement - Oximeter, Patient Monitoring System, ICCU.

UNIT 4 MODERN IMAGING SYSTEM **10 Hrs.**

Ultrasonic Diagnosis, Ultrasonic Scanning, Isotopes in Medical Diagnosis- Pace Makers, Defibrillators, Doppler Monitor(colour), Medical imaging-X-ray generation, Radiographic & Fluoroscopic Techniques - Image Intensifiers-Computer Aided Tomography, PET, SPECT- Laser Applications-Echocardiography-CT Scan-MRI/ NMR-Endoscopy.

UNIT 5 RECENT TRENDS & INSTRUMENTS FOR THERAPY **9 Hrs.**

Dialysers - Surgical Diathermy - Electro Anaesthetic and Surgical Techniques. Sources of Electric Hazards and Safety Techniques. Single Channel Telemetry, Multi channel Telemetry, Implantable Telemetry, Wireless Telemetry,Telemedicine, Telemedicine Applications.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the electrical, mechanical and chemical activities and physiology of human body
CO2 - Discuss various bio potential electrodes and transducers.
CO3 - Examine the principle and working of diagnostic instruments based on electrical activity and physiology of human body
CO4 - Compare and contrast suitable medical imaging equipment's used for diagnostic purposes
CO5 - Evaluate the working of modern therapeutic equipment's and telemedicine which would enable to create novel biomedical device
CO6 - Design and develop novel therapeutic and diagnostic biomedical equipment's

TEXT / REFERENCE BOOKS

1. Khandpur, "Handbook of Biomedical Instrumentation" 2nd Edition, Tata McGraw Hill, 2003.
2. M.Arumugam, "Biomedical Instrumentation", Anuradha Publications, Reprint 2009.
3. Leslie Cromwell, Fred J. Werbell and Eruch A. Pfeigger, "Biomedical Instrumentation and Measurements" 2nd Edition
4. W.J.Tompkins and J.G. Webster, "Design of Microcomputer Based Medical Instrumentation", Prentice Hall, 1991
5. L.A. Geddes and L.E. Baker, "Principle of Applied Biomedical Instrumentation" 3rd Edition, Wiley, 1989
6. D.W. Hill, "Principle of Electronics for Medical Research", 2nd Edition, Butterworths, 1965.

SIC1605	FIBRE OPTICS AND LASER INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 OPTICAL FIBRES AND THEIR CHARACTERISTICS 9 Hrs.

Quantum nature of light, optical laws and definitions- Principles of light propagation through a fiber -optical fiber modes, configurations and their properties-fiber materials-fiber fabrication vapor phase oxidization - fiber characteristics - Absorption losses - Scattering losses - Dispersion - Connectors and splicers -fiber termination

UNIT 2 OPTICAL SOURCES, DETECTORS AND SENSORS 9 Hrs.

Characteristics-LED structures: Surface Emitting LED- Double Heterojunction LED, Basic concepts of Laser. Optical Detectors: PN Photo diode , Avalanche photo diode ,PIN diode, Photo transistor ,Photo thyristors, Photo thermistor, opto-couplers, optrodes, modulators. Fibre optic sensors - Fiber optic instrumentation system - Interferometric method of measurement of length - Moire-fringes - Measurement of pressure and temperature

UNIT 3 LASERFUNDAMENTALS 9 Hrs.

Laser Diode Rate Equation - External Quantum Efficiency- Resonant Frequencies - Three level and four level lasers - Properties of laser -Laser modes - Resonator configuration - Q-switching and mode locking - Cavity damping - Types of lasers - Gas lasers, Solid lasers, Liquid lasers, Semiconductor lasers, Non-semiconductor lasers- The Nd:YAG laser and glass fiber lasers.

UNIT 4 LASER APPLICATIONS 9 Hrs.

Optical transmitter and Receiver designs - Laser for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect - material processing - Laser heating, welding, melting and trimming of materials - Removal and vaporization.

UNIT 5 HOLOGRAM AND MEDICAL APPLICATION 9 Hrs.

Holography- Basic principle - methods - Holographic Interferometer and application - Holography for non-destructive testing - Holographic Components - Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, tumor, vocal chords, brain surgery, plastic surgery, gynecology and oncology

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the basic laws of light, types of optical fiber, and characteristics of fiber.
CO2 - Report the working of Optical sources, detectors, sensors and Laser
CO3 - Compare and contrast different types of Laser.
CO4 - Justify the selection of appropriate optical fibers and Laser in various fields.
CO5 - Comprehend the use of laser devices for medicinal application.
CO6 - Identify the need for holography.

