SRI KRISHNA COLLEGE OF TECHNOLOGY

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING

REGULATION 2013

(CURRICULUM AND SYLLABUS)

SRI KRISHNA COLLEGE OF TECHNOLOGY (AUTONOMOUS)

KOVAIPUDUR, COIMBATORE - 641 042

REGULATIONS FOR FOUR YEAR BE / BTech DEGREE PROGRAMMES - 2013

(For the batches of candidates admitted in 2013 - 2014 and subsequently)

NOTE: The regulations, hereunder, are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the programme) as may be decided by the Academic Council.

DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i. "**Programme**" means BE / BTech Degree Programme.

ii. "**Course**" means a Theory or Practical subject that is normally studied in a semester, like Material Science, Engineering Thermodynamics, etc.,.

iii. "**Controller of Examinations"** means the Authority of the College who is responsible for all activities of the assessment process.

iv. "**Head of the Institution**" means the Principal of the College who is responsible for all academic activities of the College and for implementation of relevant rules of this Regulation.

v. **"Head of the Department"** means Head of the concerned Department of the College.

vi. "**University**" means the affiliating university, viz., Anna University, Chennai.

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1. BE / BTech PROGRAMMES OFFERED AND MODES OF STUDY

1.1. Programmes: The following are the branches of study under BE / BTech degree programme.

BE	Branch I	Civil Engineering
	Branch II	Mechanical Engineering
	Branch III	Electronics and Communication Engineering
	Branch IV	Computer Science and Engineering
	Branch V	Electrical and Electronics Engineering
	Branch VI	Instrumentation and Control Engineering
BTech	Branch I	Information Technology

1.2 MODES OF STUDY

1.2.1 Full -Time: All the programmes are full-time programmes and Candidates admitted should be available in the College during the complete working hours for curricular, co-curricular and extra-curricular activities.

2. ADMISSION REQUIREMENTS

Candidates for admission to the BE / BTech degree programme will be required to satisfy the conditions of admission thereto prescribed by the affiliating university and Government of Tamil Nadu.

3. DURATION OF THE PROGRAMME

i. Minimum Duration: The programme will extend over a period of four years leading to the Degree of Bachelor of Engineering (BE) / Bachelor of Technology (BTech) of the Anna University, Chennai. The four academic years will be divided into eight semesters with two semesters per year.

Provision is made for lateral entry of candidates in the third semester of the programme in one of the branches of study and they will be required to satisfy the conditions of admissions thereto prescribed by the affiliating university and Government of Tamil Nadu.

Each semester shall normally consist of 90 working days or 450 hours (or 490 periods of 55 minutes duration each).

ii. Maximum Duration: The candidate shall complete all the passing requirements of the BE / BTech degree programme within a maximum period of 7 years (6 years for lateral entry). These periods will be reckoned from the commencement of the first semester (third semester in the case of lateral entry) to which the candidate was first admitted to the programme.

4. STRUCTURE OF PROGRAMMES

4.1 Medium:

The medium of instruction shall be English for all Courses, Examinations, Seminar presentations and Project / Thesis / Dissertation.

The curriculum will comprise courses of study as given in curriculum section 22 infra in accordance with the prescribed syllabi.

4.2 Curriculum:

Every Programme will have a Curriculum and Syllabi consisting of core courses, elective courses and project work. The Programme may also include Seminar / Practical / Practical Training, if they are specified in the curriculum as given section 22 infra.

4.3 Electives:

Every candidate will be required to opt for one elective in VI semester and two electives each in VII & VIII semesters from the list of electives relating in his/her branch of study as given in section 22 infra. However, a candidate may be permitted to take one elective from the list of electives from other branches of BE/BTech programme during his/her course of study with specific permission from the respective head of the department.

Acceleration of Electives: A Student may be permitted to take Electives IV and V in the 6^{th} and 7^{th} semesters respectively instead of the 8^{th} semester normal course of study with specific permission from the concerned Head of the department, in order to do Project work phase II during the full period of semester 8.

4.4. One- Credit Courses:

Students can opt for one credit industry oriented courses of 15 hours duration which will be offered by experts from industry/other Institution, subject to the approval by the Head of the department. Grades for the course should be submitted by the expert to Controller of Examinations

after the course work is completed. There will not be any Semester End Examination for such One credit courses. Students can complete such one credit courses during the semesters 3 to 7 as and when the courses are offered by the department. "Elective V" can be waived if a student successfully completes three such one credit courses.

4.5 Project Work:

Every candidate will be required to undertake a suitable project in department / industry / research organization in consultation with the Head of the Department and the faculty guide and submit the project report thereon at the end of the semesters 7 and 8 on dates announced by the College/Department. Also he/she will be required to present two seminars on the progress of the project work during each of semesters 7 and 8.

4.6 Comprehensive Viva- voce:

Comprehensive viva-voce shall be conducted during seventh semester covering all the department courses of the previous semesters.

4.7 Personality development:

All candidates shall enroll, on admission, in any one of the Community Service & Extension activities (NSS / YRC / RRC/ Sports & Games) and participate actively for a minimum of 20 hours during the first four semesters of study.

National Service Scheme (NSS) will have social service activities in and around the College.

Youth Red Cross (YRC) society activities will include peace time activities like health & hygiene, international friendship, awareness camps etc.

Red Ribbon Club (RRC) activities will include the conduct of awareness and education programmes on health related issues.

Sports & Games activities will include preparation for inter-collegiate sports events.

While the training activities will normally be held during week ends, the camps will normally be held during vacation period.

4.8 Credit assignment:

Normally one credit for one period of Lecture per week, 0.5 credit for one period of Tutorial per week and one credit for three periods of Practical/Project Work per week are assigned for each course. The exact number of credits assigned to the different courses is as shown in section 22 infra.

4.8.1 Minimum credits:

The minimum number of credits to be earned through successful completion of the courses of study in the respective branches listed in section 1 supra, by a candidate to qualify for the award of degree is provided below:

Branch of Study	Minimum number of credits to be earned through successful completion of the courses of study of the respective branch listed in section 1 supra, for the award of degree	
	for entry at first semester	for *lateral entry* at third semester
BE Programme		
Branch: I Civil Engineering	185	136
Branch: II Mechanical Engineering	184	135
Branch: III Electronics and Communication Engineering	181	133
Branch: IV Computer Science and Engineering	179	131
Branch: V Electrical and Electronics Engineering	182	134
Branch: VI Instrumentation and Control Engineering	181	133
B.Tech Programme		
Branch: I Information Technology	182	134

5. FACULTY ADVISOR

To help the students in planning their courses of study and for general advice on the Academic programme, the Head of the Department will attach 20 students to a Teacher of the Department who shall function as Faculty Advisor for those students throughout their period of study. Such Faculty Advisor shall advise the students and monitor the courses taken by the students, check the Attendance and progress of the students attached to him/her and counsel them periodically. If necessary, the Faculty Advisor may also discuss with or inform the parents about the progress of the students.

6. CLASS COMMITTEE

6.1 A Class Committee consists of Teachers of the concerned class, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the Teaching-Learning Process. The functions of the class committee include

i. Solving problems experienced by students in the class room and in the laboratories

ii. Clarifying the regulations of the programme and the details of rules therein

iii. Informing the student representatives the Academic schedule including the dates of assessments and the syllabus coverage for each assessment

iv. Informing the student representatives the details of regulations regarding the weightage used for each assessment. In the case of practical courses (laboratory / Project work / Seminar etc.) the breakup of marks for each Experiment/ Exercise/ module of work, shall be clearly discussed in the class committee meeting and informed to the students.

v. Analyzing the performance of the students of the class after each test and finding the ways and means of solving academic problems of the students, if any

vi. Identifying the weak students, if any, and arrange to provide some additional help or guidance or coaching to such weak students.

6.2 The Class committee for a class under a particular programme is normally constituted by the Head of the Department. However, if the students of different programmes are mixed in a Class, the Class committee is to be constituted by the Head of the Institution.

6.3 The class committee shall be constituted on the first working day of any semester or earlier.

6.4 At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the Class committee. One Student having CGPA above average, two students having average CGPA and one student having CGPA less than average may be nominated as the class committee members for one semester.

6.5 The chairperson of the class committee may invite the Faculty advisor(s) and the Head of the Department to the meeting of the class committee.

6.6 The Head of the Institution may participate in any class committee of the institution.

6.7 The chairperson is required to prepare the minutes of every meeting, submit the same to the Head of the Institution within two days of the meeting and arrange to circulate among the concerned students and Teachers. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the management by the head of the Institution.

6.8. The First meeting of the class committee shall be held within one week from the date of commencement of the semester in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two subsequent meetings may be held (one after First test and other after second test) to discuss on the performance of the students and progress of the course work. During these meetings the student members, representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

7. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the Teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the Teachers teaching the common course belong to a single Department or to several Departments. The 'Course committee' shall meet as often as possible and ensure uniform Evaluation of the tests and arrive at a common scheme of Evaluation for the tests. Wherever it is feasible, the course committee may also prepare a common question paper for the test(s).

8. ATTENDANCE REQUIREMENTS AND PROGRESS FOR COMPLETION OF A SEMESTER

8.1 A candidate who has fulfilled the following conditions shall be deemed to have satisfied the Attendance requirements for completion of the courses of a Semester.
Ideally every student is expected to attend all classes and earn 100% attendance. However in order to allow provision for certain unavoidable reasons such as prolonged Hospitalization / Accident / specific illness the student is expected to earn a minimum of 80% overall attendance and a minimum of 50% attendance in each course to become eligible to write the End-Semester Examination.
Therefore, every student shall secure not less than 80% of overall attendance in that semester taking into account the total number of periods in all courses attended by the candidate as against the total number of periods in all courses offered during that semester and he/she should have a minimum 50% attendance in each course during that semester.

8.2. However, a candidate who secures overall attendance between 70% and 79% in that current semester due to medical reasons (prolonged hospitalization / accident / specific illness / participation in Co curricular, Extra curricular events) may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate to the Head of the Institution. The same shall be forwarded to the COE of the college for record purposes.

8.3 Candidates who could secure less than 70% overall attendance will not be permitted to write the end-semester examination of that current semester.

8.4 Notwithstanding the said provisions a candidate will be deemed to have completed the course of any semester only if the candidate's progress and conduct has been satisfactory.

8.5 Candidates who do not satisfy the requirement that they shall undergo 20 hours of NSS / YRC / RRC/ Sports & Games activities (vide section 4.7 supra) during the first four semesters will not be permitted to appear for the end semester examinations of the following semesters unless they complete the requirements specified.

8.6 Candidates who do not qualify to appear for end-semester examinations of any semester for want of attendance and/or progress and/or conduct have to register for and redo that semester programme at the next immediate available opportunity subject to the approval of Directorate of Technical Education and affiliating University.

9. REQUIREMENTS FOR APPEARING FOR SEMESTER END EXAMINATION

9.1 A candidate shall normally be permitted to appear for the Semester End Semester Examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8.1& 8.2 supra.

9.2 Further, registration is mandatory for all the courses in the current semester as well as for arrear course(s) for the Semester End Examinations failing which the candidate will not be permitted to move to the higher semester.

9.3 In the case of examination in project work, no candidate will be permitted to appear at the project work examination unless he /she has submitted the project report within the prescribed date.

10. SEMESTER END EXAMINATIONS

10.1 There shall be a semester end examination of 3 hours duration in each lecture based course. The examinations shall ordinarily be conducted between October and December during the odd semesters and between March and May in the even semesters. For the practical examinations (including project work), both internal and external examiners shall be appointed by the College. Supplementary examinations may be conducted at such times as may be decided by the College.

10.2 The following will be the weightages for different courses.

i) Lecture or Lecture cum Tutorial based courses:

Continuous Assessment	-	40%
Semester End Examination	-	60%

ii) Laboratory based courses:

Continuous Assessment	-	60%
Semester End Examination	-	40%

iii) Comprehensive Viva-voce - 100 % Semester End Examination

iv) Project work – Phase I & Project work – Phase II:

Continuous Assessment	-	60%
Viva-Voce Examination	-	40%

10.3 If a student indulges in malpractice in any of the Semester End Examinations / Tests he/she shall be liable for punitive action as prescribed by the Board of Examiners.

11. PROCEDURE FOR SEMESTER PROGRESS

A candidate will be permitted to proceed to the courses of study of any semester only if he/she has satisfied the requirements of attendance, progress and conduct in respect of the preceding semester and had paid all the fees for that semester.

12. PROCEDURE FOR REJOINING THE PROGRAMME

A candidate who is required to repeat the study of any semester for want of attendance/ progress/conduct or who desires to rejoin the programme after a period of discontinuance or who upon his/her own request is permitted by the authorities to repeat the study of any semester, may join the semester which he/she is eligible or permitted to join, only at the time of its normal commencement for a regular batch of candidates and after obtaining the approval from the Directorate of Technical Education and affiliating university. No candidate will however be enrolled in more than one semester at any time. In the case of repeaters, the continuous assessment marks secured earlier in the repeated courses will be discarded.

13. ASSESSMENT AND PASSING REQUIREMENTS

i) **Assessment:** The assessment will comprise of final examination and / or continuous assessment, carrying marks as specified in the scheme in section 22 infra. Continuous assessment marks will be awarded on assessing the candidate continuously during the semester as per guidelines framed by the College. All assessment will be done on absolute mark basis. However, for the purpose of reporting, the performance of a candidate letter grades and grade points will be awarded as per section 13 (iii) infra

The Continuous assessment for every theory subject shall be evaluated based on conduct of 3 internal tests, tutorials/seminars/mini project/assignments and attendance. The maximum marks for Continuous Assessment will be 40. Out of 40 marks for Continuous Assessment 25 marks can be given for the best two test performances, 10 marks for Tutorials/Seminars/Mini project/Assignments and 5 marks for attendance.

Every practical experiment shall be evaluated based on conduct of experiment and Records maintained duly signed by the HOD. There shall be at least one Mid-Semester test. The maximum marks for Continuous Assessment will be 60. Out of 60 marks for Continuous Assessment 20 marks can be given for Model Laboratory Test; 5 marks for attendance and the remaining 35 marks can be distributed for completion of record, observation and neatness.

ii) The break up for the award of 5 marks for attendance to a candidate who puts in 80% and above attendance is as follows:

80 %	-	1 mark
Above 80% and less than or equal 85%	-	2 marks
Above 85% and less than or equal 90%	-	3 marks
Above 90% and less than or equal 95%	-	4 marks
Above 95%	-	5 marks

A candidate will be permitted to appear for the examination of a semester only if he/she has completed the study of that semester (vide section 9 supra). A candidate will not be allowed to register for Semester End Examination of any semester unless he/she simultaneously registers for the examinations of the highest semester eligible and all the arrear courses he/she has.

iii) **Letter grade and grade point:** The letter grade and the grade points are awarded based on total marks secured by a candidate in individual courses as detailed below:

Range of Total Marks	Letter Grade	Grade Point, GP
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
< 50 or <50% in SEE	RA	0
Withdrawal	W	0
Inadequate Attendance	IA	0

"RA" – reappearance: "IA" **–** Inadequate Attendance.

14. GRADE SHEETS

After the publication of the results, each student will be issued individual grade sheet for each Semester containing the following information:

(i) The list of courses enrolled during the Semester and the grade awarded.
(ii) The Grade Point Average (GPA) for the Semester and the cumulative Grade Point Average (CGPA) of all courses successfully cleared from First Semester Onwards
(iii) Credits enrolled and credits earned up to the current semester.

FORMULAE FOR GPA & CGPA

$$GPA = \frac{\Sigma_I C_i GP_i}{\Sigma_I C_i} \qquad CGPA = \frac{\Sigma_I C_i GP_i}{\Sigma_I C_i}$$

Where, C_i - is the Credit assigned to the Course
GP_i - is the Grade point for each course corresponding to the grade obtained
Σ_I - is the sum for all courses successfully cleared during the particular semester in the case of GPA and during all the Semesters in the case of CGPA.

FORMULA FOR CALCULATING PERCENTAGE OF MARKS

CGPA X 10 = % OF MARKS

14.1 Passing a course:

a) A Candidate who secures grade point of 5 or more in any course of study will be declared to have passed that course, provided a minimum of 50% is secured in the Semester end examination of that course of study.

b) A candidate, who absents or withdraws or is disqualified as per section 8.1 or who secures a letter grade RA (Grade point 0) or less than 50% in Semester end examination in any course carrying

continuous assessment and final examination marks, will retain the already earned continuous assessment marks for the next immediate appearance only in the examination of that course and thereafter he/she will be solely assessed by semester end examination carrying the entire marks of that course.

A candidate, who absents or secures a letter grade RA (Grade point 0) in any course carrying only continuous assessment marks, will be solely examined subsequently by a final examination carrying the entire marks of that course, the continuous assessment marks obtained earlier being discarded.

c) If a candidate fails to submit the report on project work on or before the date specified by the college / department, he/she is deemed to have failed in the project work and awarded grade RA.

d) A candidate who lacks in attendance or who fails to submit the report on the 7^{th} and 8^{th} semester project (or whose report is not accepted for reasons of incompleteness or other serious deficiencies) within the prescribed date or whose project work and viva-voce has been assessed as grade RA will have to register at the beginning of a subsequent semester following the current semester, redo and submit the project report at the end of that semester. Continuous Assessment marks earned earlier for the project will be discarded.

e) If a candidate fails to appear for the viva-voce examination after submitting the report on project work on the date specified by the college / department, he/she will be marked as absent for the project work. Such candidates will be allowed to appear for the viva-voce examination at the next earliest opportunity, the project being evaluated at that time. Continuous Assessment marks earned earlier for the project will be considered.

15. REVALUATION

A candidate can apply for revaluation of his/her Semester Examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Department. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for Project work.

A student who has passed all the courses prescribed in the Curriculum for the award of the degree shall not be permitted to re-enroll to improve his/her Grades in a course or CGPA.

16. WITHDRAWAL FROM EXAMINATION

i) A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any course or courses of only one semester examination, if he/she does not have any history of arrears at the time of request for withdrawal. Also, only one application for withdrawal is permitted for that semester examination in which withdrawal is sought.

ii) Withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination and if it is made prior to the commencement of the examination in that course or courses and also recommended by the Head of the Department.

17. TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

i) A candidate is not normally permitted to temporarily break the study. However, if a candidate intends to temporarily discontinue the programme in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the programme in a later respective semester, he/she shall apply to the Principal through the Head of the Department and stating the reasons there for**.**

ii) A candidate is permitted to rejoin the programme at the respective semester as and when it is offered after the break subject to the approval of Directorate of Technical Education / affiliating University.

iii) The conditions specified for passing all the courses for the purpose of classification (vide sections 19(i) and (ii) infra), shall be applicable to such break of study permitted.

iv) The candidate permitted to rejoin the Programme after the break shall be governed by the Curriculum and Regulations in force at the time of rejoining. Such candidates may have to do additional courses as prescribed by the COE/ Principal if the Regulation warrants.

v) The total period for completion of the programme reckoned from, the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in section 3 (ii) supra irrespective of the period of break of study in order that he/she may be qualified for the award of the degree.

vi) If any candidate is detained for want of requisite attendance, progress and conduct, the period spent in that semester shall not be considered as authorized 'Break of Study'.

18. QUALIFYING FOR THE AWARD OF DEGREE

A candidate shall be declared to have qualified for the award of the BE / BTech Degree provided

i) the candidate has successfully completed the course requirements and has passed all the prescribed courses of study of the respective programme listed in section 1.1 supra within the duration specified in section 3 supra and

ii) no disciplinary action is pending against the candidate.

19. CLASSIFICATION OF DEGREE

i) **First Class with Distinction:** A candidate who qualifies for the award of the Degree (vide section 18 supra) having passed all the courses of study of all the eight semesters (six semesters for lateral entry candidates) at the first opportunity within eight consecutive semesters (six consecutive semesters for lateral entry candidates) after the commencement of his /her study and securing a CGPA of 8.50 and above shall be declared to have passed in First Class with Distinction. For this purpose the withdrawal from examination (vide section 16 supra) will not be construed as an opportunity for appearance in the examination. Further, the authorized break of study (vide section 17 supra) will not be counted for the purpose of classification.

ii) **First Class:** A candidate who qualifies for the award of the degree (vide section 18 supra) having passed all the courses of study of semesters 1 to 8 (semesters 3 to 8 for lateral entry candidates) within a maximum period of ten consecutive semesters (eight consecutive semesters for lateral entry candidates) and securing a CGPA of 6.5 and above shall be declared to have passed in First Class. Further, the authorized break of study (vide section 17 supra) will not be counted for the purpose of classification.

iii) **Second Class:** All other candidates who qualify for the award of the degree shall be declared to have passed in Second Class.

iv) A candidate who is absent in semester Examination in a course / Project work after having enrolled for the same shall be considered to have appeared in that Examination for the purpose of classification.

20. DISCIPLINE

Every student is expected to observe discipline and decorum both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the College. In the event of an act of indiscipline being reported, the Head of the Institution will refer it to a disciplinary committee constituted by the Institution to inquire into acts of indiscipline and disciplinary action to be taken.

21. REVISION OF REGULATION AND CURRICULUM

The College may from time to time revise, amend or change the Regulations, scheme of Examinations and syllabi if found necessary through the Board of Studies and Academic Council of the College and implement either retrospective or prospective shall be as decided by the Academic Council.

22. CURRICULUM AND SYLLABI

TOTAL CREDITS: 181

SEMESTER - I

Course Code	Course Title	Hours / week			C	Maximum Marks			CAT
		L	T	P		CA	SEE	Total	
THEORY									
13EN101	Technical English - I	3	0	0	3	40	60	100	HUM
13MA102	Linear Algebra, Calculus and Applications	3	1	0	4	40	60	100	BS
13PY103	Engineering Physics	3	0	0	3	40	60	100	BS
13CS105	Fundamentals of Computing and C Programming	4	0	0	4	40	60	100	EAS
13CE106	Basics of Civil and Mechanical Engineering	4	0	0	4	40	60	100	EAS
13CH108	Engineering Chemistry for Electrical Sciences	3	0	0	3	40	60	100	BS
PRACTICAL									
13CS111	Fundamentals of Computing and C Programming Laboratory	0	0	3	1	60	40	100	EAS
13ME112	Engineering Graphics	1	0	3	2	60	40	100	EAS
13PY211	Physics/Chemistry Laboratory*	0	0	3	Refer Sem. II & footnote #				BS
Total		**21**	**1**	**9**	**24**				

SEMESTER - II

Course Code	Course Title	Hours / week			C	Maximum Marks			CAT
		L	T	P		CA	SEE	Total	
THEORY									
13EN201	Technical English - II	3	0	0	3	40	60	100	HUM
13MA202	Transform Techniques and Integral Calculus	3	1	0	4	40	60	100	BS
13CH204	Environmental Science	3	0	0	3	40	60	100	EAS
13EE205	Electric Circuit Analysis	4	0	0	4	40	60	100	DC
13EE206	Electron Devices for Electrical Engineering	3	0	0	3	40	60	100	DC
13PY208	Materials Science for Electrical Sciences	3	0	0	3	40	60	100	BS
PRACTICAL									
13PY211	Physics/Chemistry Laboratory*	0	0	3	2	60	40	100	BS
13ME213	Engineering Practices	0	0	3	1	60	40	100	EAS
13CS214	Unix and Advanced C Programming Laboratory	0	0	3	1	60	40	100	EAS
Total		**19**	**1**	**9**	**24**				

SEMESTER - III

Course Code	Course Title	Hours / week			C	Maximum Marks			CAT
		L	T	P		CA	SEE	Total	
THEORY									
13ME301	Fluid Mechanics and Heat Transfer	3	1	0	4	40	60	100	EAS
13MA302	Discrete Transforms and Fourier Analysis	3	1	0	4	40	60	100	BS
13IC303	Electrical Measurements	3	0	0	3	40	60	100	DC
13IC304	Electronic Circuits	3	0	0	3	40	60	100	DC
13EE305	Electrical Machines	3	1	0	4	40	60	100	EAS
13IC306	Transducer Engineering	3	0	0	3	40	60	100	DC
PRACTICAL									
13IC311	Electron Devices and Circuits Laboratory	0	0	3	1	60	40	100	DC
13IC312	Transducers and Measurements Laboratory	0	0	3	1	60	40	100	DC
13EE315	Electrical Machines Laboratory	0	0	3	1	60	40	100	EAS
Total		**18**	**3**	**9**	**24**				

SEMESTER - IV

Course Code	Course Title	Hours / week			C	Maximum Marks			CAT
		L	T	P		CA	SEE	Total	
THEORY									
13MA401	Numerical Methods	3	1	0	4	40	60	100	BS
13IC402	Digital Logic Circuits	4	0	0	4	40	60	100	DC
13IC403	Linear Integrated Circuits and Applications	3	0	0	3	40	60	100	DC
13IC404	Power Electronics and Drives	3	1	0	4	40	60	100	DC
13IC405	Control System Engineering	3	1	0	4	40	60	100	DC
13CS406	Data Structures and Algorithms	4	0	0	4	40	60	100	EAS
PRACTICAL									
13IC412	Linear and Digital Integrated Circuits Laboratory	0	0	3	1	60	40	100	DC
13IC413	Control Systems Laboratory	0	0	3	1	60	40	100	DC
13CS415	Data Structures and Algorithms Laboratory	0	0	3	1	60	40	100	EAS
Total		**20**	**3**	**9**	**26**				

SEMESTER - V

Course Code	Course Title	Hours / week			C	Maximum Marks			CAT
		L	T	P		CA	SEE	Total	
THEORY									
13IC501	Microprocessors and Microcontrollers	3	1	0	4	40	60	100	DC
13IC502	Analytical Instrumentation	3	0	0	3	40	60	100	DC
13IC503	Industrial Instrumentation - I	3	0	0	3	40	60	100	DC
13IC504	Advanced Control Systems	3	1	0	4	40	60	100	DC
13IC505	Process Control	3	1	0	4	40	60	100	DC
13CS508	Object Oriented Programming	3	1	0	4	40	60	100	EAS
PRACTICAL									
13IC511	Microprocessors and Microcontrollers Laboratory	0	0	3	1	60	40	100	DC
13IC512	Process Control Laboratory	0	0	3	1	60	40	100	DC
13CS514	Object Oriented Programming Laboratory	0	0	3	1	60	40	100	EAS
Total		**18**	**4**	**9**	**25**				

SEMESTER - VI

Course Code	Course Title	Hours / week			C	Maximum Marks			CAT
		L	T	P		CA	SEE	Total	
THEORY									
13IC601	Digital Signal Processing	3	1	0	4	40	60	100	DC
13MB602	Principles of Management	3	0	0	3	40	60	100	HUM
13IC603	Industrial Instrumentation - II	3	0	0	3	40	60	100	DC
13IC604	System Identification and Adaptive Control	3	0	0	3	40	60	100	DC
13IC605	Intelligent Control	3	0	0	3	40	60	100	DC
13ICXXX	Elective I	3	0	0	3	40	60	100	DE
PRACTICAL									
13IC611	Simulation and Control Laboratory	0	0	3	1	60	40	100	DC
13EN612	Communication Skills Laboratory	1	0	3	2	60	40	100	HUM
13IC613	Industrial Instrumentation Laboratory	0	0	3	1	60	40	100	DC
Total		**19**	**1**	**9**	**23**				

SEMESTER - VII

Course Code	Course Title	Hours / week			C	Maximum Marks			CAT
		L	T	P		CA	SEE	Total	
THEORY									
13IC701	Power Plant Instrumentation	3	0	0	3	40	60	100	DC
13IC702	Digital Control System	3	1	0	4	40	60	100	DC
13IC703	Logic and Distributed Control Systems	3	0	0	3	40	60	100	DC
13IC704	Virtual Instrumentation	3	0	0	3	40	60	100	DC
13ICXXX	Elective II	3	0	0	3	40	60	100	DE
13ICXXX	Elective II	3	0	0	3	40	60	100	DE
PRACTICAL									
13IC711	Industrial Automation Laboratory	0	0	3	1	60	40	100	DC
13IC712	Virtual Instrumentation Laboratory	0	0	3	1	60	40	100	DC
13IC721	Comprehensive Viva –Voce	0	0	0	1	-	100	100	DC
13IC751	Project Work - Phase I	0	0	3	1	60	40	100	DC
Total		**18**	**1**	**9**	**23**				

SEMESTER - VIII

Course Code	Course Title	Hours / week			C	Maximum Marks			CAT
		L	T	P		CA	SEE	Total	
THEORY									
13ICXXX	Elective IV	3	0	0	3	40	60	100	DE
13ICXXX	Elective V	3	0	0	3	40	60	100	DE
PROJECT WORK									
13IC851	Project Work - Phase II	0	0	18	6	60	40	100	DC
Total		**6**	**0**	**18**	**12**				

- Continuous Assessment marks are awarded for performance in both semesters (I and II) as given in section 13 supra. Semester End Examination is in second semester only.
* - Laboratory classes for Physics and Chemistry are held in alternate weeks.

L - Lecture
P - Practical
CA - Continuous Assessment
BS - Basic Science
DC - Department Core
T - Tutorial
C - Credits
SEE - Semester End Examination
HUM - Humanities
CAT - Category
DE - Department Elective

LIST OF ELECTIVES

COMPUTER SCIENCE

Course Code	Course Title
13IC001	Industrial Data Networks
13IC002	Visual Programming
13IC003	Computer Architecture
13CS059	Operating Systems

INSTRUMENTATION

Course Code	Course Title
13IC021	Environmental Instrumentation
13IC022	Fibre Optics and Laser Instruments
13IC023	Instrumentation in Petrochemical Industries
13IC024	Instrumentation in Paper Industries
13IC025	Biomedical Instrumentation
13IC026	Automobile and Aircraft Instrumentation

ELECTRONICS ENGINEERING

Course Code	Course Title
13IC041	Mobile Communication
13IC042	Embedded System Design
13IC043	Modern Electronic Instrumentation
13IC044	Remote Sensing
13IC045	VLSI Design
13IC046	Fundamentals of Nano Science

CONTROL SYSTEM

Course Code	Course Title
13IC061	Robotics and Automation
13IC062	Instrumentation System Design
13EC069	Micro Electro Mechanical Systems
13CS079	Artificial Intelligence and Expert Systems

SEMESTER I

13EN101 TECHNICAL ENGLISH - I 3 0 0 3

(Common to all branches of B.E/B.Tech Programmes)

OBJECTIVES

- To develop listening skills for academic and professional purposes.
- To acquire the skill to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To improve active and passive vocabulary of the students.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I **9**

General Vocabulary – changing words from one form to another - Adjectives, comparative adjectives – Adverbs - Active and passive voice – Tenses - simple present, present continuous - compound nouns - Skimming and scanning - Listening and transfer of information – bar chart, flowchart – paragraph writing, description – discussing as a group and making an oral report on the points discussed, conversation techniques – convincing others.

Suggested activities:

1. Matching words & meanings - Using words in context – Making sentences
2. Changing sentences from active to passive voice & vice versa.
3. Skimming, cloze exercises, exercises transferring information from text to graphic form - bar charts, flow charts.
4. Writing descriptions using descriptive words & phrases, and technical vocabulary
5. Role play, conversation exercises, discussions, oral reporting exercises

Any other related relevant classroom activity

UNIT II **9**

Vocabulary – prefixes & suffixes – Antonyms-simple past tense - Spelling and punctuation –Scanning, inference - Listening & note-making - Paragraph writing - comparison and contrast - Creative thinking and speaking.

Suggested Activities:

1.. Vocabulary activities using prefixes and suffixes
2. Scanning the text for specific information
3. Listening guided note-taking - Writing paragraphs using notes, giving suitable headings and subheadings for paragraphs. Using expressions of comparison and contrast.
4. Discussion activities and exploring creative ideas.

Any other related relevant classroom activity

UNIT III **9**

Tenses - simple future and past perfect - Reading in Context -Listening & note taking – single line - Definitions – sequencing of sentences – instruction – Persuasive speaking.

Suggested activities:

1. Providing appropriate context for the use of tenses
2. Listening and note-taking
3. (a) Writing sentence definitions, instructions
   (b) Identifying the discourse links and sequencing jumbled sentences / writing instructions
4. Speaking exercises, discussions, role play exercises using explaining, convincing and persuasive strategies

Any other related relevant classroom activity

UNIT IV **9**

Modal verbs and Probability – Concord subject verb agreement – correction of errors - Cause and effect expressions – Speaking –Welcome Address-Vote of Thanks

Suggested activities:
1. Making sentences using modal verbs to express probability
2. Gap filling using relevant grammatical form of words.
3. Speaking - role play activities, discussions, extempore speaking exercises speculating about the future.
4. Any other related relevant classroom activity

TOTAL: 45

TEXT BOOK

1. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd.,2006. Themes 1 – 4 (Resources, Energy, Computer, Transport)

REFERENCE BOOKS

1. Meenakshi Raman and Sangeeta Sharma, 'Technical Communication English skills for Engineers' Oxford University Press, 2008.
2. Andrea, J. Rutherford, 'Basic Communication Skills for Technology', Second Edition, Pearson Education, 2007.

13MA102 LINEAR ALGEBRA, CALCULUS AND APPLICATIONS 3 1 0 4

(Common to all branches of B.E/B.Tech Programmes)

OBJECTIVES

- To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
- To gain adequate exposure to the theory and applications of differential calculus.
- To familiarize with functions of several variables which are needed in many branches of engineering.
- To acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.

UNIT I MATRICES 9

Introduction with Applications- Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties (excluding proof)–Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form –Reduction of quadratic form to canonical form by orthogonal transformation

UNIT II DIFFERENTIAL CALCULUS 9

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

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9

Introduction with Applications- Function of two variables -Partial derivatives – Euler's theorem for homogenous functions Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion- Maxima and Minima – Method of Lagrangian multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 9

Higher order linear differential equations with constant coefficients- Cauchy's linear differential equations - Legendre's linear differential equations-Method of Variation of parameters

UNIT V APPLICATIONS OF DIFFERENTIAL EQUATIONS 9

Modeling-Free oscillations- Undamped system-Damped system-Solution of specified differential equations connected with electric circuits and bending of beams (Differential equations and associated conditions need be given)

TUTORIALS: 15
TOTAL: 60

TEXT BOOKS

1. Kreyszig. E, "Advanced Engineering Mathematics" Eighth Edition, John Wiley and Sons (Asia) Limited, Singapore 2010.
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, 2009.

REFERENCE BOOKS

1. Veerarajan. T, "Engineering Mathematics for first year", 4th edition, Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, 2005.
2. Dr.P.Kandasamy, Dr.K.Thilagavathy, Dr.K.Gunavathy, "Engineering Mathematics", S.Chand & Company Ltd.,Ninth Edition,2010.
3. Venkataraman. M.K, "Engineering Mathematics, Volume I & II Revised Enlarged, Fourth Edition",The National Pub. Co., Chennai, 2004.

13PY103 ENGINEERING PHYSICS 3 0 0 3

(Common to all branches of B.E/B.Tech programmes)

OBJECTIVES

- To gain knowledge on principles of Ultrasonic, Lasers, Optical fibers and their applications in various medical and engineering fields.
- To acquire knowledge about various types of microscopes and their applications.
- To get exposure to the various vacuum pumps and gauges with their principle of operation and some of their applications.

UNIT I ULTRASONICS 9

Introduction – Production – Magnetostriction effect – magnetostriction generator – Piezoelectric effect – piezoelectric generator – Detection of ultrasonic waves – properties – cavitations – velocity measurement – acoustic grating – Industrial applications – drilling, welding, soldering and cleaning – SONAR – Non Destructive testing – pulse echo system through transmission and reflection modes – A,B and C scan displays, Applications - sonogram – ultrasonic flaw detector.

UNIT II LASERS 9

Introduction – Principle of spontaneous emission and stimulated emission – population inversion, pumping. Einstein's A and B coefficients – derivation. Types of lasers – He-Ne, CO_2, Nd-YAG, Semiconductor lasers (homojunction & heterojunction). Qualitative industrial applications – Lasers in welding, heat treatment, cutting – Medical applications – Holography (construction & reconstruction).

UNIT III FIBRE OPTICS & APPLICATIONS 9

Principle and propagation of light in optical fibres – Numerical aperture and acceptance angle – Types of optical fibres (material, refractive index, mode) – double crucible technique of fibre drawing – splicing, loss in optical fibre – attenuation, dispersion, bending – fibre optical communication system (Block diagram) – light sources – Detectors – fibre optic sensors – temperature & displacement – Endoscope.

UNIT IV QUANTUM PHYSICS AND MICROSCOPY 9

Compton Effect.- Theory and experimental verification – matter waves – Schrödinger's wave equation – Time dependent and time independent equations (derivation)- physical significance of wave function, particle in a box (in one dimension) .Limitations of Optical microscopy, Electron Microscope, Scanning electron microscope, Transmission electron microscope, applications.

UNIT V VACUUM SCIENCE AND TECHNOLOGY 9

Introduction-Concepts of vacuum-Throughput, Pumping speed, Effective Pumping speed and Conductance. Types of Pumps-working principle and Construction of rotary pump, diffusion pump. Operation of pressure gauges-pressure range, measurement of vacuum using Pirani and Penning Gauges, Merits and limitations-Working of Vacuum system applications.

TOTAL: 45

TEXT BOOKS

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications,New Delhi(2003).
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics',S.Chand and company, Ltd., New Delhi, 2005.

REFERENCE BOOKS

1. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007).
2. Rajendran, V and Marikani A, 'Engineering Physics' Tata Mc Graw Hill Publications Ltd, III Edition, New Delhi, (2004).
3. Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2007).
4. Jayakumar. S, 'Engineering Physics', R.K. Publishers, Coimbatore, (2003).
5. Chitra Shadrach and Sivakumar Vadivelu, 'Engineering Physics', Pearson Education, New Delhi, (2007).

13CS105 FUNDAMENTALS OF COMPUTING AND C PROGRAMMING 4 0 0 4

(Common to all branches of B.E/B.Tech programmes)

OBJECTIVES

At the end of this course student should be able

- To understand the functioning of various components of a computer system.
- To understand the role of an Operating System, Problem Solving Methods
- To know the fundamental programming aspects of C
- To know about the use of Arrays, Strings, Structures and Union in C

UNIT I COMPUTER HARDWARE AND SOFTWARE 12

Introduction - Characteristics of computers - Evolution - Computer Generations - Classification of computers - Basic computer organization - Applications of computers - Number systems and their Conversions - Input Unit - Output Unit - Recent I/O devices - Memory organization - Memory characteristics - Software: Definition - Types of software - System Software - Introduction to OS -Functions of OS - Compiler - Assembler - Application Software - Editor - Firmware.

UNIT II PROBLEM SOLVING METHODS 12

Planning the Program - Purpose - Algorithm - Flowchart - Pseudo Code - Software Development Steps - Programming Language Generations – Internet.

UNIT III INTRODUCTION TO C PROGRAMMING 12

Structure of C Program - Keywords - Character set - Constants - Variable declaration -Operators-Data Input and Output Statements - Control statements - Programming examples.

UNIT IV ARRAYS AND STRINGS 12

Arrays-Definition-Declaration-Types-one dimensional Array - two dimensional Array-Introduction to Pointers-Functions: Basics-Types-Parameter passing-Strings-Defining a String-Initialization of String-Reading and Writing a String-String manipulation.

UNIT V STRUCTURES AND UNION 12

Declaring Structures and Structure variables-Accessing the members of a Structure-Initialization of Structures-Copying and Comparing Structures-Arrays within the Structure-Union-Declaring a Union -Accessing and Initializing Members of a Union.

TOTAL: 60

TEXT BOOKS

1. D.Ravichandran, "Introduction to Computers and Communication" Tata McGraw Hill, 2006
2. Ashok N Kamthane, "Computer Programming" , ITL Education Solutions Limited, Pearson, Second Edition, 2012
3. Byron S. Gottfried, "Programming With C", Tata McGraw-Hill, 3rd Edition,2011.

REFERENCES

1. Yashwant P. Kanetkar ,"Let us C", Infinity Science Press, 8th Edition,2008
2. M.Morris Mano, "Computer System Architecture", Pearson Education,3rd Edition,2007
3. Pradip Dey, Manas Ghosh , "Computer Concepts & Programming in C" ,Oxford Higher Education, 2009.

13CE106/13CE206 BASICS OF CIVIL AND MECHANICAL ENGINEERING 4 0 0 4

OBJECTIVES

- To know the various Civil Engineering Materials and Components of Buildings
- To be familiar with the applications of various types of Power Plants
- To know the working principle of IC Engines, Refrigeration and Air conditioning Systems

UNIT I CIVIL ENGINEERING MATERIALS 12

Uses of stones- Tests for stone qualities of good building stone- Composition of brick- Comparison of brick work & stone work – Manufacturing of brick- Tests for brick- Composition of cement- Properties of cement- Manufacturing of cement- Test for cement- Types of sand- proportioning of concrete- Workability- curing of concrete - Tests on concrete-properties of mild steel

UNIT II BUILDING COMPONENTS 12

Requirement of good foundation-bearing capacity of soil- types of foundation-Roofing materials-Types of roofs-Flooring materials-types of floors- plastering-Painting-types of beams, columns and lintel-Importance of bridges and dams-stress, strain, elasticity, poisons ratio, modulus of rigidity

UNIT III POWER PLANT ENGINEERING 12

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV I C ENGINES 12

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 12

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner

TOTAL: 60

TEXT BOOKS

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi.
2. Venugopal K and Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).

REFERENCE BOOKS

1. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P)Ltd.
2. Seetharaman S. "Basic Civil Engineering", Anuradha Agencies, (2005).
3. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

13CH108 ENGINEERING CHEMISTRY FOR ELECTRICAL SCIENCES 3 0 0 3

(Common to ECE, EEE,CSE, IT, ICE)

OBJECTIVES

- To educate the principles of electrochemistry and its applications.
- To gain knowledge about the various types of energy sources, accumulators and fuel cells
- To acquire knowledge about the application of polymers and composites materials.
- To familiarize students with the specialty materials in nuclear energy.
- To get exposure about the instrumental quantitative analysis.

UNIT I ELECTROCHEMISTRY 9

Electrochemical cells – Reversible and Irreversible cells – emf of a cell – Measurement of emf of a cell – Electrode potential - Nernest equation (problems) – Electrodes – Reference electrodes – Standard hydrogen electrode and Calomel electrode – Ion selective electrode – Glass electrode – measurement of pH - emf series and its significance.

UNIT II ENERGY SOURCES & STORAGE DEVICES 9

Nuclear energy- fission and fusion reaction - Nuclear reactor for power generation (block diagram only)- Breeder reactor- Solar energy conversion- Solar cells- Wind energy-wind energy -fuel cells-hydrogen-oxygen fuel cell Batteries-alkaline batteries- lead-acid Batteries -Nickel-cadmium Lithium batteries.

UNIT- III POLYMERS AND COMPOSITES 9

Polymers - definition- polymerization- Types-addition and condensation polymerization - Mechanism- free radical only- Rubbers-Natural –Synthetic rubbers-Vulcanization of rubber-Plastics- its classification Preparation, properties and uses of PVC, Teflon, Polycarbonate, Polyurethane, nylon 6, nylon-6 6, PET. Composites-definition, types. Polymer matrix composites-FRP only.

UNIT IV SPECIALTY MATERIALS IN NUCLEAR ENERGY 9

Dielectrics, insulating materials, soldering materials, magnetic materials, metals and semiconductors – properties – and its applications. Determination of the Half-Life and Average Life of a Radioactive Nucleus. - Determination of the Binding Energy of a Nucleus or a Particle.

UNIT- V ANALYTICAL TECHNIQUES 9

Introduction –Types of Spectroscopy-UV-IR-Beer-Lambert'slaw-Applications- Problems based on Beer-Lambert's law-Colorimetry-Instrumentation–Application-Flame photometry-estimation of sodium by flame photometry-Atomic absorption spectroscopy – instrumentation -Estimation of nickel by atomic absorption spectroscopy.

TOTAL: 45

TEXT BOOKS

1. B.K.Sharma, "Engineering Chemistry",Krishna Prakasam media (P),Meerut,2001.
2. Glasstone S., Electrochemistry, 5th edition, Maurice Press, USA, 2004.

REFERENCE BOOKS

1. B.K.Sharma, ""Engineering Chemistry",Krishna Prakasam media (P), Meerut, 2001.
2. S.Bahl, G.D.Tuli and Arun Bahl "Essentials of Physical Chemistry:,S.Chand and Company Ltd,New Delhi,2004.
3. P.C.Jain and Monica Jain, "Engineering Chemistry", 15th Edition, Dhanpat Rai Publishing Company (P),Ltd,New Delhi,2007.

13CS111 FUNDAMENTALS OF COMPUTING AND C PROGRAMMING LABORATORY 0 0 3 1

(Common to all branches of B.E/B.Tech programmes)

OBJECTIVES

At the end of this course student should be able

- To demonstrate the basics in word processing

- To demonstrate the basics of spread sheet
- To implement simple programs in C

WORD PROCESSING AND SPREAD SHEET APPLICATIONS

a) WORD PROCESSING

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) SPREAD SHEET

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

C PROGRAMMING

c) BASIC C PROGRAMMING

9. Data types, Operators- Expression Evaluation
10. Data input and output statements- Condition Statements
11. Operations on Strings

d) ARRAYS ,FUNCTIONS,POINTERS

12..Arrays – One dimension –Two dimension
13. Functions, Recursion and parameter passing mechanisms
14. Use of dereferencing operator and address of operator - pointer arithmetic

e) STRUCTURES AND UNION

15. Comparing Structures variables
16. Structure within Structures
17. Accessing the Members of a Union

TOTAL: 45

13ME112/13ME212 ENGINEERING GRAPHICS 1 0 3 2

OBJECTIVES

At the end of this course the student should be able

- To understand and utilise the commands used in 2D drawing package.
- To visualise the 3D drawing
- To draw orthographic projection for simple Engineering components.
- To develop the surfaces of solids like prism, cylinders and pyramids.

UNIT I ORTHOGRAPHIC PROJECTION 12

General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – Layout views – Developing visualization skills through sketching of multiple views from pictorial views and sketching of isometric view from the multiple views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Projection of points and straight lines located in the first quadrant – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS 12

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS 12

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other.

UNIT V DEVELOPMENT OF SURFACES 12

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.

TOTAL: 60

TEXT BOOK

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited ,2008.

REFERENCE BOOKS

1. Dhananjay A. Jolhe, "Engineering Drawing with an Introduction to AutoCAD", Tata McGraw Hill Publishing Company Limited, (2008).
2. Basant Agarwal and C.M. Agarwal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).
3. K. R. Gopalakrishnana, "Engineering Drawing" (Vol. I & II), Subhas Publications, (1998).
4. N. D. Bhatt, "Engineering Drawing", Charotar Publishing House, 46th Edition, (2003).
5. K. V.Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Modeling Software Packages like DWG Editor and AutoCAD

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical Products Documentation – Size and Layout of Drawing Sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical Products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for Technical Drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical Drawings – Projection Methods.