TEXT / REFERENCE BOOKS

1. Senior J.M, “Optical Fibre Communication - Principles and Practice”, Prentice Hall of India,1985.
2. Wilson J and Hawkes J.F.B, “Introduction to Opto Electronics”, Prentice Hall of India, 2001.
3. Keiser G, “Optical Fibre Communication”, McGraw Hill, 1995.
4. Arumugam M, “Optical Fibre Communication and Sensors”, Anuradha Agencies, 2002.
5. John F. Read, “Industrial Applications of Lasers”, Academic Press, 1978.

SIC1608	POWER PLANT INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION **9 Hrs.**

Brief survey methods of power generation - hydro, thermal, nuclear, solar and wind power - Importance of instrumentation in power generation - Piping and instrumentation diagram of a thermal power plant - Boiler types - water tube - fire tube - fluidized bed - Fuels - coal, fuel oil, natural and petroleum gas, synthetic fuels and biomass - Combustion process - Combustion of solid fuel, Combustion of fuel oil, combustion of gas - Cogeneration

UNIT 2 MEASUREMENTS IN POWER PLANTS **9 Hrs.**

Metal temperature measurement in boilers, piping system for pressure measuring devices, Flow of feed water - fuel, air and steam with correction factor for temperature and pressure - smoke and dust monitor, flame monitoring. Drum level measurement - Radiation detector - Introduction to turbine supervising system - pedestal vibration - shaft vibration - eccentricity measurement. Installation of non-contracting transducers for speed measurement - rotor and casing movement and expansion measurement

UNIT 3 CONTROL LOOPS IN BOILER **9 Hrs.**

Combustion Control -air/fuel ratio control - furnace draft control - drum level control- main stream and reheat steam temp control - super heater control - attemperator - de-aerator control - distributed control system in power plants - interlocks in boiler operation- Problems associated with control of multiple pulverizers - Fan drives and control

UNIT 4 ANALYZERS IN POWER PLANTS **9 Hrs.**

Coal analyzer- thermo-gravimetri - gross calorific value - total sulphur analysis - ash analyzer - online monitor - air quality monitoring - Sampling of ambient air - general air sampling system - Flue gas oxygen analyzer - analysis of impurities in feed water and steam - dissolved oxygen analyzer - chromatography - pH Meter - pollution monitoring instruments

UNIT 5 NUCLEAR POWER PLANT INSTRUMENTATION **9 Hrs.**

Introduction - Energy from nuclear reaction - Nuclear fission and fusion - Neutron flux and reaction rate - Types of reactor - pressurized water reactor - boiling water reactor - Nuclear waste disposal - Piping and instrumentation diagram of different types of nuclear power plant - Nuclear reactor control loops - reactor dynamics - excess reactivity - pulse channel and logarithmic instrumentation - control and safety instrumentation - reliability aspects

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Interpret the methods of power generation.
CO2 - Analyze the measurement of various parameters in a power plant
CO3 - Design the appropriate control techniques for boilers
CO4 - Construct the oxygen analyzer of impurities in feed water and steam in power plant
CO5 - Categorize the various reactors in nuclear power plants
CO6 - Examine the control and safety instrumentation in nuclear power plant.

TEXT / REFERENCE BOOKS

1. Gill A.B, “Power Plant Performance”, 6th Edition, Butterworth, London, 1984
2. Liptak. B.G, Analytical Instrumentation, Vol 1 & Vol 2, Chilton Book Company, 1994
3. Nag P.K ŏPower Plant Engineeringŏ , 2nd Edition, Tata McGraw Hill, 2001
4. Sam Dukelow. G “The control of Boilers”, 2nd Edition, Instrument society of America, 1991
5. Elonka S.M, Kohan A.L, “Standard Boilers Operations”, McGraw Hill, New Delhi, 1994
6. Wakil. E.A Power Plant Engineering, Tata McGraw Hill, 1984,
7. David Lindsley, “Boiler Control Systems”, McGraw Hill, New York, 1991
8. Jain. R.K, “Mechanical and industrial Measurements”, Khanna Publishers, New Delhi, 1995

SIC1611	FUNDAMENTALS OF MECHATRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION **9 Hrs.**

Mechatronics: Definition & Key Issues - Evolution - Elements - Mechatronics Approach to Modern Engineering, Industrial design and safety Design.

UNIT 2 SENSORS AND TRANSDUCERS **9 Hrs.**

Introduction and background, difference between transducer and sensor, transducers types, transduction principle, photoelectric transducers- thermistors, thermodevices, thermocouple, inductive transducers capacitive transducers, piezoelectric transducers, piezoelectric transducers. Hall Effect transducers, Fiber optic transducers, Signal Processing - Data Display

UNIT 3 ACTUATION SYSTEMS **9 Hrs.**

Introduction to Mechanical Types and Electrical Types - Pneumatic & Hydraulic Systems - Applications - Selection of Actuators, Kinematics of robot manipulator links.