13PY211 PHYSICS/CHEMISTRY LABORATORY 0 0 3 2

(Common to all branches of B.E/B.Tech programmes)

PHYSICS LABORATORY

OBJECTIVES

- To implement and visualize theoretical aspects in the laboratory.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – uniform bending
2. Determination of thickness of a thin wire – Air wedge method
3. Determination of Wavelength of Mercury Spectrum - Spectrometer Grating
4. Determination of Coefficient of viscosity of liquid - Poiseuille's Method
5. a) Particle Size Determination using Diode Laser
   b) Determination of Laser Parameter – Wavelength
   c) Determination of Acceptance angle and Numerical Aperture of an optical fiber
6. Determination of Band Gap of a semiconducting material
7. Determination of Specific Resistance of the given coil of wire using Carey Foster's Bridge
8. Determination of Crystal Structure from XRD pattern
9. Determination of Photodiode Characteristics
10. Study of I –V characteristics of solar cell and determination of its efficiency

Demonstration

1. Determination of Thermal Conductivity of a bad conductor – Lee's Disc method
2. Determination of moment of inertia of disc and Rigidity modulus of a wire – Torsional pendulum

CHEMISTRY LABORATORY

OBJECTIVES

- To make conversant with theoretical principles and experimental procedures for quantitative estimation

LIST OF EXPERIMENTS

1. Determination of Total, Temporary calcium and magnesium hardness of water by EDTA method
2. Determination of Alkalinity and TDS in water
3. Estimation of Dissolved oxygen by Winklers method
4. Estimation of Chloride in Water sample
5. Determination of COD of water
6. Potentiometric determination of ferrous iron
7. Estimation of acids in a mixture by conductometry
8. Estimation of strength of an acid by pH metry
9. Determination of inhibitor efficiency on the corrosion rate of steel in acid media by weight loss method
10. Electroplating of Nickel and determination of cathode efficiency

Demonstration

1. Spectrophotometric determination of ferrous iron
2. Anodizing of Aluminium and determination of thickness of anodic film

TOTAL: 90

SEMESTER II

13EN201 TECHNICAL ENGLISH II 3 0 0 3

(Common to all branches of B.E/B.Tech programmes)

OBJECTIVES

- To develop listening skills for academic and professional purposes.
- To acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I **9**

Technical Vocabulary – meanings in context, sequencing words, Articles – Prepositions intensive reading and predicting content, Reading and interpretation, extended definitions, process description

Suggested activities:

1. Exercises on word formation using the prefix 'self' – Gap filling with preposition.
2. Exercises – Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings.
4. Predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II **9**

Phrases / Structures indicating use / purpose – Adverbs – Skimming – Non-verbal communication – Listening – correlating verbal and non-verbal communication – Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) – Reading comprehension exercises with texts including graphic communication – Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorize data in tables.

3. Writing formal letters, quotations, clarification, placing orders and complaint – Letter seeking permission for Industrial visits – writing analytical paragraphs on different debatable issues.

UNIT III **9**

Cause and effect expressions – Different grammatical forms of the same word – speaking – Stress and intonation, Group Discussions – Reading – Critical reading – Listening – Writing – Using connectives, report writing (industrial accident report) – types, structure, data collection, content, form, recommendations.

Suggested activities:

1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg : object – very / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions –analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question
4. Sequencing of jumble sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV **9**

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application – content, format (CV / Bio-data) – Instructions, imperative forms – Checklists, Yes / No question form – E-mail communication.

Suggested Activities :

1. Rewriting exercises using numerical adjectives
2. Reading comprehension exercises with analytical questions on content – Evaluation of content
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking – Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs –Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V **9**

Speaking – Discussion of Problems and solutions – Creative and critical thinking – writing an essay, writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 45

TEXT BOOK

1. Chapters 5-8, Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2) Chennai : Orient Longman Pvt.Ltd.,206. Themes 5-8 (Technology, Communication, Environment, Industry)

REFERENCE BOOKS

1. P.K. Dutt, G. Rajeevan and C.L.N.Prakash, 'A Course in Communication Skills',Cambridge University Press, India 2007
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd. (Reprinted 1994 – 2007)
3. Edgar Thorpe, Showick Thorpe, Objective English', Second Edition, Pearson Education, 2007.

13MA202 TRANSFORM TECHNIQUES AND INTEGRAL CALCULUS 3 1 0 4

(Common to all branches of B.E/B.Tech programmes)

OBJECTIVES

- To develop logical thinking and analytical skills in evaluating multiple integrals.
- To grasp the concept of expression of a function under certain conditions as a double integral.
- To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines.
- To know the Fourier transform and Laplace Transform, their properties and the possible special cases with attention to their applications.

UNIT I MULTIPLE INTEGRALS 9

Introduction with Applications -Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

UNIT II VECTOR CALCULUS 9

Introduction with Applications - Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds

UNIT III LAPLACE TRANSFORM 9

Introduction with Applications -Laplace transform –Conditions for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals-Transform of unit step function and impulse functions – Transform of periodic functions- Inverse Laplace transform – Convolution theorem (excluding proof).

UNIT IV APPLICATIONS OF LAPLACE TRANSFORM 9

Initial and Final value theorems - Solution of linear ODE of second order differential equations with constant coefficients -First order simultaneous differential equations with constant coefficients –Integro Differential equations using Laplace transform techniques.

UNIT V FOURIER TRANSFORMS 9

Introduction with Applications -Statement of Fourier Integral Theorem- Fourier Transform Pairs-Fourier sine and cosine transforms-Properties-Transforms of simple functions-Convolution theorem- Parseval's Identity.

TUTORIALS: 15
TOTAL: 60

TEXT BOOKS

1. Kreyszig. E, "Advanced Engineering Mathematics" Eighth Edition, John Wiley and Sons (Asia) Limited, Singapore 2010.
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2009).

REFERENCE BOOKS

1. Veerarajan. T, "Engineering Mathematics for first year ", 4th edition, Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, 2005.
2. Dr.P.Kandasamy, Dr.K.Thilagavathy, Dr.K.Gunavathy, "Engineering Mathematics", S.Chand & Company Ltd.,Ninth Edition,2010.
3. Venkataraman. M.K, "Engineering Mathematics", Volume I & II Revised Enlarged Fourth Edition", The National Pub. Co., Chennai, 2009.

13CH204 ENVIRONMENTAL SCIENCE 3 0 0 3

(Common to all branches of B.E/B.Tech programmes)

OBJECTIVES

To be familiar with the need and scope of the environmental studies and to know about the natural resources.

- To gain knowledge about the various ecosystems and its biodiversity.
- To get exposure to various pollutions and its control measures.

- To conversant with the environmental issues and its possible solutions.
- To get awareness about the environmental laws.

UNIT I INTRODUCTION TO ENVIRONMENTAL SCIENCE AND NATURAL RESOURCES 9

Definition, scope and importance- Need for public awareness.

Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing 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 life styles.

UNIT II ECOSYSTEM AND BIODIVERSITY 9

Concept of an ecosystem –Structure and function of an ecosystem-producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids.

Introduction- types- characteristic features, structure and functions-Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, and 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 III ENVIRONMENTAL POLLUTION 9

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 IV SOCIAL ISSUES RELATED TO ENVIRONMENT 9

From Unsustainable to Sustainable development-Urban problems related to energy-Water conservation, rain water harvesting, watershed management-Resettlement and rehabilitation of people; its problems and concerns, case studies-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.

UNIT V ENVIRONMENTAL LEGISLATIONS AND HUMAN POPULATION 9

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-Public awareness- standards –permissible level of pollutants.

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.

TOTAL: 45

TEXT BOOKS

1. Anubha Kaushik and Kaushik.C.P, 3rd edition, “Environmental Science and Engineering” New age International (P) Ltd., Publishers, 2008.
2. Linda D. Williams – “Environmental Science Demystified”, Tata Mc Graw Hill Publishing Company Limited, 2005.

REFERENCE BOOKS

1. Tyler Miller.G., "Environmental Science"- Thomson, 2004.
2. Trivedi R.K., "Hand book of Environmental Laws, Rules, Guidelines, Compliances and Standards", Volume I& II, Enviro Media, 2006.
3. Dharmendra.S.Sengar, 'Environmental Law"Prentice hall of India Pvt Ltd., New Delhi, 2007.
4. Rajagopalan.R, "Environmental studies-From crisis to cure", Oxford University press, 2005.

13EE205 ELECTRIC CIRCUIT ANALYSIS 4 0 0 4

OBJECTIVES

At the end of this course the student should be able

- To understand the concept of circuit laws, waveforms, mesh and nodal analysis.
- To solve the electrical network using network reduction techniques and network theorems.
- To know the basic concepts of resonance and coupled circuits.
- To analyze the transient response of electric circuits and to solve problems in time domain using Laplace Transform.
- To know the basic concepts of three phase circuits and power measurement.

UNIT I BASIC CIRCUITS ANALYSIS 12

Ohm's Law – Kirchhoff's laws – Resistors in series and parallel circuits - voltage and current division- Introduction to AC Circuits – Generation and equation of sinusoidally varying voltage and current,RMS value and average value of important waveforms, form factor and peak factor-phasor representation of sinusoidally varying alternating quantities-representation of sinusoidal quantities in polar form- Analysis of RL,RC and RLC series circuits-AC parallel circuits(simple problems)- Power and Power factor – Analysis of Mesh current and node voltage methods.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS 12

Network reduction: source transformation – star delta conversion. Thevenins and Norton Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS 12

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling.

UNIT IV TRANSIENT RESPONSE 12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V THREE PHASE CIRCUITS 12

Three phase voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected balanced loads – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits using two wattmeter methods.

TOTAL: 60

TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi,2002.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.

REFERENCE BOOKS

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, 1996.
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi 2001.
3. Chakrabarti A, "Circuit Theory Analysis and synthesis, Dhanpath Rai & Sons, New Delhi, 1999.

4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2003.
5. Prof.T.Nageswara Rao,"Electric Circuit Analysis", Eleventh Edition, A.R.Publications, 2011.

13EE206 ELECTRON DEVICES FOR ELECTRICAL ENGINEERING 3 0 0 3

OBJECTIVES

At the end of this course student should be able

- To understand energy levels and energy bands of electrons, to understand the difference between conductors, semiconductors and insulators, to explain p and n type materials , pn junction, and origin of the junction depletion region.
- To explain diode forward and reverse characteristics, to know diode parameters, to sketch diode equivalent circuit and understand the working of different types of diodes.
- To describe the construction and explain the operation of BJT in terms of junction currents and voltages, to explain BJT parameters and characteristics, and to write equations relating base, collector and emitter currents.
- To explain the operation of JFET, to draw the characteristics and identify FET current and voltages, to identify different FET parameters and explain the operation and characteristics of MOSFET.
- To explain the applications of various electron devices.

UNIT I INTRODUCTION 9

Energy Band Structure of Conductors, Semiconductors & Insulators-Semiconductor materials- Ge, Si, GaAs-Intrinsic materials--Extrinsic materials-Semiconductor Conductivity-Mass Action Law-pn junction-Reverse Biased and Forward Biased junctions-Shockley equation.

UNIT II SEMICONDUCTOR DIODES 9

Semiconductor Diode - Characteristics – Ideal Diode – Resistance Levels – Equivalent Circuits – DC Load line analysis- Transition and Diffusion Capacitances – Reverse Recover Time – Zener Diodes – Light Emitting diodes, Schottkey- varactor, power, Tunnel diode

UNIT III BIPOLAR JUNCTION TRANSITORS 9

Transistor construction –transistor operation-BJT voltages and currents – Input and output characteristics of CE, CB and CC configurations – Transistor hybrid model for CE configuration – Analytical expressions for transistor characteristics – Transistor switching times – Voltage rating – Power transistors.

UNIT IV FIELD EFFECT TRANSITORS 9

Junction Field Effect Transistor – Pinch off voltage – JFET volt-ampere characteristics – JFET small signal model – MOSFETs and their characteristics – FET as a variable resistor.

UNIT V APPLICATIONS 9

Half wave rectifier-Full wave rectifier-Bridge rectifier-Capacitor filter-RC filter-Zener diode voltage regulators-Clipping and Clamping circuits-Voltage Multipliers-Diode logic circuits-SMPS- Transistor as Switch-BJT as an amplifier-FET in fiber optic system.

TOTAL: 45

TEXT BOOKS

1. Jacob. Millman, Christos C.Halkias, 'Electronic Devices and Circuits', Tata McGraw Hill Publishing Limited, New Delhi, 2003.
2. David A.Bell, 'Electronic Devices and Circuits', Prentice Hall of India Private Limited, New Delhi, 2003.

REFERENCE BOOKS

1. Theodore. F. Boghart, 'Electronic Devices & Circuits', Pearson Education, VI Edition, 2003.
2. Ben G. Streetman and Sanjay Banerjee, 'Solid State Electronic Devices', Pearson Education, 2002 / PHI.
3. Allen Mottershed, 'Electronic Devices and Circuits – An Introduction', Prentice Hall of India Private Limited, New Delhi, 2003.
4. S. Salivahanan,N.Suresh Kumar' Electronic Devices and Circuits', Tata McGraw Hill Publishing Limited, New Delhi, 2008.
5. Robert L.Boylestad, Louis Nashelsky,' 'Electronic Devices and Circuit Theory', Pearson Prentice hall publication,2009.

13PY208 MATERIALS SCIENCE FOR ELECTRICAL SCIENCES 3 0 0 3

OBJECTIVES

- To familiarize the students about the types of crystal structures.
- To gain knowledge about the metals and alloys.
- To acquaint the students about the semi conducting materials and their applications.
- To know about the types of magnetic and dielectric materials and their applications.
- To give an exposure to the students on advanced materials.

UNIT I CRYSTALLOGRAPHY 9

Definitions in crystallography-Bravais lattices and seven crystal systems-Miller indices-Bragg's law-Determination of crystal structure by Debye Scherrer method -Atomic radius, Number of atoms per unit cell,Co-ordination number,atomic packing factor for SC,BCC,FCC,and HCP,interplanar distance, Imperfections in crystals-point,line,surface-Polymorphism and allotrophy

UNIT II METALS AND ALLOYS 9

Drude Lorentz Theory of electrical conduction - Wiedemann-Franz law(derivation) –Band theory of solids.Factors affecting resistivity of metals – temperature ,alloying , magnetic field and strain. Applications of conductors – strain gauges, transmission lines, conducting materials, precision resistors, heating elements and resistance thermometer.

UNIT III SEMICONDUCTING MATERIALS 9

Elemental and Compound semiconductors-Intrinsic semiconductor-carrier concentration derivation- Fermi level-Variation of Fermi level with temperature- Electrical conductivity-band gap determination- extrinsic semiconductors- carrier concentration derivation in n-type and p-type semiconductor- variation of Fermi level with temperature and impurity concentration- Hall effect-Determination of Hall Coefficient.

UNIT IV MAGNETIC AND DIELECTRIC MATERIALS 9

Origin of magnetic moment – Bohr magneton, Properties of dia, para and ferro, antiferro magnetic materials – Ferromagnetism–Domain theory of Ferromagnetism-different types of energies involved in the domain growth-Hysteresis – Hard and soft magnetic materials - Ferrites – Applications- Dielectric materials – Electronic, Ionic, Orientational and space charge polarization – Frequency and temperature dependence of polarization–Dielectric loss – Dielectric breakdown – Ferroelectric materials – properties and applications.

UNIT V ADVANCED MATERIALS 9

Nanomaterials- properties –synthesis techniques – Plasma arcing, Chemical vapour deposition, Sol-gel method, Electro deposition, Ball milling –applications. Shape memory alloys(SMA) – Characteristics – Shape memory effect, Pseudo elasticity, Hysterisis- Properties of Ni-Ti alloy,applications,advantages and disadvantages of SMA.Super conductivity,types of super conductors, High Tc superconductors- applications of super conductors. Metallic glasses, preparation, properties, applications.

TOTAL: 45

TEXT BOOKS

1. William D.Callister Jr,Materials Science and Engineering –An Introduction ,John Wiley and Sons Inc., Sixth Edition , New York,2007.
2. Shaffer J P ,Saxena A,Antolovich S D , Sanders T H Jr and Warner S B ,"The Science and Design of Engineering Materials" McGraw Hill Companies,Inc., New York,1999.

REFERENCE BOOKS

1. Arumugam M, Materials Science, 3rd Edition. Anuradha agencies, Kumbakonam, 2007.
2. Rajendran V. and Marikani A., Applied Physics for Engineers, 3rd Edition.Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2003.
3. Pillai S.O., Solid State Physics, 5th Edition,New Age International Publication, New Delhi, 2003.
4. Ali Omar M., Elementary Solid State Physics, Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2002.
5. Jayakumar.S,"Material Science", R.K Publishers, Coimbatore,2006.

13ME113/13ME213 ENGINEERING PRACTICES 0 0 3 1

(Common to all branches of B.E/B.Tech programmes)

OBJECTIVES

At the end of this course student should be able

- To obtain knowledge about plumbing, carpentry ,carpentry tools ,welding and sheet metal practices
- To know the assembly practices of centrifugal pump and air conditioner
- To do the residential house wiring and soldering.

GROUP A - (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 9

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

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

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 13

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Turning and drilling practices.

(b) Smithy operations, upsetting, swaging, setting down and bending. Example –Exercise – Production of hexagonal headed bolt.
(c) Foundry operations like mould preparation for gear and step cone pulley.
(d) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B - (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 10

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair-case wiring.
4. Measurement of electrical quantities – voltage, current, power and power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of insulation resistance of electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 13

1. Study of Electronic components and equipments – Resistor, color coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, XOR and NOT.
3. Soldering practice – Components Devices and Circuits – Using general purpose
4. Study of PCB.
5. Measurement of ripple factor of HWR and FWR.
6. VI characteristics of PN diode and Zener diode.

TOTAL: 45

TEXT BOOKS

1. .Jeyapoovan, M.Saravanapandian & S.Pranitha, "Engineering Practices Lab Manual", Vikas Publishing House Pvt. Ltd, (2006).
2. P.Kannaiah & K.L.Narayana, "Manual on Workshop Practice", SciTech Publications,(1999)

REFERENCE BOOKS

1. K.Jeyachandran, S.Natarajan and S.Balasubramanian, "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
2. H.S.Bawa, "Workshop Practice", Tata McGraw Hill Publishing Company Limited, (2007).
3. A.Rajendra Prasad & P.M.M.S. Sarma, "Workshop Practice", Sree Sai Publication, (2002).

13CS214 UNIX AND ADVANCED C PROGRAMMING LABORATORY 0 0 3 1

OBJECTIVES

At the end of this course the student should be able

- To study the basics of UNIX OS
- To understand Shell Programming
- To familiarize with C Programming on UNIX and Graphics with C

a) UNIX COMMANDS

Study of Unix OS - Basic Shell Commands - Unix Editor

b) SHELL PROGRAMMING

Simple Shell program - Conditional Statements - Testing and Loops

c) C PROGRAMMING ON UNIX

Dynamic Storage Allocation-Pointers-Functions-File Handling

d) GRAPHICS WITH C

Graphics and Text Mode-graphics.h-Drawing- Lines, Rectangle, Circle, Arcs and Polygon

TOTAL: 45

SEMESTER III

13ME301 FLUID MECHANICS AND HEAT TRANSFER 3 1 0 4

OBJECTIVES

- To understand the structure and the properties of the fluid.
- To analyse and appreciate the complexities involved in solving the fluid flow problems.
- To understand the physical behavior of various modes of heat transfer like conduction, convection and radiation.
- To understand the application of various experimental heat transfer correlations in engineering calculations.

OUTCOMES

At the end of this course student should be able to:

- Apply knowledge of mathematics, science, and engineering.
- Design and conduct experiments, as well as to analyze and interpret data.
- Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- Identify, formulate, and solve engineering problems.
- Use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Apply principles of engineering, basic science, and mathematics to design, model and realize components, physical systems, or processes and work professionally in mechanical system areas.

UNIT I BASIC CONCEPTS AND PROPERTIES 9

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS 9

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net – fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube.

UNIT III CONDUCTION 9

Basic Concepts – Mechanism of heat transfer – conduction, convection and radiation. General differential equation of heat conduction – Fourier law of conduction, Cartesian and cylindrical coordinates. One dimensional steady state heat conduction - Conduction through plane wall, cylinders. Composite Systems - Extended Surfaces.

UNIT IV CONVECTION 9

Basic Concepts – Convective heat transfer coefficients, boundary layer concept, types of convection. Forced Convection – External Flow - Flow over plates, cylinders and spheres. Internal Flow – Laminar and Turbulent Flow. Free Convection - Flow over vertical Plate, horizontal Plate, inclined Plate, cylinders and spheres.

UNIT V RADIATION AND HEAT EXCHANGERS 9

Basic Concepts, Laws of Radiation – Stefan Boltzmann Law, Kirchoff's Law - Black Body Radiation - Grey body radiation.

Heat Exchangers - Types of Heat Exchangers, Overall heat transfer coefficient, LMTD method of heat exchanger analysis, Fouling factors, "Effectiveness – NTU" method of Heat Exchanger Analysis.

UNIT VI STATE OF THE ART/ADVANCES (NOT FOR EXAMINATION)

CFD software- FLUENT,STAR CD, PHONEIX, ANSYS - heat transfer modules, http://www.cfd-online.com, National Society Of Fluid Mechanics And Fluid Power -IITB

TUTORIAL: 15
TOTAL: 60

TEXT BOOKS

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (9th edition), Laxmi publications (P) Ltd, New Delhi, 2005.
2. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 2010.
3. Rajput R.K "Heat and Mass Transfer" S. Chand Publications, 2007.

REFERENCES

1. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
2. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.
3. Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 2006
4. Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, 2000.
5. Ozisik M.N, "Heat Transfer", McGraw-Hill Book Co., 1994

13MA302 DISCRETE TRANSFORMS AND FOURIER ANALYSIS 3 1 0 4

OBJECTIVES

- To study the concept of mathematical formulation of certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- To understand the different possible forms of Fourier series and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
- To learn the working procedure of formulating and identifying certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results.
- To learn the concept of evaluating the complex integration in terms of residue theorem.
- To understand the basics of Z – transform in its applicability to discretely varying functions.

OUTCOMES

At the end of the course the student should be able to

- Solve the engineering problems using PDE
- Find Fourier series solution to the engineering problems
- Find the derivatives of the complex numbers and to evaluate complex integrals.
- Design and formulate certain problems in terms of difference equations and solve them using Z-transform technique

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions- Solution of standard types of first order partial differential equations- Lagrange's linear equation – Linear homogeneous partial differential equations of second and higher order with constant co-efficient

UNIT II FOURIER SERIES 9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Change of interval- Parseval's identity- harmonic analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9

Classification– Solution of one dimensional wave equation – one dimensional heat equation – steady state solution of two dimensional heat equations (excluding insulated edges) – Fourier series solution in Cartesian coordinates.

UNIT IV ANALYTIC FUNCTIONS AND COMPLEX INTEGRATION **9**

Functions of a complex variable–Analytic functions–Necessary conditions, Cauchy-Riemann equation and Sufficient conditions (excluding proofs) – Harmonic conjugate – Construction of analytic functions - Complex integration–Singular points – Residues – Residue theorem statement – Application of residue theorem to evaluate real Integrals.

UNIT V Z- TRANSFORM AND DIFFERENCE EQUATIONS **9**

Z-transform- Properties – Inverse Z- transform- Convolution theorem- Formation of difference equations – Solution of difference equations using Z-transform

UNIT VI STATE OF THE ART/ADVANCES (NOT FOR EXAMINATION)

Modeling of heat and mass transfer equation using PDE – Discrete Fourier transform in the field of Digital Signal Processing and Spectral analysis – Analytic continuation – Special functions.

TUTORIAL: 15
TOTAL: 60

TEXT BOOK

1. Grewal B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).
2. Kreyszig. E, "Advanced Engineering Mathematics", tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2011.

REFERENCES

1. Veerarajan.T., "Engineering Mathematics" (for semester III), third edition, Tata McGraw-Hill Pub. Co., New Delhi, 2005.
2. Venkataraman. M.K, "Engineering Mathematics", Volume I & II Revised Enlarged Fourth Edition", National Pub. Co., Chennai, 2005.
3. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 2007.

13IC303 ELECTRICAL MEASUREMENTS 3 0 0 3

OBJECTIVES

- To understand the basics of meters used to measure current & voltage.
- To have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included.
- To elaborate discussion about potentiometer & instrument transformers.
- To have detailed study of resistance measuring methods.
- To have detailed study of inductance and capacitance measurement.

OUTCOMES

At the end of this course student should be able to:

- Analyze the measurement of electrical and physical parameters and implement in level, pressure, temperature measurement in various process control stations.
- Use the basic functions of Potentiometers and Instrument Transformers in efficient way.
- Solve the errors that occur in measuring instruments.

UNIT I MEASUREMENT OF VOLTAGE AND CURRENT **9**

Basics of meters– Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters – Extension of range and calibration of voltmeter and ammeter – Errors and compensation, Galvanometers – Ballistic, D'Arsonval galvanometer.

UNIT II MEASUREMENT OF POWER AND ENERGY **9**

Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading — Calibration of wattmeter- Dynamometer and Induction type energy meter.

UNIT III POTENTIOMETERS & INSTRUMENT TRANSFORMERS 9

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – C.T and P.T construction, theory, operation and characteristics. Magnetic measurements: Determination of B-H curve and measurement of iron loss.

UNIT IV RESISTANCE MEASUREMENT 9

Measurement of low, medium & high resistance – Ammeter, voltmeter method – Kelvin double bridge-Wheatstone bridge – Series and shunt type ohmmeter – High resistance measurement – Megger – Direct deflection methods – Price's guard-wire method – Earth resistance measurement.

UNIT V IMPEDANCE MEASUREMENT 9

A.C bridges – Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Schering bridge – Anderson bridge – Campbell bridge to measure mutual inductance – Errors in A.C. bridge methods and their compensation – Detectors – Excited field – A.C. galvanometer – Vibration galvanometer.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Calibration of Wattmeter and Energy meter using simulation.

TOTAL: 45

TEXT BOOKS

1. Golding,E.W., and Widdis,F.C., "Electrical Measurements and Measuring Instruments", A H Wheeler & Company, Calcutta, 5thedition, 2003.
2. Sawhney.A.K., "A Course in Electrical & Electronic Measurement and Instrumentation", Dhanpat Rai & Company Private Limited, New Delhi, 18th Edition, 2007.

REFERENCES

1. J.B.Gupta, "A Course in Electronic and Electrical Measurements and Instrumentation", S.K. Kataria & Sons, Delhi, 2003.
2. S.K.Singh, "Industrial Instrumentation and control", Tata McGraw Hill, 2nd edn., 2002.
3. H.S.Kalsi, "Electronic Instrumentation", Tata McGraw Hill, 2004.
4. Martin U. Reissland, "Electrical Measurement – Fundamental Concepts and Applications", New Age International (P) Ltd., 2001.
5. J. B. Gupta, "Electronic Instrumentation and Measurements", S. K. Katariya & Sons, New Delhi, 2010.
6. P. Sharma, "Electronic Measurements and Instrumentation", Umesh Publications, New Delhi, 2008.
7. D. Patranabis, "Principles of Electronic Instrumentation", PHI Learning Pvt. Ltd., New Delhi, 2009.

13IC304 ELECTRONIC CIRCUITS 3 0 0 3

OBJECTIVES

- To acquire basic knowledge about Power Supply Circuits.
- To learn basic types of Amplifiers and their response.
- To gain knowledge on Oscillators and their stability.

OUTCOMES

At the end of this course student should be able to:

- Analyze the circuits, operations and their performance characteristics.
- Solve various design problems in devices like Field Effect Transistors, Oscillators and Multivibrators.
- Use the concepts of amplifiers and oscillators in designing electronic circuits for robotics and automation process.

UNIT I POWER SUPPLY CIRCUITS **9**

Rectifiers – Half wave and Full wave rectifiers, Average and RMS value, Ripple factor, Regulation, Rectification efficiency, Transformer Utility Factor. Filters – Inductor, Capacitor, L type and Π type, Ripple Factor and Regulation. Need for voltage regulators – Series and Shunt regulators, Comparison, Current limiting and protection circuits

UNIT II TRANSISTOR BIASING **9**

BJT - Need for biasing - Fixed bias circuit, Load line and quiescent point. Variation of quiescent point due to β variation within manufacturers' tolerance. Stability factors. Different types of biasing circuits. Advantage of Self bias (voltage divider bias) over other types of biasing. Use of Self bias circuit as a constant current circuit.

UNIT III FREQUENCY RESPONSE OF AMPLIFIERS **9**

General shape of frequency response of amplifiers. Definition of cut off frequencies and bandwidth. Low frequency analysis of amplifiers to obtain lower cut off frequency Hybrid - pi equivalent circuit of BJTs. High frequency analysis of BJT amplifiers to obtain upper cut off frequency. High frequency equivalent circuit of FETs. High frequency analysis of FET amplifiers. Gain-bandwidth product of FETs.

UNIT IV LARGE SIGNAL AMPLIFIERS **9**

Classification of amplifiers (Class A, B, AB, C&D), Efficiency of class A, RC coupled and transformer-coupled power amplifiers. Class B complementary-symmetry, push-pull power amplifiers. Calculation of power output, efficiency and power dissipation. Crossover distortion and methods of eliminating it.

UNIT V OSCILLATORS AND MULTIVIBRATORS **9**

Oscillators – Barkhausen criteria, RC and LC oscillators using BJT – RC phase shift, Wien bridge oscillators, Hartley and Colpitt's oscillators. Frequency stability of oscillators. Crystal oscillators. Non-sinusoidal oscillators – Multivibrators – Bistable, Monostable, Astable multivibrators and Schmitt Trigger using BJT.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Frequency analysis of BJT and FET amplifiers using simulation. Characteristics of Crystal Oscillators through Simulation.

TOTAL: 45

TEXT BOOKS

1. Jacob. Millman, Christos C.Halkias, "Electronic Devices and Circuits", Tata McGraw Hill Publishing Limited, New Delhi, 2003.
2. David A.Bell, "Electronic Devices and Circuits", Prentice Hall of India Private Limited, New Delhi, 2006.
3. S.Salivahanan, "Electronic Devices and Circuits" 5th ed.,Tata McGraw-Hill, 2010.

REFERENCES

1. Theodre. F. Boghert, "Electronic Devices & Circuits", Pearson Education, VI Edition, 2003.
2. Ben G. Streetman and Sanjay Banerjee, "Solid State Electronic Devices", Pearson Education, 2002 / PHI
3. Allen Mottershead, "Electronic Devices and Circuits – An Introduction", Prentice Hall of India Private Limited, New Delhi, 2003.
4. Millman J and Halkias .C., "Integrated Electronics", TMH, 2007.
5. I.J. Nagrath, "Electronic Devices and Circuits", PHI, 2007.
6. Robert L. Boylestad, "Electronic Devices and Circuit Theory", Pearson Education, (11th Edition) , 2012.
7. S. Prakash and S. Rawat ,"A Textbook Of Electronic Devices And Circuits", Anand Publications, New Delhi, 2012.

13EE305 ELECTRICAL MACHINES 3 1 0 4

OBJECTIVES

- To know the theory of structures, operating principle, characteristics, and applications of D.C and A.C rotating machines and transformers in detail.
- To have an introductory knowledge on Special Machines.

OUTCOMES

At the end of this course student should be able to:

- Analyze the working and characteristics of motors and generators.
- Solve the operational problems in various power generating and transforming machines.
- Use the concepts in handling the electrical machines in automation process.

UNIT I D.C. MACHINES **9**

Construction of D.C. Machines - Principle and theory of operation of D.C. generator - EMF equation - Characteristics of D.C. generators. Principle of operation of D.C. motor - Voltage equation - Torque equation - Types of D.C. motors and their characteristics –Starters - Speed control of D.C. motors - Applications.

UNIT II TRANSFORMERS **9**

Principle - Theory of ideal transformer - EMF equation - Construction details of shell and core type transformers - Tests on transformers - Equivalent circuit - Phasor diagram - Regulation and efficiency of a transformer - Introduction to three - phase transformer connections.

UNIT III THREE PHASE INDUCTION MACHINES **9**

Induction motor: - Construction and principle of operation, Classification of induction motor, Torque equation, Condition for maximum torque, Torque/Slip Characteristics, Starting methods and Speed control of induction motors.

UNIT IV SYNCHRONOUS MACHINES **9**

Principle of alternators: - Construction details, Equation of induced EMF and Vector diagram - Synchronous motor: - Starting methods, Torque, V curves and Hunting.

UNIT V SPECIAL MACHINES **9**

Types of single phase Induction Motor –Double revolving field theory – Cross field theory – Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor – Universal motor - Switched reluctance motor – Brushless D.C motor.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Performance characteristics of dc motors and dc generators through simulation.

TUTORIAL: 15
TOTAL: 60

TEXT BOOKS

1. Kothari. D P and I J Nagrath, “Electric Machines”, 4th edn, Tata McGraw-Hill, New Delhi. 2010.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., “Electric Machinery”, McGraw- Hill, Singapore, 2011.

REFERENCES

1. Theraja, B.L., “A Text book of Electrical Technology”, S.C Chand and Co., New Delhi, 2008.
2. J. B. Gupta, “Electrical And Electronics Engineering Materials” , S.k. Katariya & Sons, New Delhi, 2010.
3. Cotton, H., “Advanced Electrical Technology”, Sir Isaac Pitman and Sons Ltd., London, 1999.
4. K.Venkataratnam, “Special Electrical Machines”, University Press, 2009.

13IC306 TRANSDUCER ENGINEERING 3 0 0 3

OBJECTIVES

- To impart knowledge about the principles and analysis of sensors.
- Discussion of errors and error analysis.
- Emphasis on characteristics and response of transducers.
- To have an adequate knowledge in resistance transducers.
- Basic knowledge in inductance and capacitance transducers and exposure to other transducers.

OUTCOMES

At the end of this course student should be able to:

- Use the fundamentals of measurement and instrumentation, units and standards in Industries.
- Solve technical defects by acquiring knowledge in measurement of resistance, inductance and capacitance using different transducers and sensors.
- Analyze the performance of instruments in various automation processes.

UNIT I SCIENCE OF MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS **9**

Units and standards – Calibration methods – Static calibration – Classification of errors – Error analysis – Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

UNIT II CHARACTERISTICS OF TRANSDUCERS **9**

Static characteristics – Accuracy, precision, resolution, sensitivity, linearity –Dynamic characteristics – Mathematical model of transducer – Zero, I and II order transducers. Response to impulse, step, ramp and sinusoidal inputs.

UNIT III VARIABLE RESISTANCE TRANSDUCERS **9**

Principle of operation, construction details, characteristics and application of potentiometer, strain gauge, resistance thermometer, Thermistor, Thermocouple, hot-wire anemometer, piezoresistive sensor and humidity sensor.

UNIT IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS **9**

Induction potentiometer – Variable reluctance transducers – EI pick up – Principle of operation, construction details, characteristics and application of LVDT –Capacitive transducer and types – Capacitor microphone – Frequency response.

UNIT V SPECIAL TRANSDUCERS **9**

Piezoelectric transducer, Hall Effect transducer – Different types of Photo detectors- Digital transducers – Smart sensors - Fibre optic sensors, SQUID sensors, Film sensors, MEMS – Nano sensors.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Characteristics of Strain Gauge, Potentiometer, RTD and Thermocouple using Simulation.

TOTAL: 45

TEXT BOOKS

1. E.A. Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw Hill, New York, 2000.
2. Sawhney.A.K., “A Course in Electrical & Electronic Measurement and Instrumentation”, Dhanpat Rai & Company Private Limited, New Delhi, 18th Edition, 2007.

REFERENCES

1. D. Patranabis, “Sensors and Transducers”, Prentice Hall of India, 2003.
2. John P. Bentley, “Principles of Measurement Systems”, III Edition, Pearson Education, 2000.
3. D.V.S. Murty, “Transducers and Instrumentation”, PHI Learning Private Limited; 2nd edition, 2012.
4. Ian Sinclair,”Sensors and Transducers”, Third Edition, Kindle Edition, 2000.

5. R.Y. Borse, "Sensors and Transducers: Principles And Applications", Adhyayan Publishers & Distributors, 2009.

13IC311 ELECTRON DEVICES AND CIRCUITS LABORATORY 0 0 3 1

OBJECTIVES

- To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters and study of circuit characteristics.
- To study the characteristics and to determine the device parameters of various solid state devices.

LIST OF EXPERIMENTS

1. Verification of Ohm's and Kirchoff' laws.
2. Series & Parallel resonance circuits.
3. Verification of Superposition theorem, Thevenin's theorem and Maximum power transfer theorem.
4. Measurement of power and power factor in RLC circuits.
5. Mesh and Nodal analysis.
6. Characteristics of diode and clipper circuits.
7. Characteristics of Zener diode and Zener voltage regulator.
8. Characteristics of BJT in Common Emitter Mode.
9. Application of BJT as an amplifier and switch.
10. Characteristics of JFET.
11. Simulation of Diode and Zener diode characteristics.
12. Characteristics of Wein Bridge Oscillators.
13. Frequency Response of UJT relaxation oscillator.
14. Frequency Response of RC phase shift oscillator.

TOTAL: 45

13IC312 TRANSDUCERS AND MEASUREMENTS LABORATORY 0 0 3 1

OBJECTIVE

- To provide a platform for understanding the basic concepts of transducers and its application to practical systems.

LIST OF EXPERIMENTS

1. Calibration of Single-phase energy meter and watt meter.
2. Calibration of Ammeter and Voltmeter using student type potentiometer.
3. Calibration of CT and PT.
4. Measurement of resistance using Kelvin's double bridge and Wheatstone bridge.
5. Capacitance measurement using Schering Bridge and Inductance measurement using Anderson Bridge.
6. Characteristics of Potentiometric Transformers.
7. Characteristics of Strain Gauge and Load Cell.
8. Characteristics of LDR, Thermistor and Thermocouple.
9. Step response characteristics of RTD and Thermocouple and Study of smart transducers.
10. Characteristics of LVDT, Hall Effect Transducer and Photoelectric Tachometer.

TOTAL: 45

13EE315 ELECTRICAL MACHINES LABORATORY 0 0 3 1

OBJECTIVES

- To impart hands on experience in verification of circuit laws and theorems, measurement f circuit parameters, study of circuit characteristics and simulation of time response.
- To expose the students to the basic operation of electrical machines and helps them to develop experimental skills.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of self-excited D.C. generator.
2. No load speed control of D.C. shunt motor
3. Load test on D.C. shunt motor.
4. Load test on D.C. series motor.
5. Swinburne's test.
6. Load test on single phase transformer and open circuit and short circuit test on single phase transformer.
7. Separation of no load losses in Transformer.
8. Load Test on Three Phase Induction motor
9. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters).
10. Load test on single phase induction motor.

TOTAL: 45

SEMESTER IV

13MA401/13MA601 NUMERICAL METHODS 3 1 0 4

OBJECTIVES

- To study the concept of calculating the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- To study the concept of constructing approximate polynomial to represent the given numerical data and to find the intermediate values.
- To learn the methods of finding the solution of ordinary differential equations and partial differential equations as most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations.

OUTCOMES

At the end of the course the student should be able to

- Find the numerical solutions of nonlinear (algebraic or transcendental) equations, simultaneous equations.
- Use numerical methods to solve differential equations and partial differential equations.
- Solve integral equations numerically.

UNIT I SOLUTIONS OF EQUATIONS 9

Solutions of non linear equations by Iteration method, Regula - Falsi method and Newton Raphson method – Solutions of linear system of equations by Gauss Elimination, Gauss Jordan, Gauss Jacobian and Gauss Seidel methods – Inverse of a matrix by Gauss Jordan.

UNIT II INTERPOLATION AND APPROXIMATION 9

Equal Intervals - Newton's Forward and Backward difference formulas - Unequal intervals - Newton's' Divided difference formula , Lagrangian and inverse Lagrangian polynomials.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Newton's Forward and Backward Differences to compute derivatives- -Trapezoidal rule – Simpson's 1/3 rule, Simpson's 3/8 rule (both Single and Double integral) -– Two and three point Gaussian quadrature formulas.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Taylor series method- Euler and modified Euler method – Fourth order Runge-Kutta method for solving first order equations- Milne's and Adam's Predictor and Corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equations- Finite difference solutions of one dimensional heat equation – Bender - Schmidt method – Crank Nicolson method - One dimensional wave equation -Two dimensional Laplace and Poisson equations.

UNIT VI STATE-OF-THE-ART/ADVANCES (NOT FOR EXAMINATION)

Solutions of transcendental and algebraic equations – differential equations – integral equations using mathematical software.

TUTORIAL:15
TOTAL: 60

TEXT BOOKS

1. Grewal, B.S., Numerical methods in Engineering and Science. 9th edition, Khanna Publishers, 2007.
2. VenkataramanM.K, "Numerical Methods", National Publishing Company, 2000.

REFERENCES

1. Rajasekaran S., Numerical methods in Science and Engineering – A Practical Approach, 2nd edition,Wheeler Publishing, 1999.
2. Jain M.K. Iyengar, K & Jain R.K., "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd, Publishers 2003.
3. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", PHI Pvt Ltd, New Delhi, 3rd Edition, 2007.

13IC402 DIGITAL LOGIC CIRCUITS 4 0 0 4

OBJECTIVES

- To study various numbering systems.
- To simplify the mathematical expressions using Boolean functions – simple problems.
- To study implementation of combinational circuits
- To study the design of various synchronous and asynchronous circuits.
- To expose the students to various memory devices.

OUTCOMES

At the end of this course student should be able to:

- Use the fundamentals of logic circuits, the number systems used and their conversions and implement in digital instruments.
- Design various combinational circuits, synchronous sequential circuits and asynchronous sequential circuits and implement in control process in various process stations.
- Analyse the performance of digital instruments by acquiring knowledge in combinational and sequential circuits.

UNIT I NUMBERING SYSTEMS & BOOLEAN ALGEBRA 12

Review of number system; types and conversion – Decimal, Binary, Octal and Hexadecimal; types of codes. Boolean algebra: De-Morgan's theorem, switching functions and simplification using K-maps & Quine McCluskey method.

UNIT II DESIGN OF COMBINATIONAL CIRCUITS 12

Design of Logic gates- Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates & multiplexers.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 12

Flip flops - SR, D, JK and T. Analysis of synchronous sequential circuits; design of synchronous sequential circuits – Counters –Ring Counter, Jhonson Counter, Mod –n Counter, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENCTIAL CIRCUIT 12

Introduction, types of asynchronous sequential circuits, transition table, Primitive Flow Table, Analysis of asynchronous sequential machines, state assignment, asynchronous design problem.

UNIT V PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES 12

Memories: Architecture and Theory of ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Design of flip flops, shift registers and counters using simulation.

TOTAL: 60

TEXT BOOKS

1. M. Morris Mano and Michael D, "Digital Design" , Ciletti Prentice Hall; 4th edition,2009.
2. John M. Yarbrough, "Digital Logic Applications and Design", Thomson,2009.
3. Brown S & Vranesic Z,"Fundamentals of Digital Logic with VHDL Design", 3rd ed, New York, Mc Graw Hill,2009.

REFERENCES

1. Charles H.Roth, "Fundamentals Logic Design", Jaico Publishing, IV edition, 2006.
2. Floyd and Jain, "Digital Fundamentals", Pearson Education, 8th edition, 2007.
3. Thomas Floyd," Digital Fundamentals", Pearson New International Edition, 10th Edition, Jul 2013.
4. M. Mano, Michael Ciletti,"Digital Design: International Editions", 5th Edition, Mar 2012.
5. Leach Donald P., Malvino Albert Paul, Saha Goutam, "Digital Principles and Applications", Tata McGraw-Hill, 2006.

13IC403 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS 3 0 0 3

OBJECTIVES

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks of special ICs.
- To study the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.

OUTCOMES

At the end of this course student should be able to:

- Use the fundamentals of IC fabrication and packaging in designing microprocessor and controller for automated systems.
- Analyze the performance of various types of amplifiers, ICs and their applications and implement in analyzing the level, pressure and temperature signals in process stations.
- Solve the technical problems that occur in designing of various electronic devices like Clippers, Clampers etc.,

UNIT I IC FABRICATION **9**

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging.

UNIT II CHARACTERISTICS OF OPERATIONAL AMPLIFIER **9**

Ideal OP_AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator and integrator.

UNIT III APPLICATIONS OF OPERATIONAL AMPLIFIER **9**

Instrumentation amplifier, log and anti-log amplifiers, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

UNIT IV SPECIAL ICs **9**

IC555 Timer circuit – Functional block, characteristics & applications; IC566-voltage controlled oscillator circuit; IC565-phase lock loop circuit functioning and applications, Analog multiplier ICs.

UNIT V APPLICATION OF OTHER ICs **9**

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, optocoupler, optoelectronic ICs.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Characteristics of clippers, clampers and voltage regulators using simulation packages.

TOTAL: 45

TEXT BOOKS

1. Ramakant A. Gayakwad," Op-Amps and Linear Integrated Circuits", 4th ed, PHI learning (P) Ltd, 2010.
2. D.Roy Choudhary, Sheil B.Jani, "Linear Integrated Circuits", II edition, New Age, 2010.

REFERENCES

1. Jacob Millman, Christos C.Halkias, "Integrated Electronics - Analog and Digital circuits system", Tata McGraw Hill, 2009.
2. Robert F.Coughlin, Fredrick F.Driscoll, "Op-amp and Linear ICs", Pearson Education, 4th edition, 2002 / PHI.
3. David A.Bell, "Op-amp & Linear ICs", Prentice Hall of India, 2nd edition, 1997.
4. K. Lal Kishore,"Operational Amplifiers and Linear Integrated Circuits", Pearson Education, 2013.

13IC404 POWER ELECTRONICS AND DRIVES 3 1 0 4

OBJECTIVES

- To get an overview of different types of power semi-conductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologies of Choppers and Inverters
- To learn about A.C. and D.C motor control
- To know the practical application for power electronics converters in conditioning the power supply.

OUTCOMES

At the end of this course student should be able to:

- Use the fundamentals of power semiconductor devices like SCRs and transistors like MOSFETs, GTOs ad IGBTs in speed control techniques of machines.
- Analyze the performance of converters, choppers and inverters and implement as power converters in PLCs.
- Solve various problems in speed control drives and implement in speed control techniques of motors and locomotives.

UNIT I POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS **9**

SCR characteristics - Two transistor analogy - Methods of turning on and turning off - Other members of SCR family - Series and parallel connection of SCRs -Thyristor protection. Other semiconductor devices: Power transistors, Power MOSFETs, GTOs, IGBT.

UNIT II CONVERTERS **9**

Single phase controlled rectifiers - Half wave controlled rectifier with i) resistive load ii) R,L load iii) R,L load and free wheel diode iv) R,L load and battery; Full wave controlled rectifier- half controlled bridge rectifier and fully controlled bridge rectifier with the above four types of loads. Three phase controlled rectifiers: Half controlled bridge, Fully controlled bridge rectifiers. AC voltage controller, Single phase Cycloconverter.

UNIT III INVERTERS **9**

Single phase inverter: Series and Parallel Inverters, Half and Full Bridge inverters; Three phase inverter: Bridge Inverters (120^0 and 180^0 Mode); Current source inverter.

UNIT IV CHOPPERS **9**

Principle of operation of Choppers, Control Strategies for Choppers, Step-up chopper, Various types – Type A, Type B, Type C, Type D and Type E.

UNIT V AC AND DC DRIVES **9**

AC motor control: Speed control methods for induction motor - controlled slip system - slip power recovery scheme -braking of induction motor. Synchronous motor control DC motor control - Single phase and three phase SCR drives - reversible SCR drives - chopper controlled DC drives..

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Characteristics of SCR, MOSFET and IGBT using simulation packages.