UNIT 4 DIGITAL AND CONTROL SYSTEMS **9 Hrs.**

Digital logic neuron system, Types of Controllers - Programmable Logic Controllers - applications - ladder diagrams - Microprocessor Applications in Mechatronics: Temperature measurement system, Domestic washing machine - Programming Interfacing - Computer Applications: CNC drilling machine

UNIT 5 RECENT ADVANCES **9 Hrs.**

Manufacturing Mechatronics - Automobile Mechatronics - Medical Mechatronics - Office Automation – Case Studies

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Illustrate the approach of Mechatronics to engineering concepts
CO2 - Classify the different types of sensors, transducers.
CO3 - Select an actuator and use of robot kinematics.
CO4 - Distinguish the different control and interfacing techniques.
CO5 - Compare the applications of mechatronics in the fields of automobile, robotics, medicine, manufacturing, office automation through case studies.
CO6 - Formulate the design for mechatronics for industrial application

TEXT / REFERENCE BOOKS

1. Bolton. W “Mechatronics: Electronic Control System for Mechanical & Electrical Engineering”, 2nd Edition Pearson Education, 2004.
2. Ramachandran. K.P,Vijaya Raghavan. G.K, Mechatronics, A.R.S. Publications, Second Edition, 2008.
3. Bradly.D.A, Dawson.D, Burd. N.C, Loader. A.J “Mechatronics: Electronics in Products and Processes” Nelson Publisher, 2004.
4. Michael B. Histand & David G. Alciators, “Introduction to Mechatronics & Measurement systems”, McGraw- Hill International Editions, 1998
5. Dan Necsulescu, “Mechatronics”, Pearson Education, 2005.Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.

SPR1307	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION AND LINAER PROGRAMMING 9 Hrs.

Operations Research(OR)-Nature-Characteristics-Phases.-Role of OR in Decision making- Outline of OR Models Linear Programming – Formulation of L.P.problems –Solution by graphical method, simplex method, Two Phase Method, Big M methods, Dual Simplex method

UNIT 2 TRANSPORTATION AND ASSIGNMENT MODEL 9 Hrs.

Transportation problem – Initial Basic feasible solution- Northwest corner method, Least Cost method, Vogel's approximation method – Test for optimality-MODI method. Assignment problems- Hungarian assignment models Travelling salesman problems

UNIT 3 RESOURCE SCHEDULING AND NETWORK ANALYSIS 9 Hrs.

Problem of Sequencing – Problem with N jobs and 2 machines N Jobs 3 machines N Jobs and m machines and 2 Jobs m machines (Graphical method). Project Management -Basic concepts–Network construction and scheduling Critical Path Method (CPM) & Program evaluation review technique (PERT) and resource leveling by network techniques, time – Cost trade off.

UNIT 4 INVENTORY CONTROL 9 Hrs.

Inventory Control – Various Types of inventory models – deterministic inventory models – Production model, Purchase model– with and without shortage- Economic Order Quantity (EOQ) – Buffer stock – Shortage quantity, Probabilistic inventory models – Quantity Discount and Price Breaks

UNIT 5 QUEUING THEORY 9 Hrs.

Queuing theory – Poisson arrivals and exponential service times, Single channel models only, Replacement policy for items whose maintenance cost increases with time- Consideration of time value of money - Replacement policy- Individual, Group replacement of items that fail completely and suddenly.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Solve the optimization problems through graphical, simplex Big M dual simplex and 2-phase simplex methods.
CO2 - Solve transportation model problems through NWC,LCM,VAM and Modi method and assignment problems using Hungarian method
CO3 - Apply n-job 2 machines n-job m-machine method problems and analyze for the job sequencing problems, and CPM and PERT methods for networks scheduling problems.
CO4 - Analyze the inventory problems using various models, such as purchasing model manufacturing model and price break model.
CO5 - Apply the queuing model for Poisson arrivals and exponential service times.
CO6 - Apply the replacement model for individual policy and group policy.

TEXT / REFERENCE BOOKS

1. R.Panneerselvam,"operation research", 2nd Edn., Prentice Hall, 2001.
2. S.D Sharma,"operation research Theory,Methods and Application", 17th Edn., Kedar Nath Ram Nath Publication, 2010.
3. Nita H Shah, Ravi M Gor & Hardik Soni, "operation research", 4th Edn., PHI, 2010.
4. Hamdy A.Taha," Opeartion Research", 8th Edn, PHI, 2008
5. Hiller & Liberman., Introduction to Operations Research, 5th Edition, Mc Graw Hill, 2001
6. Ravindran,Phillips &Solberg, "Operations Research: principles and practice", 2nd Edn., Wiley India Lts, 2007
7. Ronald L. Rardin," Optimization in Operations Research", Prentice Hall, 1998