TUTORIAL:15
TOTAL: 60

TEXT BOOKS

1. Rashid.M.H, “Power Electronics-Circuits,Devices and applications”, Prentice-Hall,2009.
2. Joseph Vidhayathil,”Power Electronics Principles and Aplications”, Tata McGraw Hill Pub., 2010.

REFERENCES

1. Bhimbhra.P.S, “Power Electronics”, Khanna Publishers, Third edition, New Delhi, 2005
2. Jaganathan.V, “Introduction to Power Electronics”, Prentice Hall of India, 2004.
3. Daniel W. Hart,”Power Electronics”,Tata McGraw-Hill Education, 2011.
4. M.D.Singh,”Power Electronics”,Tata Mcgraw-Hill Publishing Company Limited, 2006.
5. G.K.Dubey, S.R.Doradia, A.Joshi, R.M.K.Sinha, “Thyristorized Power Controllers”, John Wiely & Sons, 1986.
6. Gopal K Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall Inc., New Yersy, 1989.
7. Vedam Subramanyam, “Electric Drives – Concepts and Applications”, Tata McGraw Hill publishing company Ltd., New Delhi, 2002.

13IC405 CONTROL SYSTEM ENGINEERING 3 1 0 4

OBJECTIVES

- To understand the methods of representation of systems and getting their transfer function models.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To give basic knowledge is obtaining the open loop and closed–loop frequency responses of systems.
- To understand the concept of stability of control system and methods of stability analysis.
- To study the three ways of designing compensation for a control system.

OUTCOMES

At the end of this course student should be able to:

- Use the basics of Control Systems, understand the difference between open loop and closed loop systems.
- Analyze problems arising in linear systems and solve using P,PI and PID Controllers in controlling the stability of chemical process stations.
- Analyze the stability of control systems using Routh Hurwitz, Root Locus and Nyquist Stability Criterion.
- Design the lag, lead lag-lead compensators and implement in robotics and automation.

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems – Open and closed loop systems – Mathematical modeling of Physical parameters-Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9

Time response – Time domain specifications – Types of test input – I and II order System response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

UNIT III FREQUENCY RESPONSE 9

Frequency response – Bode plot – Polar plot – Constant M an N circles – Nichols chart – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

UNIT IV STABILITY OF CONTROL SYSTEM 9

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

UNIT V COMPENSATOR DESIGN 9

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Stability Analysis of Linear And Non-Linear Systems Through Simulation using MATLAB.

TUTORIAL: 15
TOTAL: 60

TEXT BOOKS

1. K.Ogata, “Modern Control Engineering”, Pearson Education, New Delhi, 5th Ed, Prentice Hall 2010.
2. I.J.Nagrath & M.Gopal, “A Textbook of Control Systems Engineering”, New Age International Publishers, 2010.

REFERENCES

1. B. C. Kuo and Farid Golnaraghi ,"Automatic Control Systems" , John wiley and son's, 8th edition, 2003.
2. M. Gopal, "Control Systems, Principles & Design", Tata McGraw Hill, New Delhi, 2002.
3. M.N. Bandyopadhyay, "Control Engineering Theory and Practice", Prentice Hall of India, 2003.
4. Huibert Kwakernaac, Raphael Sivan,"Linear Optimal Control Systems",John Wiley & Sons, USA.
5. Norman S. Nise, "Control Systems Engineering", 6th Edition [Kindle Edition], 2010.
6. S. Ghosh ,"Control Systems", New Delhi, 2009.
7. B. S. Manke ,"Linear Control Systems" , Khanna Publishers, 2009.

13CS406 DATA STRUCTURES AND ALGORITHMS 4 0 0 4

OBJECTIVES

- To know the systematic way of solving problems
- To understand the different methods of organizing large amounts of data
- To efficiently implement the different data structures
- To efficiently implement solutions for specific problems

OUTCOME

On the completion of the course the students are able to

- Acquire knowledge in fundamental data structures and implementation of the same using c

UNIT I ABSTRACT DATA TYPES **12**

Abstract Data Type (ADT) – The List ADT: Singly, Doubly, circular Linked List-Cursor Implementation of Linked List – The Stack ADT– The Queue ADT-Circular Queue –Applications of Stack and Queue

UNIT II SEARCHING AND SORTING **12**

Linear Search-Binary Search-Sorting Types-Internal Sorting-External Sorting-Insertion Sort-Merge Sort-Quick Sort-Bubble Sort-Selection Sort

UNIT III TREES **12**

Preliminaries – Binary Trees – expression trees- Tree Traversals – The Search Tree ADT – Binary Search Trees – AVL Trees

UNIT IV GRAPHS **12**

Definitions – Topological Sort – Shortest Path Algorithms – Unweighted Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm – Applications of Depth - First Search – Undirected Graphs – Biconnectivity

UNIT V ALGORITHM ANALYSIS **12**

Introduction – Space Complexity –Time Complexity- Asymptotic Notation (O, Ω, θ, o)-Algorithm design techniques- greedy method- divide & conquer-backtracking.

UNIT VI STATE OF THE ART /ADVANCES (NOT FOR EXAMINATION)

Data Structures for Web Servers- Oracle iPlanet Web Server 7.0.9- Data Structures for Hardware Technology

TOTAL: 60

TEXT BOOK

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia, 2007.

REFERENCES

1. Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, "Data Structures using C", Pearson Education Asia, 2009.
2. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", Thomson Brooks / COLE, 2004.
3. Aho, J. E. Hopcroft and J. D. Ullman, "Data Structures and Algorithms", Pearson Education Asia, 2009.
4. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran ,"Computer Algorithms/C++", University Press ,2007

13IC412 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY 0 0 3 1

OBJECTIVES

- To study various digital & linear integrated circuits used in simple system configuration.

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LIST OF EXPERIMENTS

1. Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF and D FF.
2. Implementation of Boolean Functions, Adder/ Subtractor circuits.
3. (a). Design and implementation of Code converters, Parity generator and parity checking, Excess-3, 2s Complement, Binary to Gray code using suitable ICs.
   (b). Design and implementation of Encoders and Decoders, Implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable ICs.
4. Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
5. Design & implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
6. Design of 4:1; 8:1 multiplexer, 1:4 and1:8 demultiplexer.
7. Study of NE/SE 555 timer in Astable, Monostable operation.
8. Slew rate verifications, inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
9. Study of Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's.
10. Study of VCO and PLL ICs:
    (a) Voltage to frequency characteristics of NE/ SE 566 IC.
    (b) Frequency multiplication using NE/SE 565 PLL IC.

TOTAL: 45

13IC413 CONTROL SYSTEMS LABORATORY 0 0 3 1

OBJECTIVE

- To provide a platform for understanding the basic concepts of linear control theory and its application to practical systems.

LIST OF EXPERIMENTS

1. Determination of transfer function parameters of DC servo motor.
2. Determination of transfer function parameters of AC servo motor.
3. Analog simulation of type-0 and type-1 system.
4. Digital simulation of linear systems.
5. Digital simulation of non-linear systems.
6. Design and implementation of compensators through Simulation.
7. Design of P, PI and PID controllers through Simulation.
8. Stability analysis of linear systems through Simulation.
9. Characteristics of Closed loop control system through Simulation.
10. Study of Synchros.

TOTAL: 45

13CS415 DATA STRUCTURES AND ALGORITHMS LABORATORY 0 0 3 1

OBJECTIVES

- To write programs in C
- To implement the various data structures as Abstract Data Types
- To write programs to solve problems using the ADTs

LIST OF EXPERIMENTS

1. Array implementation of List Abstract Data Type (ADT).
2. Linked list implementation of List ADT.
3. Cursor implementation of List ADT.
4. Array implementations of Stack ADT
5. Linked list implementations of Stack ADT
6. Implement the application for checking 'Balanced Paranthesis' using array implementation of Stack ADT
7. Implement the application for checking 'Balanced Paranthesis' using linked list implementation of Stack ADT
8. Implement the application for 'Evaluating Postfix Expressions' using array and linked list implementation of Stack ADT
9. Queue ADT
10. Search Tree ADT - Binary Search Tree

TOTAL: 45

SEMESTER V

13IC501 MICROPROCESSORS AND MICROCONTROLLERS 3 1 0 4

OBJECTIVES

- To study the Architecture of 8085.
- To study the addressing modes & instruction set of 8085
- To learn commonly used peripheral / interfacing ICs – To study simple applications.
- To study the Architecture of 8051.
- To study the simple programming and learn the applications of microcontrollers.

OUTCOMES

At the end of the course the student should be able to

- Design programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor.
- Analyze programs using the capabilities of the stack, the program counter, and the status register and show how these are used to execute a machine code program.
- Use the knowledge of the microprocessor's internal registers and operations by use of a PC based microprocessor simulator.
- Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.

UNIT I 8085 PROCESSOR : ARCHITECTURE AND PROGRAMMING 9

Functional block diagram - Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure.

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table -

Subroutine instructions stack.

UNIT II PERIPHERAL INTERFACING **9**

Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board and display controller and 8253 Timer/ Counter – Interfacing with 8085 - A/D and D/A converter interfacing.

UNIT III MICRO CONTROLLER 8051 **9**

Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer –I/O ports – Serial communication- Data Transfer, Manipulation, Control & I/O instructions Simple programming exercises

UNIT IV APPLICATIONS USING MICROPROCESSOR AND MICROCONTROLLER **9**

Keyboard and display interface – Closed loop control of servo motor, stepper motor control, Traffic light control

UNIT V ADVANCED PROCESSORS AND CONTROLLERS

Pentium Processor – Pins and signals – architecture, ARM processor – Architecture, PIC – Functional block diagram - Simple programming exercises **9**

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)

Microprocessor based temperature control system – Motor speed control system – Traffic light control system – Stepper motor control system.

TUTORIAL: 15
TOTAL: 60

TEXT BOOKS

1. R.S. Gaonkar, "Microprocessor Architecture Programming and Application", Wiley Eastern Ltd., New Delhi, 2013.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, "The 8051 Micro Controller and Embedded Systems", Pearson Education, 5th Indian reprint, 2010.

REFERENCES

1. William Kleitz, "Microprocessor and Micro Controller Fundamental of 8085 and 8051 Hardware and Software", Pearson Education, 2013.
2. Krishna Kant ,"Microprocessor and Microcontroller", PHI Learning Pvt Ltd, 2008.
3. Douglas Hall and P Rao, "Microprocessors and its Interfacing" , Tata McGraw-Hill Publishing Company; 3rd edition 2012.

13IC502 ANALYTICAL INSTRUMENTATION 3 0 0 3

OBJECTIVES

- To understand the different types of Colorimeters and spectrophotometers.
- To study the concepts of various techniques of Chromatography and their applications.
- To learn the working of gas analyzers and pollution monitoring instruments
- To study the principles of pH meters, dissolved component analyzer and their types.
- To understand the knowledge on radiochemical and magnetic resonance techniques.

OUTCOMES

At the end of the course the student should be able to

- Use the basic knowledge of measurement systems towards measurements of absorption and transmittance and concentration.
- Analyze and compare different types of gas analyzers.
- Use of pH meters, dissolved component analyzer and their types in various applications.

UNIT I COLORIMETRY AND SPECTROPHOTOMETRY **9**

Special methods of analysis – Beer-Lambert law – Colorimeters – UV-Visspectrophotometers – Single and double beam instruments – Sources and detectors – IR Spectrophotometers – Types – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers.

UNIT II CHROMATOGRAPHY **9**

Different techniques – Gas chromatography – Detectors – Liquid chromatographs – Applications – High-pressure liquid chromatographs – Applications.

UNIT III INDUSTRIAL GAS ANALYZERS & POLLUTION MONITORING INSTRUMENTS **9**

Types of gas analyzers – Oxygen, NO_2 and H_2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation -Dust and smoke measurements.

UNIT IV pH METERS AND DISSOLVED COMPONENT ANALYZERS **9**

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

UNIT V RADIO CHEMICAL AND MAGNETIC RESONANCE TECHNIQUES **9**

Nuclear radiations – Detectors – GM counter – Proportional counter – Solid state detectors – Gamma cameras – X-ray spectroscopy – Detectors – Diffractometers – Absorption meters – Detectors. NMR – Basic principles – NMR spectrometer -Applications. Mass spectrometers – Different types – Applications.

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)

Microprocessor based spectrophotometer - Clinical flame Photometer - Amino acid analyzer - PC based pH meter - Ion analyzer - Fiber optic based blood gas sensors.

TOTAL: 45

TEXT BOOKS

1. Willard.H.H, Merritt.L.L, Dean.J.A, Settle.F.A, "Instrumental Methods of Analysis", CBS publishing & distribution, 2004.
2. Khandpur.R.S, "Handbook of Analytical Instruments", Tata McGraw Hill publishing Co. Ltd., 2007.

REFERENCES

1. Douglas A. Skoog, Stanley R. Crouch and F.James Holler, " Principles of Instrumental Analysis" International Student Edition 2006
2. Bela G. Liptak, "Analytical Instrumentation", Chilton Book Company, United states, 2000.
3. Jone's "Instrument Technology", Vol.2, Butterworth-Heinemann, International Edition, 2003.

13IC503 INDUSTRIAL INSTRUMENTATION – I 3 0 0 3

OBJECTIVES

- To study the concept of load cells, torque meter and various velocity pick-ups.
- To understand the different types of accelerometer pick-ups, vibrometers, density and viscosity pick-ups.
- To learn the working of pressure transducers.
- To study the concepts of temperature standards, calibration and signal conditioning used in RTD's.
- To learn the working of thermocouples and pyrometry techniques.

OUTCOMES

At the end of this course student should be able to

- Design and apply basic knowledge of measurement systems towards measurements of load, strain, pressure and temperature.
- Analyze the basic concepts of various accelerometer pick-ups, vibrometers and density meters.
- Design signal conditioning unit for RTD and calibration methods of instruments.

UNIT I MEASUREMENT OF FORCE, TORQUE AND VELOCITY 9

Electric balance – Different types of load cells – Hydraulic, pneumatic strain gauge- Magneto elastic and Piezo electric load cell – Different methods of torque measurements: strain gauge-Relative angular twist-Speed measurement:-Capacitive tacho-Dragcup type tacho-D.C and A.C tachogenerators – Stroboscope.

UNIT II MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY 9

Accelerometers:- LVDT, Piezo-electric, Strain gauge and Variable reluctance type Vibrometers : Calibration of vibration pickups – Units of density and specific gravity – Baume scale, and API scale-Pressure head type densitometers- Float type densitometers – Ultrasonic densitometer- Bridge type gas densitometer.

UNIT III PRESSURE MEASUREMENT 9

Units of pressure-Manometers-Different types –Elastic type pressure gauges: Bourdon tube, bellows and diaphragms-Electrical methods: Elastic elements with LVDT and strain gauges –Capacitive type pressure gauge –Piezo-resistive pressure sensor-Resonator pressure sensor-Measurement of vacuum:-McLeod gauge-Thermal conductivity gauges- Ionization gauges:– Cold cathode type and hot cathode type-Testing and calibration of pressure gauges-Dead weight tester.

UNIT IV TEMPERATURE MEASUREMENT USING RTD AND THERMISTOR 9

Definitions and standards-Primary and secondary fixed points –Calibration of thermometers - Different types of filled in system thermometer-Sources of errors in filled in systems and their compensation-Bimetallic thermometers – Electrical methods of temperature measurement-Signal conditioning of industrial RTDs and their characteristics-3 lead and 4 lead RTDs - Thermistors.

UNIT V TEMPERATURE MEASUREMENT USING THERMOCOUPLES AND RADIATION PYROMETERS 9

Thermocouples-Laws of thermocouple –Fabrication of industrial thermocouples –Signal conditioning of thermocouple output-Isothermal block reference junctions – Commercial circuits for cold junction compensation-Response of thermocouple –Special techniques for measuring high temperature using thermocouples – Radiation fundamentals- Radiation methods of temperature measurement –- Total radiation pyrometers-Optical pyrometers-Two colour radiation pyrometers – Fiber optic temperature measurement.

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)

Design of Signal Conditioning circuits for Thermocouple, RTD, Strain gauge and LDR - Water level control - DC motor speed control.

TOTAL: 45

TEXT BOOKS

1. Doebelin, E.O., “Measurement systems Application and Design”, International Student Edition, 5th Edition, McGraw Hill Book Company,2003.
2. J.B.Gupta , “ A Course In Electronics & Electrical Measurements And Instrumentation” S K Kataria and Sons 2006.
3. A.K. Sawhney, “A course in Electrical & Electronic Measurements and Instrumentation”, Dhanpath Rai & Co (P) Ltd, 2007.

REFERENCES

1. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 2005

2. Patranabis.D., "Principles of Industrial Instrumentation", 2nd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2007.
3. D.V.S. Moorthy, "Transducers and Instrumentation", Prentice Hall of India Pvt Ltd, 2007.
4. Nakra, B.C., and Chaudry, K.K., "Instrumentation measurement and Analysis", TataMcGraw Hill publishing Company Limited, 2004.

13IC504 ADVANCED CONTROL SYSTEMS 3 1 0 4

OBJECTIVES

- To study the description and stability of non-linear system.
- To understand the conventional technique of non-linear system analysis.
- To learn the discrete time systems using conventional techniques.
- To study the analysis of digital control system using state-space formulation.
- To study the formulation and analysis of multi input multi output (MIMO) system

OUTCOMES

At the end of the course the student should be able to

- Design the mathematical model of a system.
- Analyze the response of different order systems for various inputs
- Solve and analyze the stability of linear and non-linear system.

UNIT I STATE VARIABLE ANALYSIS **9**

Limitations of conventional control theory – concepts of state variables and state model-state model for linear time invariant systems: State space representation using physical, Phase and Canonical variables. Transfer function from state model – Transfer matrix – Decomposition of transfer functions- Direct, cascade and parallel decomposition techniques.

UNIT II SYSTEM TRANSFORMATION AND SYSTEM RESPONSE **9**

Characteristic equation – Eigen values and Eigen vectors – Invariance of Eigen values – Diagonalization – Jordan Canonical form. Solution of state equation – STM – Properties of STM

UNIT III CONTROLLABILITY AND OBSERVABILITY **9**

Concepts of Controllability and Observability – Kalman's and Gilbert's tests – Controllable and observable phase variable forms – Effect of pole-zero cancellation on controllability and observability. Pole placement by state feedback- Full and reduced order observers

UNIT IV STABILITY **9**

Lyapunov stability analysis – stability in the sense of Lyapunov – Definiteness of Scalar Functions – Quadratic forms – Second method of Lyapunov – Lyapunov stability analysis of linear time invariant systems – Krasovskii's method.

UNIT V CONTROLLER SYNTHESIS FOR NON-LINEAR SYSTEMS **9**

Introduction – Properties of Nonlinear systems – Classification of Non-linear system - Common physical non-linearities – Methods of linearizing nonlinear systems -Linear design and non-linear verification – Non-linear internal model control – Parameter optimization

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)

Adaptive controller - Model predictive controller – Optimal controller - H-Infinity Controller using simulation package.

TUTORIAL: 15
TOTAL: 60

TEXT BOOKS

1. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Private Ltd., New Delhi, Fourth Edition, 2010.
2. Gopal M, "Digital Control and State Variable Methods", Tata McGraw-Hill Publishing Company Limited, New Delhi, India Fourth Edition, 2012**.**

REFERENCES

1. D. Roy Choudhury, "Modern Control Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi, First edition 2005.
2. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 2009.
3. B.S. Manke, "Linear Control Systems", Khanna Publishers, Delhi, 2012.
4. Torkel Glad & Lennart Ljung, "Control Theory – Multi Variable and Nonlinear Methods", Taylor's & Francis Group, 2000

13IC505 PROCESS CONTROL 3 1 0 4

OBJECTIVES

- To study the basic characteristics of first order and higher order processes.
- To understand the different types and characteristics of various controller modes and methods of tuning of controller.
- To study about the concepts of various complex control schemes.
- To learn the working, characteristics and application of control valves.
- To study the five selected unit operations and a case study of distillation column control.

OUTCOMES

At the end of the course the student should be able to

- Design the mathematical model of a system.
- Analyze the response of different modes of controller for various inputs
- Design and analysis of different control strategies for various processes.
- Use of different types of control valves and its characteristics in various applications.

UNIT I MATHEMATICAL MODELING OF PROCESSES 9

Need for process control – mathematical model of first order level, pressure and thermal processes – higher order process – interacting and non-interacting systems – lumped and distributed model- CSTR-Distillation column-– continuous and batch processes- degrees of freedom-self-regulation – servo and regulator operations.

UNIT II CONTROL ACTIONS AND CONTROLLERS 9

Basic control actions – characteristics of on-off, proportional, single-speed floating, integral and derivative control modes P,P+I, P+D and P+I+D control modes – pneumatic and electronic controllers to realize various control actions-Practical form of PID controller modes.

UNIT III OPTIMUM CONTROLLER SETTINGS 9

Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio – determination of optimum settings for mathematically described processes using time response and frequency response – Tuning – Process reaction curve method – Ziegler Nichols method – Damped oscillation method.

UNIT IV MULTILOOP CONTROL 9

Feed-forward control – ratio control- cascade control – Adaptive control - inferential control – split-range control – introduction to multivariable control – examples from distillation column and boiler systems.

UNIT V FINAL CONTROL ELEMENT 9

I/P converter – pneumatic and electric actuators – valve positioner – control valves – characteristics of

control valves – inherent and installed characteristics – valve body – commercial valve bodies – control valve sizing – cavitation and flashing – selection criteria

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)
Mixing – Evaporation – Drying – Heat exchanger – Distillation process – Case study of control schemes of binary distillation column

TUTORIAL: 15
TOTAL: 60

TEXT BOOKS
1. Stephanopoulis, G, "Chemical Process Control, Prentice Hall of India", New Delhi, 2012.
2. Donald R. Coughanowr, "Process Systems Analysis and Control", McGraw hill International edition, 2009.

REFERENCES
1. Krishnaswamy.K, "Process Control", New Age International, 2009.
2. Johnson.C.D, "Process Control Instrumentation Technology", Prentice Hall of India, 2009.
3. B.Wayne Bequette, "Process Control: Modeling, Design and Simulation", Prentice hall professionals, 2003.

13CS508 OBJECT ORIENTED PROGRAMMING 3 1 0 4

OBJECTIVES
- To understand the concepts of Object oriented Programming.
- To write simple applications using C++ and Java.
- To compare and contrast features of C++ and Java.

OUTCOME
On the completion of the course the students are able to
- To program using C++ and JAVA

UNIT I INTRODUCTION TO OBJECT ORIENTED PROGRAMMING 9
Object-oriented paradigm, elements of object oriented programming – Merits and demerits of OO methodology – C++ fundamentals – data types, operators and expressions, control flow, arrays, strings, pointers and functions.

UNIT II PROGRAMMING IN C++ 9
Classes and objects – constructors and destructors, operator overloading – inheritance, virtual functions and polymorphism.

UNIT III FILE HANDLING 9
C++ streams – console streams – console stream classes-formatted and unformatted console I/O operations, manipulators - File streams - classes file modes file pointers and manipulations file I/O

UNIT IV JAVA INTRODUCTION 9
An overview of Java, data types, variables and arrays, operators, control statements, classes, objects, methods – Inheritance - wrapper classes.

UNIT V JAVA PROGRAMMING 9
Packages and Interfaces, Exception handling, Multithreaded programming, Strings, Input /Output.

UNIT – VI STATE OF THE ART /ADVANCES (NOT FOR EXAMINATION)
Programming to solve electrical problems- mesh analysis-node analysis

TUTORIAL:15
TOTAL: 60

TEXT BOOKS

1. K.R.Venugopal, RajkumarBuyya, T.Ravishankar, “Mastering C++”, TMH, 2003
2. Herbert Schildt, “The Java 2: Complete Reference”, Fourth edition, TMH, 2002

REFERENCES

1. Ira Pohl, “Object oriented programming using C++”, Pearson Education Asia, 2003
2. BjarneStroustrup, "The C++ programming language" Addison Wesley, 2000
3. John R.Hubbard, "Programming with C++", Schaums outline series, TMH, 2003
4. H.M.Deitel, P.J.Deitel, "Java: how to program", Fifthe edition, PHI private limited.
5. E.Balagurusamy “ Object Oriented Programming with C++”, TMH 2/e
6. www.exforsys.com/tutorials/oops.html
7. http://www.eli.sdsu.edu/courses/fall97/cs535/notes/index.html

13IC511 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY 0 0 3 1

OBJECTIVE

- To understand programming using instruction sets of processors.

LIST OF EXPERIMENTS

1. Programming for 8/16 bit Arithmetic operations Using 8085
   - Addition / subtraction / multiplication / division
2. Programming with control instructions Using 8085
   - Ascending / Descending order
   - Maximum / Minimum of numbers
   - ASCII / BCD code conversions.
3. Interfacing of USART with 8085 microprocessor
4. Interfacing of D/A and A/D converters with 8085 microprocessor
5. Interface of key board and display using programmable controllers with 8085 Microprocessor.
6. Interface of programmable timer/counter with 8085 microprocessor.
7. Interfacing and Programming of Stepper Motor control using 8085.
8. Interfacing and Programming of DC Motor Speed control using 8085.
9. Programming for 8/16 bit Arithmetic operations Using 8051
   - Addition / subtraction / multiplication / division
10. Traffic light controller using 8051.

TOTAL: 45

13IC512 PROCESS CONTROL LABORATORY 0 0 3 1

OBJECTIVES

- To gain the practical knowledge in the response of different order processes, PID controller, cascade and feed forward control systems.
- To have an adequate knowledge on closed loop response.

LIST OF EXPERIMENTS

1. Response of different order processes with and without transportation delay.
2. Study of interacting and non interacting systems
3. Design of Electronics PID controller..
4. Response of PID controller using MATLAB.
5. Tuning of PID controller using MATLAB.
6. Closed loop response of flow control loop.

7. Closed loop response of level control loop.
8. Closed loop response of temperature control loop.
9. Closed loop response of pressure control loop.
10. Response of cascade, ratio and feed forward control scheme.
11. Response of multi loop control scheme.
12. Characteristics of control valve with and without positioner.

TOTAL: 45

13CS514 OBJECT ORIENTED PROGRAMMING LABORATORY 0 0 3 1

OBJECTIVES

- To Implement programs using Functions and Classes
- To develop programs to implement compile time and run time polymorphism
- To design simple application using virtual functions with virtual base classes
- To implement programs for File handling operations

LIST OF EXPERIMENTS

C++

1. Programs Using Functions
   - Functions with default arguments
   - Implementation of Call by Value, Call by Address and Call by Reference
2. Simple Classes for understanding objects, member functions and Constructors
   - Classes with primitive data members
   - Classes with arrays as data members
   - Classes with pointers as data members – String Class
   - Classes with constant data members
   - Classes with static member functions
3. Compile time Polymorphism
   - Operator Overloading including Unary and Binary Operators.
   - Function Overloading
4. Runtime Polymorphism
   - Inheritance
   - Virtual functions
   - Virtual Base Classes
   - Templates

JAVA

6. Simple Java applications
   - For understanding reference to an instance of a class (object), methods
   - Handling Strings in Java
7. Simple Package creation.
   - Developing user defined packages in Java
8. Interfaces
   - Developing user-defined interfaces and implementation
   - Use of predefined interfaces

TOTAL: 45

SEMESTER VI

13IC601 DIGITAL SIGNAL PROCESSING 3 1 0 4

OBJECTIVES

- To study the concepts of signals and systems & their mathematical representation.
- To study the concepts of discrete time systems.
- To understand the different types of transformation techniques & their computation.
- To study the concept of filters and their design for digital implementation.
- To learn the working of programmable digital signal processor & quantization effects.

OUTCOMES

At the end of the course the student should be able to

- Analyze the mathematical model of a signals and systems.
- Use different transformation techniques and their computation in various applications.
- Design and analysis of different types of filters.
- Analyze the processor's internal registers and operations.

UNIT I INTRODUCTION TO SIGNALS AND SYSTEMS 9

Classification of signals: continuous and discrete, energy and power; Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. analog to digital conversion, Digital signal representation

UNIT II DISCRETE TIME SYSTEM ANALYSIS 9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response (magnitude and Phase representation) – Convolution.

UNIT III FAST FOURIER TRANSFORMS 9

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – FFT Algorithm - DIT & DIF (radix 2 – Butterfly structure).

UNIT IV DESIGN OF DIGITAL FILTERS 9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics.

IIR design: Analog filter design - Butterworth approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

UNIT V DSP PROCESSORS 9

Architecture of TMS 320C50 signal processing chip – Pipelining, Addressing modes, Instruction set – Basic programs using DSP Processor.

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)

Recent advanced processors and its features – Simulation of digital filters using MATLAB

TUTORIAL: 15
TOTAL: 60

TEXT BOOKS

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 4th edition 2007.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 3rd edition 2007.

REFERENCES

1. Alan V. Oppenheim and Ronald W. Schafer, 'Discrete Time Signal Processing', Pearson Education, New Delhi, Third edition 2013.
2. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, Second edition 2010.
3. 3.S. Salivahanan, A. Vallavaraj, C. Gnanapriya, 'Digital Signal Processing', Tata McGraw Hill, New Delhi, Second edition 2009.
4. P. Ramesh Babu , "Digital Signal Processing", Scitech Publications 2011.

13MB502/13MB602 PRINCIPLES OF MANAGEMENT 3 0 0 3

OBJECTIVES

- To study the basic managerial functions such as planning, organizing, leading, and controlling resources to accomplish organizational goals.
- To understand different types of management theories, models and principles
- To learn the various levels of management

OUTCOMES

At the end of the course the student should be able to

- Apply management functions such as planning, organizing and budgeting.
- Analyze the role of the managers and resources they use.
- Evaluate different management approaches.

UNIT I MANAGING **9**

Management : Definition –Nature & Scope- Functions- Evolution- Managerial roles and Styles - Decision making approach – Management & Society.

UNIT II PLANNING **9**

Nature and purpose of planning - Planning process - Types of plans – Objectives - Managing by Objective (MBO) Strategies - Types of strategies - Policies - Planning premises- Forecasting- Decision Making - Types of decision - Decision Making Process.

UNIT III ORGANIZING & STAFFING **9**

Nature and Purpose of Organizing - Organization Structure - Formal and Informal Organization - Line and Staff Authority – Departmentation – Line/Staff authority, Empowerment and Decentralization - Staffing - Selection and Recruitment – Selection Process-Techniques– Training –Feed Back-Performance Appraisal.

UNIT IV DIRECTING **9**

Human Factors and Motivation - Motivation Theories - Leadership Styles -Leadership Traits-Leadership Theories - Communication – Communication Process- Barriers to Effective Communication .

UNIT V CONTROLLING **9**

Process of Controlling - Types of Control - Control Techniques - Managing Productivity - Cost Control - Purchase Control – Maintenance Control - Quality Control - Planning Operations.

UNIT VI STATE OF THE ART/ADVANCES (NOT FOR EXAMINATION)

Social Responsibility of Business - Ethics- Value Chain of Business- Creativity and Innovation-Globalization of Business- Management of Big Data.

TOTAL: 45

TEXT BOOKS

1. Harold Koontz and Heinz Weihrich, "Essentials of Management", Tata McGraw Hill ,2009.
2. Tripathy and Reddy, Principles of Management, Tata McGraw Hill,2008

REFERENCES

1. Rao and Hari Krishna, Management: Text and Cases, Excel Books, 2008.
2. Aswathappa and Karminder Ghuman, Management : Concept and Cases, McGraw Hill, 2010
3. Karuppasamy and Saravnan, Principles of Management, Sci Tech,2010

13IC603 INDUSTRIAL INSTRUMENTATION – II 3 0 0 3

OBJECTIVES

- To study the concepts of flow meters and their different parts.
- To study different types of quantity meters, area flow meters and mass flow meters
- To learn working, operation, constructional features and calibration of electrical type flow meters.
- To learn the different level measurement techniques
- To understand the methods of measurement of viscosity, humidity and moisture

OUTCOMES

At the end of the course the student should be able to

- Use the basic knowledge of measurement systems towards measurements of viscosity, humidity and moisture
- Analyze basic concepts of types flow meters and level measurement techniques.
- Analyze various calibration techniques and selection of flow meters.

UNIT I MECHANICAL TYPE FLOWMETERS **9**

Flow rate equation for incompressible and compressible fluids – variable head type flow meters – orifice plate – venturi tube – flow nozzle – dall tube –installation of head flow meters – piping arrangement for different fluids – pitot tube.

UNIT II QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS **9**

Positive displacement flow meters – constructional details and theory of operation of mutating disc, reciprocation piston, oval gear and helix type flow meters – inferential meter – turbine flow meter – rota meter – theory and installation – angular momentum mass flow meter – coriolis mass flow meters – thermal mass flow meter – volume flow meter plus density measurement.

UNIT III ELECTRICAL TYPE FLOW METER **9**

Principle and constructional details of electromagnetic flow meter – different types of excitation – schemes used – different types of ultrasonic flow meters –laser Doppler anemometer systems – Vortex shedding flow meter – target flow meter – solid flow rate measurement – calibration of flow meters – dynamic weighing method. – Guidelines for selection of flow meter.

UNIT IV LEVEL MEASUREMENT **9**

Gauge glass technique coupled with photo electric readout system – float type level indication – different schemes – level switches level measurement using displacer and torque tube – bubbler system. Boiler drum level measurement –differential pressure method – hydra step systems – electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors

UNIT V MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE **9**

Viscosity – units – terms – say bolt viscometer – rotameter type viscometer industrial consistency meters – humidity terms – dry and wet bulb psychrometers – hot wire electrode type hygrometer – dew cell – electrolysis type hygrometer –commercial type dew point meter – moisture terms – different methods of moisture measurement – moisture measurement in granular materials, solid penetrable materials like wood, web type material.

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)

Instrumentation in Petrochemical Industries - Paper Industries - Cement and Steel Industries -Nuclear power plant - Aircraft Instrumentation.

TOTAL: 45

TEXT BOOKS

1. Jain.R.K, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi 2008.
2. Ernest O Doebelin, "Measurement systems Application and Design", International Student Edition, Fifth Edition, Tata McGraw-Hill Book Company, 2003.
3. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill, New Delhi, 2008.

REFERENCES

1. Krishnaswamy.K, Vijayachitra.S, Industrial Instrumentation, New Age International Publishers, New Delhi, 2010.
2. S K Singh, Industrial Instrumentation and Control, Third Edition, Tata-McGraw-Hill Education,2008.
3. D.P. Eckman, "Industrial Instrumentation", CBS 2004.

13IC604 SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL 3 0 0 3

OBJECTIVES

- To study the concepts of theoretical foundation of Adaptive Control System for the process.
- To understand the different types modeling, identification, different methods of adaptive controllers.
- To study the concepts of state estimation and observers and advancement in the adaptive control.

OUTCOMES

At the end of the course the student should be able to

- Use the knowledge to identify the process using different parametric and non parametric methods.
- Design and analysis of different types of adaptive control schemes.
- Analysis of various design issues of adaptive control.

UNIT I NON PARAMETRIC METHODS **9**

Nonparametric methods: Transient analysis-Step response method – Impulse response method-frequency analysis-Correlation analysis- Spectral analysis.

UNIT II PARAMETRIC METHODS **9**

Linear in parameter models - ARX – ARMAX – ARIMAX – Least square estimation – Recursive least square estimation – Extended least square estimation – Maximum likelihood estimation – Introduction to non-linear systems identification - Pseudo random binary sequence.

UNIT III RECURSIVE IDENTIFICATION METHODS **9**

The recursive lest squares method-the recursive Instrumental variable method-the recursive prediction error method-model validation and model structure determination. Identifications of systems operating in closed loop: Identifiability considerations-direct identification-Indirect identification-joint input – output identification.

UNIT IV ADAPTIVE CONTROL SCHEMES **9**

Introduction – users- Definitions-auto tuning-types of adaptive control-gain scheduling controller-model reference adaptive control schemes – self tuning controller. MRAC and STC: Approaches – The Gradient approach – Lyapunov functions – Passivity theory – pole placement method Minimum variance control – Predictive control.

UNIT V ISSUES IN ADAPIVE CONTROL AND APPLICATION **9**

Stability – Convergence – Robustness – Application of adaptive control.

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)

Parametric and Non-parametric identification of process using MATLAB .

TOTAL: 45

TEXT BOOKS

1. Soderstorm.T and Petre stioca, System Identification, Prentice Hall International (UK) Ltd. 1998.
2. Karl J.Astrom and Bjorn Wittenmark, Adaptive Conrol, Pearson Education, 2nd Editon, 2008.

REFERENCES

1. Lennart Ljung,System Identification: Theory for the user, Prentice Hall Information and System Sciences, 1999.
2. Shankar Sastry, Marc Bodson **,** Adaptive Control: Stability, Convergence and Robustness, Prentice Hall inc., New Jersey, 2011.
3. Rik Pintelon and, Johan Schoukens System Identification: A Frequency Domain Approach Wiley-Blackwell; 2nd Edition 2012.

13IC605 INTELLIGENT CONTROL 3 0 0 3

OBJECTIVES

- To study the concepts and idea of intelligent agents and search methods.
- To study the concepts of representing knowledge.
- To study concepts of reasoning and decision making in uncertain world.
- To understand the different plans and methods for generating knowledge.
- To learn the working of expert systems

OUTCOMES

At the end of the course the student should be able to

- Analyze and acquire basic necessity of the intelligent controllers.
- Solve and analyze of different type's optimization techniques.
- Use the knowledge of artificial neural networks in various real time problems.

UNIT I FUNDAMENTALS OF NEURAL NETWORKS **9**

Introduction to Artificial Neutral Network – Biological neurons and their artificial models – Neural processing; learning and adaptation; Neural Network Learning Rules – Hebbian, perception, delta; widrow – Hoff correlation – Activation functions- Learning factors – Linear seperabilty.

UNIT II NEURAL NETWORK ARCHITECTURES **9**

Single layer perceptions – Adaline – Madaline - Multilayer Feedforward Networks – Back propagation network – Hopfield network – Discrete Hopfield network – Recurrent Auto and Hetero associative memory – Bidirectional Associative memory – Botzmann machine – Hamming network – Self organizing feature maps – Adaptive Resonance Theory network (ART) – Radial basis function networks - Application of Neural networks – XOR problem - Handwritten character recognition – Traveling salesman problem - Neuro controller Process control system.

UNIT III FUNDAMENTALS OF FUZZY LOGIC **9**

Crisp set – Vagueness – Uncertainty and Imprecision – Fuzziness – Basic definitions - fuzzy set theory – classical set Vs fuzzy set - properties of fuzzy sets – Fuzzy operation – Fuzzy arithmetic – Fuzzy relation – Fuzzy relational equations – Fuzzy Cartesian product and composition – Non interactive fuzzy sets – Tolerance equations relations – Fuzzy ordering relations – Fuzzymorphism.

UNIT IV FUZZY MODELS AND CONVERSION **9**

Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems- Self-organizing fuzzy logic control- Fuzzy logic control for nonlinear time-delay system- Fuzzy Pattern recognition – Fuzzy image processing - Fuzzy logic controllers.

UNIT V HYBRID CONTROL **9**

Introduction Neuro Fuzzy control – Genetic Algorithm - Basic Concepts - Working Principle- Encoding

- Fitness Function- Reproduction - Inheritance operators - Cross over, Inversion and Deletion, mutation operator, Bitwise operator - Generation Cycle- Convergence of Genetic Algorithm- applications.

UNIT VI STATE OF ART / ADVANCES (NOT FOR EXAMINATION)

Optimization based on Differential evolution algorithm – PSO based optimization – Sample programs using simulation package.

TOTAL: 45

TEXT BOOKS

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1994.
2. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 2012.

REFERENCE

1. S.N.Sivanandam.S.N., Deepa.S.N. "Principles of Soft Computing", Wiley India Publication, 2012.

13IC611 SIMULATION AND CONTROL LABORATORY 0 0 3 1

OBJECTIVES

At the end of the course the student should be able to

- To gain the practical knowledge in open loop and closed loop position and speed control system.
- To have an adequate knowledge on MATLAB simulation of control systems.

LIST OF EXPERIMENTS

1. Open loop and closed loop position control system.
2. Open loop and closed loop speed control system.
3. Digital position control system.
4. Simulation of second order system with dead time.
5. Transfer function of field control DC motor.
6. Transfer function of armature control DC motor.
7. Transfer function of separately excited DC generator.
8. Simulation of the above systems using MATLAB package.
9. Design of PI and PID controllers for a second order system using MATLAB.
10. Design of PI and PID controllers for a first order system with dead time using MATLAB.
11. Design of LAG Compensators using MATLAB package.
12. Design of LEAD Compensators using MATLAB package

TOTAL: 45

13EN512/13EN612 COMMUNICATION SKILLS LABORATORY 1 0 3 2

Theory **15**

Presentation Skills –Group Discussion-Body Language-Team Work- Time Management-Stress Management –Interview Skills

A. English Language Lab **18**

1. Listening Comprehension:

Listening and typing – Listening and sequencing of sentences – Filling in the blanks -Listening and answering questions.

2. Reading :

Reading Newspapers- Skimming –Scanning -Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. Speaking:
Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises –Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation

4.Writing
Correction of Errors- Sequencing of Sentences - Letter Writing-Resume-Technical Reports –Minutes of meeting –E mail Communication

B. Viewing and discussing audio-visual materials /Practice Sessions **27**

1. Resume / Report Preparation / Letter Writing
Structuring the resume / Report - Letter writing / Email Communication.

2. Presentation skills:
Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language

3. Soft Skills:
Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise

4. Group Discussion:
GD a part of selection process - Structure of GD – Moderator –Types of GD- Strategies in GD – Team work - Body Language - Mock GD - Technical seminar

5. Interview Skills:
Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews.

TOTAL: 60

13IC613 INDUSTRIAL INSTRUMENTATION LABORATORY 0 0 3 1

OBJECTIVES
At the end of the course the student should be able to

- To gain the practical knowledge in the measurement of flow, pressure, temperature, torque and etc., and to get exposure pH meter.
- To have an adequate knowledge on calibration of industrial instrumentation.

LIST OF EXPERIMENTS

1. Determination of co-efficient of discharge of Venturi meter.
2. Determination of co-efficient of discharge of orifice meter
3. Calibration & Measurement of Flow transmitter.
4. Calibration of Pressure gauge using dead weight tester.
5. Calibration & Measurement of Pressure transmitter.
6. Calibration of Temperature sensor.
7. Torque measurement.
8. Viscosity measurement of liquids using saybolt viscometer.
9. Level measurement using d/p transmitter.
10. Level measurement using displacer and torque tube.
11. Measurement of absorbance and transmittance of a sample using UV – Visible spectrophotometer
12. pH meter standardization and measurement of pH values of solutions.

TOTAL: 45

SEMESTER VII

13IC701 POWER PLANT INSTRUMENTATION 3 0 0 3

OBJECTIVES

- To study the concept of the process involving in power plant.
- To understand the Techniques of control system for process parameters.
- To learn about non-conventional power generation.

OUTCOMES

At the end of the course the student should be able to

- Analyze the concepts of Control system in Power Plants
- Design about Non-Conventional Power Generation
- Use the various Controlling Techniques

UNIT I OVERVIEW OF POWER GENERATION 9

Brief survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – thermal power plants – building blocks – details of boiler processes -P & I diagram of boiler – cogeneration.

UNIT II MEASUREMENTS IN POWER PLANTS 9

Electrical measurements:- Current,Voltage,Power,Frequency,Power-factor -Non electrical parameters:- Flow of feed water,fuel,air and steam with correction factor for temperature – Steam pressure and Steam temperature –Drum level measurement –Radiation detector-Smoke density measurement-Dust Monitor.

UNIT III ANALYZERS IN POWER PLANTS 9

Fuel gas oxygen analyzer – Analysis of impurities in feed water and steam – Dissolved oxygen analyzer –Chromatography –pH meter –Fuel analyzer – Pollution monitoring instruments.

UNIT IV CONTROL LOOPS IN BOILER 9

Combustion Control –Air/fuel ratio control –Furnace draft control – Drum level control – Main steam and reheat steam temperature control- Attemperator – Deaerator control –Distributed Control system in power plants – Interlocks in boiler operation.

UNIT V TURBINE-MONITORING AND CONTROL 9

Speed, Vibration, Shell temperature monitoring and Control – Steam pressure control – Lubricant oil temperature control –Cooling system.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

SCADA in Power plants (hydro, thermal, nuclear, solar and wind power)

TOTAL: 45

TEXT BOOKS

1. Bela G. Liptak, “Process Control” , Butterworth-Heinemann Ltd, Fourth edition, 2005.
2. Dukelow S.G., “The Control of Boilers”,2nd Edition,Instrument Society of America,1991.
3. Arora.S.C, Domkundwar.S, Domkundwar.A.V, “A course in Power Plant Engineering”, Dhanpat Rai & Co. (P) Ltd, Fifth revised and enlarged edition, 2006.

REFERENCES

1. Elonka S.M and Kohal A.L., “Standard Boiler Operations”, McGraw-Hill, New Delhi, 1994.
2. Jain R.K., “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 1999.

13IC702 DIGITAL CONTROL SYSTEM 3 1 0 4

OBJECTIVES

At the end of the course the student should be able

- To study the concept of sample data control system.

- To learn about signal processing in digital control.
- To understand the importance of discrete systems and stability analysis of discrete data system.
- To study the importance of state space representation for discrete data system.
- To study the concept of digital controllers.

OUTCOMES

At the end of the course the student should be able to

- Analyse the concept of controllers and its design process.
- Analyse the characteristics of frequency domain and sampling theorem involved in digital control systems.
- Solve linear and state difference equations.
- Analyse the modelling of discrete systems and various stability tests involved in it.

UNIT I COMPUTER CONTROLLED SYSTEM **9**

Configuration of the basic digital control scheme – general sampled data system variables – signal classifications – usage of digital control system – Advantages – disadvantages – examples of discrete data and digital control systems.

UNIT II SIGNAL PROCESSING IN DIGITAL CONTROL **9**

Sampling process – Frequency domain analysis – ideal samples – Shanon's sampling theorem – generation and solution of process – linear difference equations – data reconstruction process – frequency domain characteristics.

UNIT III DISCRETE SYSTEM MODELLING **9**

Determination of the Z transform – mapping between s and Z domains - Z transform of system equations – open loop Hybrid sampled Data Control Systems – open loop discrete Input Data Control System – closed loop sampled data control system – modified Z transform method – response between sampling instants – stability on the Z - plane and jury's stability test – steady state error analysis for stable systems.

UNIT IV STATE VARIABLE ANALYSIS OF DIGITAL CONTROL SYSTEMS **9**

State descriptions of digital processors – conversion of state variable models to transfer functions – conversion of transfer functions to canonical state variable models – first comparison form – second companion form – Jordon Canonical form – state description of sampled continuous time plants – solution of state difference equations – closed form solution – state transition matrix – Cayley Hamilton Technique – concept of controllability and observability – loss of controllability and absorbability due to sampling.

9

UNIT V DESIGN OF DIGITAL CONTROLLER

Digital PID – Position and Velocity form – Dead beat algorithm – Dahlinis algorithm – Kalman's algorithm – Smith predictor algorithm – Pole placement Controller – Predictive Controller – state regulator design – design of state observers – dead beat control by state feedback and dead beat observers.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Computerized Flow – Temperature control using simulation package.

TUTORIAL:15
TOTAL :60

TEXT BOOKS

1. M.Gopal, 'Digital Control and State Variables Methods', Tata McGraw HILL publishers, fourth edition, 2012.
2. Gregory L.Moss, 'Digital Systems: Principles and Applications', Pearson publisher, tenth edition,2009.

REFERENCES

1. M.Sami Fadali, 'Digital control Engineering- Analysis and Design', Elsevier publisher, Second edition, 2013.
2. Surekha Bhanot, 'Process Control: Principles and Applications', Oxford University press, second edition, 2008.

13IC703 LOGIC AND DISTRIBUTED CONTROL SYSTEMS 3 0 0 3

OBJECTIVES

- To study the concept of PLC and programming languages.
- To understand the architecture and local control unit of distributed control system.
- To understand the usage of PC as PLC.
- To learn the working process of Computer Controlled Systems.

OUTCOMES

At the end of the course student should be able to

- Design Programmable Logic Controllers.
- Analyse about architectures and instructions involved in PLC.
- Analyse about Interfacing involved in DCS.
- Design and analyse about supervisory control and data acquisition system.

UNIT I PROGRAMMABLE LOGIC CONTROLLER 9

Evolution of PLC's – Components of PLC – Advantages over relay logic – Architecture of PLC– Programming devices - Discrete and Analog I/O modules – Programming languages — Ladderdiagram – Programming timers and counters – Design of PLC.

UNIT II APPLICATIONS OF PLC 9

Instructions in PLC – Program control instructions, math instructions, sequencer instructions – Use of PC as PLC – Application of PLC – Case study of bottle filling system.

UNIT III COMPUTER CONTROLLED SYSTEMS 9

Basic building blocks of Computer controlled systems – SCADA – data Acquisition System – supervisory Control – Direct digital Control .

UNIT IV INSTRUMETATION FOR REMOTE SENSING 9

DCS - Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities.

UNIT V DISTRIBUTED CONTROL SYSTEM 9

Operator interfaces - Low level and high level operator interfaces – Operator displays – Engineering interfaces – Low level and high level engineering interfaces – General purpose computers in DCS.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

HART and Field bus, Interoperability and Interchangeability using simulation package.

TOTAL: 45

TEXT BOOKS

1. Biswanath Paul, 'Industrial Electronics and Control', PHI learning private limited publisher, Second edition, 2009.
2. Peng Zhang, 'Advanced Industrial control Technology', Elsevier publisher, first edition, 2010.

REFERENCES

1. W.Bolton,'Programmable Logic Controllers', Elsevier publisher, fifth editon,2011.
2. Krishna Kant , 'Computer based Industrial Control', PHI learning private limited publisher', second edition,2010.

13IC704 VIRTUAL INSTRUMENTATION 3 0 0 3

OBJECTIVES

- To understand background information required for studying virtual instrumentation.
- To study the basic building blocks of LabVIEW Environment.
- To learn the various Programming techniques of virtual instrumentation
- To study the Data Acquisition in virtual instrumentation & understand the instrument control
- To learn few applications in virtual instrumentation

OUTCOMES

At the end of the course the student should be able to

- Design and control of any process using Virtual Instrumentation
- Acquire knowledge of VI Programming
- Analyze data obtained through Data Acquisition
- Usage of various analysis tool and its application

UNIT I INTRODUCTION TO VIRTUAL INSTRUMENTATION 9

General functional description of a digital instrument, block diagram of a virtual instrument, computers in instrumentation; historical perspective; advantages of virtual instruments (VI) and graphical programming; VI for test, measurement and control, development of virtual instrument using GUI

UNIT II SOFTWARE AND CONSTRUCTS 9

Software environment; palettes; data types and colour coding; editing, debugging and running a vi; data-flow programming; modular programming, loops, local and global variables; arrays; clusters .

UNIT III PROGRAMMING 9

Plotting data; making decisions in a VI; string; File I/O, semaphores, TCP/IP, shared variables, data publishing, state machines.

UNIT IV DATA ACQUISITION 9

Classification of signals; analog and digital interfacing; DAQ hardware and software; configuring the hardware; ADC, DAC, Digital I/O, counters and timers; basic system components of a signal conditioning system, advanced triggering of audio and video signals. .

UNIT V CONTROL AND AUTOMATION 9

Real time controls, time critical systems, PID controls, simple closed loop systems, distributed control systems, deadband, alarms, historical trending and data logging, challenges and solutions, image acquisition, condition monitoring, motion control to complete process automations.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Simulation of ECG signal, Simulation of offline controller and nonlinear plant model, Analyse closed-loop characteristic of controlled plant.

TOTAL : 45

TEXT BOOKS

1. Sanjeev Gupta, 'Virtual Instrumentation using Labview' Tata McGraw Hill, 2004.
2. Gary Johnson, 'Lab view graphical programming', II Ed., McGraw Hill, 1999.

REFERENCES

1. Lisa K Wells & Jeffrey Travels, 'Lab view for everyone', Prentice Hall, 2003.
2. Jovitha Jeome 'Virtual Instrumentation using Lab View' PH1 Learning Pvt Ltd, 2009.

13IC711 INDUSTRIAL AUTOMATION LABORATORY 0 0 3 1

OBJECTIVES

- To understand about controllers and PLC applications in control systems.
- To understand and have an adequate knowledge in simulation of control systems.
- To learn the design process of various signal conditioning circuits.

LIST OF EXPERIMENTS

1. Simulation of first order system and second order system with and without dead time using Discretization method and Runge – Kutta method.
2. Design of HART wire based communication system.
3. PLC programming in timers and counters.
4. Control of bottle filling system using PLC.
5. Simulation of feedback, feed forward, ratio and cascade complex control system using MATLAB package.
6. Design of Velocity control in Distributed control system using simulation package.
7. Design of dead beat / Dahlin / Kalman's Algorithms.
8. Design of Multivariable control system using MATLAB.
9. Design of pole placement controller for distributed control system.
10. Design of Instrumentation amplifier.
11. Design of cold – junction compensation circuit for thermocouples using RTD.
12. Design of signal conditioning circuit for strain gauge and RTD.

TOTAL: 45

13IC712 VIRTUAL INSTRUMENTATION LABORATORY 0 0 3 1

OBJECTIVES

- To provide a practical fundamental principles of virtual instrumentation.
- To understand how to acquire, analyze and present data using Labview as the application Environment.
- To understand how to Builds the concept of virtual instrumentation by using programming elements.
- To understand how to make a VI as a SubVI, functions in VI, arrays in VI, VISA functions, shift registers.

LIST OF EXPERIMENTS

1. Creating Virtual Instrumentation For Simple Applications
2. Programming exercises for loops and charts
3. Programming exercises for clusters and graphs.
4. Programming exercises on case and sequence structures, file Input / Output.
5. Using arrays develop a VI.
6. Converting the VI into a Sub VI.
7. Build a VI using shift register
8. Developing signal generator using DAQ cards.
9. Simulating reactor control using Virtual Instrumentation.
10. Build a VI that reads and writes information from the NI instrument simulator using VISA functions.

TOTAL: 45

ELECTIVES

COMPUTER

13IC001 INDUSTRIAL DATA NETWORKS 3 0 0 3

OBJECTIVES

- To study basic concepts of client/server architecture, network scalability, geographical scope, the Internet, intranets and extranets.
- To study the concepts of layered communication, the process of encapsulation, and message routing in network equipped devices using appropriate protocols.
- To learn the working of network management and systems administration.

OUTCOMES

At the end of the course the student should be able to

- Analyze the basic data networks and internet working
- Design and use various communication protocols
- Analyze and design various configurations of network

UNIT I DATA NETWORK FUNDAMENTALS 9

Network hierarchy and switching – Open System Interconnection model of ISO– Data link control protocol: - HDLC – Media access protocol – Command/response – Token passing – CSMA/CD, TCP/IP. Serial connections: RS232, RS485.

UNIT II INTER NETWORKING 9

Bridges – Routers – Gateways –Standard ETHERNET and ARCNET configuration special requirement for networks used for control. Application layer services: DNS, DHCP, FTP, TFTP, SMTP, SNMP, HTTP.

UNIT III HART AND FIELDBUS 9

Introduction- Evolution of signal standard – HART communication protocol – Communication modes – HART networks – HART commands – HART applications.
Fieldbus: – Introduction – General Fieldbus architecture – Basic requirements of Fieldbus standard – Fieldbus topology – Interoperability – Interchangeability – Introduction toOLE for process control (OPC).

UNIT IV MODBUS and PROFIBUS PA/DP/FMS AND FF 9

MODBUS protocol structure – function codes – troubleshooting Profibus: Introduction – profibus protocol stack – profibus communication model – communication objects – system operation – troubleshooting – review of foundation field bus. BUS types- The I/O BUS- ISA bus - EISA Bus - PCI bus – GPIB.

UNIT V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION 9

Industrial Ethernet : Introduction – 10Mbps Ethernet, 100Mbps Ethernet. Radio and wireless communication : Introduction – components of radio link – the radio spectrum and frequency allocation – radio modems.

UNIT VI STATE OF THE ART / ADVANCES (NOT FOR EXAMINATION)

Hybrid networks: Wireless and Power line networks in Industry

TOTAL: 45

TEXT BOOKS

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, ‘Practical Industrial Data networks
2. Design, Installation and Troubleshooting’, Newnes publication, Elsevier First edition, 2004.
3. Lawrence M. Thompson,’Industrial Data Communications’, ISA, 2008

4. Wayne Tomasi, 'Introduction To Data Communication And Networking', Pearson
5. Education,2009

REFERENCES

1. Theodore S. Rappaport, 'Wireless communication: Principles & Practice'2nd Edition, Pearson Education India, 2009
2. Willam Stallings, ' Wireless Communication & Networks' Pearson Education India, 2009.

13IC002 VISUAL PROGRAMMING 3 0 0 3

OBJECTIVES

- To understand the different types of windows programming models, MFC applications drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- To study about the integrated development programming event driven programming, variables, constants, procedures and basic ActiveX controls in visual basic.
- To understand the different types of database and the database management system, visual data manager, data bound controls and ADO controls in VB.

OUTCOMES

At the end of the course the student should be able to

- Design projects with menus and submenus applying visual programming.
- Analyse various types of data, operators, built-in functions, and control statements
- Solve the error handling and multiple-forms application issues

UNIT I FUNDAMENTALS OF WINDOWS AND MFC **9**

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective.The benefits of C++ and MFC - MFC design philosophy - Document/View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map.

Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

UNIT II RESOURCES AND CONTROLS **9**

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus.

The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

UNIT III DOCUMENT / VIEW ARCHITECTURE **9**

The inexistence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows.

Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard.

Opening, closing and creating the files - Reading & Writing – C file derivatives –Serialization basics - Writing serializable classes.

UNIT IV FUNDAMENTALS OF VISUAL BASIC **9**

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer– Form layout – Intermediate window. Designing the user interface: Aligning the controls– Running the application – Visual development and event driven programming.

Variables: Declaration – Types – Converting variable types – User defined data types -Lifetime of a variable. Constants - Arrays – Types of arrays. Procedures: Subroutines –Functions – Calling procedures. Text box controls – List box & Combo box controls –Scroll bar and slider controls – File controls.

UNIT V DATABASE PROGRAMMING WITH VB **9**

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Table def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

UNIT VI STATE OF THE ART / ADVANCES (NOT FOR EXAMINATION)

Net Programming – Net Controls – SQL Server with Net connectivity

TOTAL: 45

TEXT BOOKS

1. A.A.Puntambekar, 'Visual Programming', Technical Publication Pune, 2009.
2. Bryan Newsome,'Beginning Visual Basic', John Wiley & Sons, 2012

REFERENCES

1. Ivor Horton, 'Beginning Visual C++ 2008'Wiley publishers, 2008.
2. Ying Bai, 'Practical Database Programming with Visual Basic.NET', Wiley Publication2012.
3. Julia Case Bradley,Anita C. Millspaugh,'Programming in Visual Basic 2010', McGraw-Hill Education, 2010.

13IC003 COMPUTER ARCHITECTURE 3 0 0 3

OBJECTIVES

- To study the concepts of representations of data, register transfer language for micro-operations and organization and design of a digital computer.
- To study the concept of micro-programmed control unit, the central processing unit, stack and instruction formats.
- To understand the different types of arithmetic operation's algorithms and their hardware implementations and concept of pipelining and vector processing.
- To understand the techniques to communicate with input and output devices.
- To study the organization and operation of various memories and memory management hardware.

OUTCOMES

At the end of the course the student should be able to

- Use different types of data types and operations over it.
- Analyze the processing unit and control unit
- Design appropriate algorithm for processing the data and scheduling it.
- Analyze data transfer in input - output devices and memory management.

UNIT I DATA REPRESENTATION, MICRO-OPERATIONS AND DESIGN **9**

Data representation: Data types, complements, fixed–point representation, floating-point representation, other binary codes, error detection codes.

Register transfer and micro operations: Register transfer language, register transfer, bus and memory transfers, arithmetic micro-operations, logic micro-operations, shift micro-operations, arithmetic logic

shift unit.
Basic computer organization and design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions, input-output and interrupt. Complete computer description, design of basic computer, design of accumulator logic.

UNIT II CONTROL AND CENTRAL PROCESSING UNIT 9

Micro programmed control: Control memory, address sequencing, micro-program example and design of control unit.
Central processing unit: General register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, reduced instruction set computer.

UNIT III COMPUTER ARITHMETIC, PIPELINE AND VECTOR PROCESSING 9

Computer arithmetic: Addition and subtraction, multiplication algorithms, division algorithms, floating-point arithmetic operations, decimal arithmetic unit, decimal arithmetic operations.
Pipeline and vector processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline, vector processing array processors, Advanced pipelining techniques - Loop unrolling, Basic pipeline scheduling, Dynamic scheduling.

UNIT IV INPUT-OUTPUT ORGANIZATION 9

Input-output organization: Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access, input-output processor, serial communication.

UNIT V MEMORY ORGANIZATION 9

Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory and virtual machines, memory management hardware, design of memory hierarchies.

UNIT VI STATE OF THE ART / ADVANCES (NOT FOR EXAMINATION)

Multi processing – performance characteristics, Modern DRAM technologies.

TOTAL: 45

TEXT BOOKS

1. Morris Mano, 'Computer System Architecture', 3rd Edition, Pearson Education, 2007.
2. Vincent P.Heuring and Harry F.Jordan, 'Computer Systems Design and Architecture', Pearson Education Asia Publications, 2008.

REFERENCES

1. Andrew S.Tanenbaum, 'Structured Computer Organization', 6th Edition, Prentice Hall of India/Pearson Education, 2012.
2. William Stallings, 'Computer Organization and Architecture', 9th Edition, Prentice Hall of India/Pearson Education, 2012.
3. Joseph D. Dumas II, 'Computer Architecture: Fundamentals and Principles of Computer Design', CRC Press, 2006.

13CS059 OPERATING SYSTEMS 3 0 0 3

OBJECTIVES

- To study the basic concepts of operating system, computer system structures and operating system structures.
- To study about processes, threads, CPU scheduling, process synchronization and deadlocks.
- To study about memory management, virtual memory, file system interface and file system implementation.
- To study about I/O systems and mass-storage structure, distributed system structures, distributed file systems and distributed coordination.

OUTCOMES

On the completion of the course the students are able to

- Gain knowledge about the Structure and different types of operating systems
- Understand ,analyze and implement various processes, storage of files and I/O systems
- Adequate knowledge about distributed systems

UNIT I OPERATING SYSTEMS – AN OVERVIEW **9**

Definition of OS – Mainframe systems – Desktop systems –Multiprocessor systems – Distributed systems – Clustered systems – Real time systems – Handheld systems.

Computer system operation – I/O structure – Storage structure – Storage hierarchy – Hardware protection – Network structure. System components – Operating system services – System calls – System programs – System structure – Virtual machines – System design and implementation – System generation.

UNIT II PROCESS MANAGEMENT **9**

Process concept – Process scheduling – Operations on processes – Cooperating processes – Inter process communication – Communication in client-server systems. Threads - Overview - Multithreading models – Threading issues.

Basic concepts – Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling – Process scheduling models. The critical section problem – Synchronization hardware – Semaphores – Classic problems of synchronization.

System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

UNIT III STORAGE MANAGEMENT **9**

Background **–** Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with Paging. Background – Process creation – Page replacement – Allocation of frames – Thrashing.

File concept: Access methods – Directory structure – File system mounting – File sharing – Protection. File system structure – File system implementation – Directory implementation – Allocation methods – Free-space management – Efficiency and performance – Recovery.

UNIT IV I/O SYSTEMS **9**

I/O hardware – Application I/O interface – Kernel I/O subsystem – Transforming I/O to hardware operations – Streams – Performance.

Disk structure – Disk scheduling – Disk management – Swap-space management – RAID structure – Disk attachment – Stable – Storage implementation – Tertiary storage structure.

UNIT V DISTRIBUTED SYSTEMS **9**

Background **–** Topology – Network types – Communication – Communication protocols – Robustness – Design issues. Naming and transparency – Remote file access – File replication.

Event ordering – Mutual exclusion – Atomicity – Concurrency control – Deadlock handling – Election algorithms – Reaching agreement.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Issues and techniques in resource allocation in real time distributed systems – Power Management issues – Concepts of scheduling in real time systems.

TOTAL: 45

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 'Operating System Concepts', Sixth Edition, Windows XP update, John Wiley & Sons (ASIA) Pvt. Ltd, 2002.
2. Harvey M. Deitel, 'Operating Systems', Second Edition, Pearson Education Pvt. Ltd., 2002.

REFERENCES

1. Andrew S. Tanenbaum, 'Modern Operating Systems', 2nd Edition, Pearson Education, 2000.
2. William Stallings, 'Operating System', Pearson Education, 4th Edition, 2003 / PHI.

INSTRUMENTATION

13IC021 ENVIRONMENTAL INSTRUMENTATION 3 0 0 3

OBJECTIVES

- To understand the different types of water and air quality parameters.
- To understand the different types of environmental measurement techniques.
- To study the concept of pollution measurement techniques.

OUTCOMES

At the end of the course, the student should be able to

- Analyze various pollutants and their impacts.
- Design effective method for measuring the pollutants.
- Use appropriate methods to control pollution.

UNIT I INTRODUCTION TO ENVIRONMENT MONITORING 9

Need for environmental monitoring - Indian Standards for pollution levels (concentrations) in respect of air quality and water quality. Noise levels. Impact of pollution on human health, vegetation, animals and property value. Biological quality of water-bacteria and virus - applications of sophisticated microscopes including electron microscope for identification of microbial organisms

UNIT II WATER QUALITY PARAMETERS 9

Water quality parameters - pH - conductivity - temperature - turbidity – chemical pollutants -Chlorides - sulphates - sulphides - Nitrates and nitrites - phosphates - flouride, Phenolic compounds - measurement techniques for these parameters.

UNIT III ELEMENTS IN WATER & AIR 9

Elemental concentration in water - Mercury, lead, chromium, arsenic, zinc, cadmium, copper, selenium, nickel, sodium, potassium, lithium – measurement techniques for these parameters. Air pollutants - gases, vapours, particulate matter and their impact. Air quality standards prescribed by B.I.S..Control of air pollution. Energy environment relationship

UNIT IV MEASUREMENT TECHNIQUES 9

Measurement Techniques for particulate matter in air - oxides of sulphur, oxides of nitrogen, ıydrocarbons, carbon dioxide, carbon monoxide, ozone. Air flow measurement, Ground water g: Level measurement in ground water monitoring wells

UNIT V POLLUTION MEASUREMENTS 9

Noise pollution - desirable levels of sound. Measurement of sound level. Soil pollution - insecticides, pesticides, fertilizers - measurement techniques for these pollutants. Solid waste disposal techniques - incinerators - impact of solid waste dumps

UNIT VI STATE OF THE ART / ADVANCES (NOT FOR EXAMINATION)

Rain water Harvesting – necessity, methods, Instrumentation set up for waste water treatment plant. Latest methods of waste water treatment plants.

TOTAL: 45

REFERENCES

1. Marcel van der Perk, ‘Soil and Water Contamination’, CRC press,2013
2. Mahajan.S.P, ‘Air Pollution Control’,TERI Press,2009
3. S. K. Agarwal,’Noise Pollution’,APH Publishing Corporation,2009.
4. N.F. Gray, ‘Drinking Water Quality’,Cambridge University press,2008
5. Rao.C.S., ‘Environmental Pollution Control Engineering’, New age International Publishers, 2006.

13IC022 FIBRE OPTICS AND LASER INSTRUMENTS 3 0 0 3

OBJECTIVES

- To study the concepts of laser operations and techniques.
- To understand the various applications of fiber optics instruments.
- To learn the working process depends on industrial application related

OUTCOMES

At the end of the course Students should be able to

- Analyse the different methods of Industrial application of lasers.
- Used holography & Medical applications of Lasers.
- Design the new techniques for future use.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moiré fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – 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.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, length, velocity, acceleration, current, voltage and
Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

UNIT VI STATE OF ART /ADVANCES (NOT FOR EXAMINATION)

New plastic Optical fibre technology – Laser for space communication.

TOTAL: 45

TEXT BOOKS

1. S. Nagabhushanam, “Laser And Optical Instrument”,I.K.Publication Pvt.Ltd,2010.
2. V.S. Bagad, “Optical Communication”, First Edition, Technical Publication 2008.
3. Pierrevlecoy ,‘Fibre Optic Communication’, Iste&Wiley, First Edition, 2008.

REFERENCES

1. Govind P Agrawal, “Fibre Optic Communication System”, fourth Edition, Wiley 2012.
2. V.S.Bagad, “Optical fibre Communication”, First Edition, Technical Publication 2009.
3. John Ready, “Industrial Application Of Laser”, Elsevier Academic C Press Inc(LONDON)td 2012.
4. K.R.Nambiar, “Laser Principle Types and Applications”, New Age International Publication,2006.
5. Optical Fiber Communications: Principles and Practice, John M. Senior, Pearson Education, 2006.
6. John F. Read, ‘Industrial Applications of Lasers’, Academic Press, 1978.

13IC023 INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES 3 0 0 3

OBJECTIVES

- To study an in-depth understanding of the various unit operations in the industry.
- To learn the working process of petrochemical industry.
- To understand the petroleum products and the chemicals obtained from them.

OUTCOMES

At the end of the course students should be able to

- Used to understand the fundamentals of petrochemical industrial operations.
- Analyse the exploration of petroleum production.

UNIT I PETROLEUM PROCESSING **9**

Petroleum exploration – Recovery techniques – Oil – Gas separation - Processing wet gases – Refining of crude oil.

UNIT II OPERATIONS IN PETROLEUM INDUSTRY **9**

Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerisation – Alkylation – Isomerization – Production of ethylene, acetylene and propylene from petroleum

UNIT III CHEMICALS FROM PETROLEUM PRODUCTS **9**

Chemicals from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products

UNIT IV MEASUREMENTS IN PETROCHEMICAL INDUSTRY **9**

Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of Instruments.

UNIT V CONTROL LOOPS IN PETROCHEMICAL INDUSTRY **9**

Process control in refinery and petrochemical industry – Control of distillation column – Control of catalytic crackers and pyrolysis unit – Automatic control of polyethylene production – Control of vinyl chloride and PVC production.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Recent techniques for protection to form of corrosion in the petrochemical industry - New Technologies in the Petrochemical Industry Wastewater Treatment**.**

TOTAL: 45

TEXT BOOKS

1. L. Waddams, “Chemicals from Petroleum”, Butter and Janner Ltd.,2nd edition published by Chemical pub.co.inc.2013.
2. S.K.Singh, “Process control concepts, dynamics and application”, PHI publication.2009.

REFERENCES

1. Austin G.T. Shreeves, “Chemical Process Industries”, McGraw Hill International Student Edition, Singapore, 2010.
2. Cecill L.Smith, “Advanced process control”, Wiley publication, 2011.

13IC024 INSTRUMENTATION IN PAPER INDUSTRIES 3 0 0 3

OBJECTIVES

- To study an in-depth understanding of the various unit operations in the industry
- To learn the working and controls schematics for specific applications.
- To understand the fundamentals of industrial operations.
- To understand the paper making process in industry.

OUTCOMES

At the end of the course Students should be able to

- Gain the more knowledge for industrial purpose.
- Analyse the operations and design of paper making process in industry.
- Used to understand the importance of safety to plant and personnel

UNIT I INTRODUCTION TO PAPER PROCESSING 9

Wood: The Raw Material – The Basic Process – The Pulping Process – The Chemical Recovery Process – The Papermaking Process – Converting.

UNIT II MEASUREMENTS IN PAPER INDUSTRIES 9

Basic Weight Measurement – Density and Specific Gravity Sensors – Flow Sensors – Liquid Level Sensors – Solid Level Sensors – Pressure Detectors – Temperature Detectors.

UNIT III ANALYZERS, CONTROLLERS AND DISPLAYS 9

Consistency Sensors – Moisture Analyzers – Oxidation-reduction Potential and pH – Pneumatic Vs Electronic Instrumentation – Control Panels – Graphic Displays and Alarms.

UNIT IV VALVES 9

Selection Factors – Valve Types and Their Application – Ball Valves – Butterfly Valves – Gate Valves – Plug Valves – Pinch Valves.

UNIT V COMPUTER APPLICATIONS AND TYPICAL CONTROL SYSTEMS 9

Applications – Blowdown Tank Controls – Digester Liquor Feed Pump Controls – Brown Stock Washer Level Control – Stock Chest Level Control – Basis Weight Control of a Paper Machine – Yankee Dryer Temperature Control – Smelt Dissolving Tank Density Control – White Liquor Clarifier Density Control – White Liquor Flow Control – Lime Storage Silo Level Detection – Condensate Conductivity Control.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

New Technologies in the Paper and Pulp Industry Waste Water Treatment. Biological Treatment of Wastewater by Anaerobic or Aerobic Processes.

TOTAL: 45

REFERENCES

1. Walt Boyes,"instrumentation reference book" 4th edition, B.H.Publications.2010.
2. Patrick H.Garrett,"high performance instrumentation and automation", CRC press, 2010.
3. UNEPIE,"Environmental management in the pulp and paper industry,"(volume 22-34),United Nation Publication.
4. Libby, C. E., Pulp and Paper Science and Technology (Volume 1, Pulp), (Volume 2, Paper), New York McGraw Hill.

13IC025 BIOMEDICAL INSTRUMENTATION 3 0 0 3

OBJECTIVES

- To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Methods of different transducers used.
- To introduce the student to the various sensing and measurement devices of electrical origin.
- To provide the latest ideas on devices of non-electrical devices.
- To bring out the important and modern methods of imaging techniques.
- To provide latest knowledge of medical assistance / techniques and therapeutic equipments

OUTCOMES

On the completion of the course the students are able to

- Gain knowledge about different macro and micro measurement units

- Appreciate the role of instruments in medicine
- Analysis medical images

UNIT I PHYSIOLOGY AND TRANSDUCERS **9**

Cell and its structure – Action and resting – Potential propagation of action potential – Sodium pump – Nervous system – CNS – PNS – Nerve cell – Synapse – Cardio pulmonary system – Physiology of heart and lungs – Circulation and respiration – Transducers – Different types – Piezo-electric, ultrasonic, resistive, capacitive, inductive transducers – Selection criteria.

UNIT II ELECTRO – PHYSIOLOGICAL MEASUREMENTS **9**

Basic components of a biomedical system – Electrodes – Micro, needle and surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier.ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms.

UNIT III NON-ELECTRICAL PARAMETER MEASUREMENTS **9**

Measurement of blood pressure – Cardiac output – Cardiac rate – Heart sound – Respiratory rate – Gas volume – Flow rate of Co_2, o_2 in exhaust air - PH of blood, ESR, GSR measurements – Plethysmography.

UNIT IV MEDICAL IMAGING AND PMS **9**

X-ray machine - Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Electrical safety.

UNIT V ASSISTING AND THERAPEUTIC EQUIPMENTS **9**

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dializers.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Lasers in Medicine - Positron emission tomography- Digital Subtraction angiography.

TOTAL: 45

TEXT BOOKS

1. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II Edition, Pearson Education, 2002.
2. Shakti Chatterjee, Aubert Miller, "Biomedical Instrumentation Systems", Cengage Learing, 2010.
3. R.S.Khandpur, 'Handbook of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.

REFERENCES

1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.
3. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.
4. Barbara Christe,"Introduction to Biomedical Instrumentation: The Technology of Patient Care",Cambridge University Press, 2009
5. John Webster, "Medical Instrumentation: Application and Design", Third Edition, Willey India, 2009.
6. Anandanatrajan, "Bio Medical Instrumentation and Measurements" PHI learning Pvt Ltd., 2011.

13IC026 AUTOMOBILE AND AIRCRAFT INSTRUMENTATION 3 0 0 3

OBJECTIVES

- To study about the performance of basic instruments and devices.
- To understand the various sensing and measurement devices of instrumentation.
- To understand the different methods used for emission process.

- To learn about the various instruments used and its components.

OUTCOMES

At the end of the course the student should be able to

- Get a picture about the performance of basic instruments.
- Gain an overview on various components, methods and process.
- Familiar with various sensors used.

UNIT I MEASURING DEVICES IN AUTOMOBILES **9**

Selection of measuring instrument, requirements of measurement such as precision, accuracy, errors, sensitivity, readability and reliability – Devices to measure temperature and pressure of the working fluid, coolant, air and fuel flow into the engine- Indicating and integrating instruments – Vibrometer, Accelerometer, vibration and pressure pickups, vibration test methods and counters.

UNIT II SENSORS AND ACTUATORS FOR AUTOMOBILES **9**

Introduction to basic sensor arrangement – types of sensors – Oxygen sensors, crank angle position sensors – Fuel metering / vehicle speed sensor and detonation sensor – Altitude sensor – Flow sensors – Throttle position sensors – Solenoids, stepper motors, relays – Electronic dash board systems – GPS.

UNIT III INSTRUMENTATION FOR EMISSION MEASUREMENT **9**

Test procedures – NDIR analyzers – Flame ionization detectors –Chemiluminescent analyzers – Gas chromatograph – Smoke meters – Emission– Standards.

UNIT IV FLIGHT INSTRUMENTATION AND GYROSCOPIC INSTRUMENTS **9**

Classification of aircraft instruments – Instrument displays, panels, cockpit layout – Altimeters – Airspeed indicators – Machmeters – Accelerometers – Gyroscopic theory – Directional gyro indictor – Artificial horizon – Turn and slip indicators.

UNIT V AIRCRAFT COMPUTER SYSTEMS **9**

Terrestrial magnetism – Aircraft magnetism- Direct reading magnetic components – Compass errors – Gyromagnetic compass – Performance margin indicators – Safe take off indicators - Aircraft take off monitoring systems – Autopilot and navigation systems.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Simulation of Missile control instrumentation-Instrumentation in space and Automobile research.

TOTAL: 45

TEXT BOOK

1. Robert Buck, "Weather Flying", Published by Mc Graw Hill Professional, Fifth Edition, 2013.

REFERENCES

1. Snorri Gudmundsson"General Aviation Aircraft Design: Applied Methods and Procedures", Published by Butterworth-Heinemann, First Edition, 2013.
2. Nagabhushana.S "Aircraft Instrumentation and Systems" I K International Publishing House, 2010.

ELECTRONICS

13IC041 MOBILE COMMUNICATION **3 0 0 3**

OBJECTIVES

- To understand the mobile channel environment, communication techniques and wireless standards for mobile communication.
- To study the fundamental cellular radio concepts such as frequency reuse and handoff.

- To learn the many operating environment.

OUTCOMES

At the end of the course Students should be able to

- Design the new technique for future use.
- Analyse the problem identification in mobile communication.
- Used to gain more knowledge about cellular system.

UNIT I FUNDAMENTALS AND CELLULAR CONCEPT **9**

Introduction: Applications – history – simplified reference model .Medium access control: MAC - SDMA – FDMA – TDMA – CDMA. Telecommunication systems: GSM –DECT –TETRA – UMTS and IMT – 2000.

Cellular concept: Frequency reuse, channel assignment hand off, interference and system capacity, tracking and grade of service, improving coverage and capacity in cellular systems.

UNIT II MODULATION TECHNIQUES AND EQUALIZATION **9**

Modulation techniques: Minimum shift keying, Gaussian MSK, M-ary QAM, performance of MSK modulation in slow-flat fading channels.

Equalization: Survey of equalization techniques, linear equalization, non-linear equalization, algorithms for adaptive equalization. Diversity Techniques, RAKE receiver.

9

UNIT III MOBILE RADIO PROPAGATION

Free space propagation model, reflection, diffraction, scattering, link budget design, outdoor propagation models, indoor propagation models, small scale multipath propagation, impulse model, small scale multipath measurements, parameters of mobile multipath channels, types of small scale fading.

UNIT IV CODING AND MULTIPLE ACCESS TECHNIQUES

Coding: Vocoders, linear predictive coders, selection of speech coders for mobile communication, GSM coders. **9**

Multiple access techniques: FDMA, TDMA, CDMA, SDMA, capacity of cellular CDMA.

UNIT V WIRELESS SYSTEMS AND STANDARDS

Second generation and third generation wireless network and standards, WLL, blue tooth, GSM, IS- 95 and DECT. World wide web – Wireless application protocol. **9**

UNIT VI STATE OF ART /ADVANCES (NOT FOR EXAMINATION)

Current and future wide band system- Cellular system concepts in recent real time applications - Spectrum allocation for wireless communication.

TOTAL: 45

TEXT BOOKS

1. Theodore S. Rappaport,"Wireless Communication Principle And Practice", 2nd Edition, Pearson Education India 2009.
2. Andreas F, Molisch, Johnwiley & Sons, 'Wireless Communications', Second Edition, Wiley Publication 2012.

REFERENCES

1. K.Lin.Du, M.N.S.Swamy,"Wireless Communication System", Cambridge University Press, 2010.
2. Jochen Schiller'Mobile Communications, Second Edition, Pearson Education, 2009.
3. Dharma Agarwal, Qing, An-Zeng," Introduction to Wireless and Mobile System", Engage Learing, 2010.
4. Michal .Fitz "Fundamentals of Communication System". Tata McGraw Hill. 2008.

13IC042 EMBEDDED SYSTEM DESIGN 3 0 0 3

OBJECTIVES

- To study the basic concept and various components within an embedded system.
- To learn the different techniques of inter facing between processors & peripheral device related to embedded processing.
- To understand the basic concepts of systems programming like operating system, assembler compliers etc and to understand the management task needed for developing embedded system.

OUTCOMES

At the end of the course the student should be able to

- Analyse the various features and various applications of embedded system.
- Use the programming concepts for various applications.
- Implement Real Time Operating Systems.

UNIT I INTRODUCTION TO EMBEDDED SYSTEM **9**

Introduction to functional building blocks of embedded systems – Register, memory devices, ports, timer-Timing diagram –Shared data problem - interrupt controllers using circuit block diagram representation for each category- Interrupt latency.

UNIT II PROCESSOR AND MEMORY ORGANIZATION **9**

Structural units in a processor; selection of processor & memory devices; shared memory; DMA; interfacing processor, memory and I/O units; memory management – Cache mapping techniques, dynamic allocation - Fragmentation.

UNIT III DEVICES, BUSES FOR DEVICES NETWORK AND ARM PROCESSOR **9**

I/O devices; timer & counting devices; serial communication using I^2C, CAN, USB buses; parallel communication using ISA, PCI, PCI/X buses, arm bus; interfacing with devices/ports, device drivers in a system – Serial port & parallel port. Processor and memory organization – data operation – flow of control – ARM bus.

UNIT IV I/O PROGRAMMING SCHEDULE MECHANISM **9**

Intel I/O instruction – Transfer rate, latency; interrupt driven I/O - Non-maskable interrupts; software interrupts, writing interrupt service routine in C & assembly languages; preventing interrupt overrun; disability interrupts. Multi threaded programming – Context switching, premature & non-premature multitasking.

Scheduling – Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, watch dog timers.

UNIT V REAL TIME OPERATING SYSTEM (RTOS) **9**

Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS – Interrupt handling, task scheduling; embedded system design issues in system development process – Action plan, use of target system, emulator, use of software tools- Debugging Strategies.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Simulation of Real Time Operating Systems application.

TOTAL: 45

TEXT BOOKS

1. Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata McGraw Hill, 2008.
2. Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2012.

REFERENCES

1. Dr. Arnold Berger,"Embedded Systems Design: An Introduction to Processes, Tools, and Techniques" CRC Press, 2010

2. Rob Toulson, Tim Wilmshurst, "Fast and Effective Embedded System Design" Elsevier Ltd., 2012.
3. Peter Marwedel,"Embedded System Design" Second Edition, Springer, 2011
4. Achin Rettberg, Rainer Domar,"Embedded system Design", Springer 2007.

13IC043 MODERN ELECTRONIC INSTRUMENTATION 3 0 0 3

OBJECTIVES

- To study the basic operation and working of digital voltmeter and multimeters.
- To understand the various types of display devices and recording devices.
- To study the concept of various modern instrumentation and control systems.
- To learn about the construction, characteristics and application of virtual instrumentation.

OUTCOMES

At the end of the course the student should be able to

- Analyse the basic operations and characteristics of advanced instruments
- Solve and design for various applications of virtual instruments.
- Analyse the various recorders used in advanced instruments.

UNIT I DIGITAL INSTRUMENTS **9**

Digital voltmeters, Microprocessor based ramp type DVM and multimeters –Microprocessor based DMM with auto ranging and self diagnostic features – Digital IC tester – Digital phase meter- Frequency, period, time interval and pulse width measurement.

UNIT II DISPLAY AND RECORDING DEVICES **9**

Cathode ray oscilloscope – General purpose and advanced types – Sampling and storage scopes – Wave analyzers – Signal and function generators – Distortion factor meter – Q meter – Seven segment and dot matrix display – X-Y recorders – Magnetic tape recorders – Digital recording and data loggers.

UNIT III COMMUNICATION STANDARDS: RS 232 AND RS 485 **9**

Modern instrumentation and control systems – OSI model – EIA 232 Interface standard - EIA 485 Interface standard - EIA 422 Interface standard – 20 mA current loop – Bus types – I/O Bus, ISA Bus, PCI Bus -Serial Interface converters.

UNIT IV VIRTUAL INSTRUMENTATION **9**

Virtual instrumentation – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Review of software in virtual instrumentation - VI programming techniques – VI , sub VI, loops and charts ,arrays, clusters and graphs, case and sequence structures, formula nodes, string and file input / output.

UNIT V DAQ CARDS **9**

DAQ cards for VI applications – Requirements – DAQ modules with serial communication – Design of digital voltmeters with transducer input – Design of ON/OFF controller for temperature control applications.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Simulation of Microprocessor Based digital filter- Multi channel Data Acquisition System.

TOTAL: 45

TEXT BOOKS

1 Rick Bitter, Taqi Mohiuddin and Matt Nawrocki, "Labview Advanced Programming Techniques", Second Edition, CRC Press, 2007.
2 Albert D. Helfrick, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall PTR, 2013.

3 Kalsi H.S., "Electronic Instrumentation", Second Edition, Tata Mc Graw Hill Company, New Delhi, 2010.

REFERENCES

1 Sawhney.A.K., "A Course in Electrical & Electronic Measurement and Instrumentation", Dhanpat Rai & Company Private Limited, New Delhi, 18th Edition, 2007.
2 Janardan Prasad, M.N.Jayaswal, Vishnu Priye," Instrumentation and Process Control" K.International Pvt Ltd, 2009.

13IC044 REMOTE SENSING 3 0 0 3

OBJECTIVES

- To study the concept of remote sensing techniques.
- To learn the working operation of aerial photography.
- To understand the various types of satellites.
- To learn about the different instruments used in Remote Sensing.

OUTCOMES

At the end of the course the student should be able to

- Aware of Satellites and the technologies involved.
- Figure out the performance measures of aerial photography and instruments used.
- Absorb the basic concepts and principles of remote sensing.

UNIT I PRINCIPLES AND CONCEPTS **9**

Definition- Components of remote sensing –Energy source, electromagnetic spectrum, radiation principle, platforms and sensors - Active & passive remote sensing interference - Atmospheric effects on remote sensing – Energy interaction with earth surface feature - Data acquisition - Reflectance, spectral signature, resolution data analysis - Display forms - Importance of remote sensing - Synoptivity & reptivity-Limitation .

UNIT II AERIAL PHOTOGRAPHY **9**

Definition - Types of aerial photographs - Acquisition of photographic image – Geometric characteristics of vertical aerial photograph - Relief displacement - Height determination stereopair - Stereoscopy - Mono vision - Binoculars vision - Image characteristics - Interpretation -Fundamentals of photo interpretability - Qualifications of a good photo inter preter, satellite remote sensing .

UNIT III SATELLITE REMOTE SENSING **9**

Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT,SPOT & IPS resolution - Spectral, spatial, radio metric & temperal resolution - Microwave remote sensing – Digital image processing - Characteristics - Application of satellite imaging - Merits - Demerits - Comparison with aerial photographs- Concept of Microwave remote sensing.

UNIT IV INSTRUMETATION FOR REMOTE SENSING **9**

Imaging devices - Aerial camera - Different types - Multiband photographic optical sensors - Multi spectral scanner(MSS),thermal scanners, imaging radars - Imaging - Thermal infrared imaging, radar imaging-film for recording images - Black & white, colour & infrared films - Devices for analysing photographic images - Stereoscopes - Optical & electronic colour combiner.

UNIT V APPLICATION OF REMOTE SENSING TECHNIQUES **9**

Remote sensing & GIS, remote sensing application in water resources engineering – Landuse - Soil sciences – Geology, agriculture, forestry &Oceanography.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Simulation of Active, Passive, Optical Remote sensing, visible, infrared, thermal, sensors and characters.

TOTAL: 45

TEXT BOOK

1. John A.Richards "Remote Sensing Digital Image Analysis: An Introduction" Published by Springer, Fifth Edition, 2012.

REFERENCES

1. Thomas Lillesand "Remote Sensing and Image Interpretation" Published by Wiley, Sixth Edition, 2007.
2. Games B.Campbell "Introduction to Remote Sensing", Published by The Guilford Press; Fifth Edition, 2011.

13IC045 VLSI DESIGN 3 0 0 3

OBJECTIVES

- To understand the different modes of operation in MOS technology.
- To understand the various design methodologies.
- To have a basic idea of CMOS and its design.
- To study the concept of modeling a digital system using Hardware Description Language.

OUTCOMES

At the end of the course the student should be able to

- Design the fabrication techniques.
- Analyse the various designing procedures.
- Adopt HDL language for projects.

UNIT I INTRODUCTION TO MOS TECHNOLOGY 9

MOS transistor – Modes of operation – NMOS and CMOS fabrication – Process parameters for NMOS and CMOS – Pass transistor – NMOS and CMOS inverter – Pull up and pull down ratio – Electrical properties of MOS circuits and device modelling.

UNIT II LAYOUT DESIGN 9

MOS & CMOS Layers – stick diagram – design rules & layout – subsystems design: switch logic – gate logic – other forms of logic- Combinational Logic Design example: Passing generator – Bus arbitration logic Multiplexer- Gray to binary code converter.

UNIT III DESIGN OF DIGITAL CIRCUITS AND CIRCUIT SYSTEMS 9

PLA – Finite state machine – PLA based finite state machine design – design of 4 bit shifter – design of ALU Subsystem: Adders – Multiplexers- memory: dynamic shift register – dynamic RAM cells – one transistor dynamic memory cell – 4*4 bit register array – RAM array.

UNIT IV CMOS CIRCUIT AND LOGIC DESIGN 9

Introduction – CMOS Logic gate design – Basic physical design of simple Logic gates – CMOS logic structure – Clocking strategies –I/O Structures.

UNIT V CIRCUIT DESIGN USING VHDL 9

EDA Tools- VHDL Code Structures – Data Types – Concurrent Code – Sequential Code – Signal and Variables – Simple Design Examples.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Simulation of SRAM, DRAM, ROM, Content Addressable Memory using FPGA.

TOTAL: 45

TEXT BOOK

1. Pucknell.D.A. and Eshraghian.K.,'Basic VLSI Design Systems and Circuits', III Edition, Prentice Hall India , 2005.

REFERENCES

1. K. Lal Kishore,"VLSI Design", I.K. International Publishing House Pvt. Ltd., 2010.
2. Charles H. Roth. "Digital System Design Using VHDL", PWS Publishing Company, 2008.
3. Kiran Kumar V. G, "Fundamentals of CMOS VLSI Design" Pearson Education, 2011.

13IC046 FUNDAMENTALS OF NANO SCIENCE 3 0 0 3

OBJECTIVES

- To learn about the basics of Quantum mechanics.
- To study about transportation in nanostructures.
- To understand the concept of fundamental electronic properties.
- To learn the basics and working operation of magnetic materials.

OUTCOMES

At the end of the course the student should be able to

- Discover a clear idea about the fundamentals of Nano particles.
- Gain knowledge on the characteristics of Nano science.
- Use the basic concept of optical properties in various applications.

UNIT I INTRODUCTION TO NANO SCIENCE **9**

Introduction to Quantum Mechanics - Schrodinger equation and expectation values - Solutions of the Schrodinger equation for free particle - particle in a box - particle in a finite well - Reflection and transmission by a potential step and by a rectangular barrier.

UNIT II TRANSPORT IN NANOSTRUCTURE **9**

Confinement and Transport in nanostructure - Current, Reservoirs and Electron channels, Conductance formula for nanostructures, Quantized conductance. Local density of states - Ballistic transport, Coulomb blockade, Diffusive transport, Fock space.

UNIT III ELECTRONIC PROPERTIES **9**

Free electron theory of metals - Band theory of solids - Bloch theorem, Kroning-Penne model, Metals and Insulators, Semiconductors: Classification - Transport properties - Size and Dimensionality effects - Band structures - Brillouin zones - Mobility, Resistivity, Relaxation time, Recombination centers, Hall effecs.

UNIT IV OPTICAL PROPERTIES **9**

Photoconductivity- Optical absorption & transmission – Photoluminescence – Fluorescence – Phosphorescence - Electroluminescence.

UNIT V MAGNETIC MATERIALS **9**

Basic Magnetic Phenomena – Diamagnetism – Paramagnetism – Ferromagnetism – Ferrimagnetism - Anti-ferromagnetism - Some examples of these materials and their applications

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Simulation of Mobility, Resistivity, Relaxation time, Recombination centers, Hall effects.

TOTAL: 45

TEXT BOOK

1. Bhusan "Handbook of Nanotechnology", Springer, Berlin Heidelberg New York, 2010.

REFERENCES

1. R. Shankar, "Principles of Quantum Mechanics", Springer London, Limited 2nd edition, 2012.
2. 2.Elwood D. Carlson "Encyclopedia of Nanotechnology", Nova Science Publishers, 2009.

CONTROL

13IC061 ROBOTICS AND AUTOMATION 3 0 0 3

OBJECTIVES

- To study the concepts of robotics and automation.
- To learn the working of robot.
- To understand the design methods of robot for automation.

OUTCOMES

At the end of the course Students should be able to

- Design the new technique for future use.
- Used for various application aspects.
- Understand the fundamentals of industrial operations using robotics.

UNIT I CLASSIFICATION OF ROBOTIC SYSTEMS **9**

Basic structure of a robot - Classification of robots: Cartesian, Cylindrical, Spherical, Articulated, SCARA. Accuracy, resolution and repeatability of robots. Robot application in manufacturing: Material transfers - Machine loading and unloading - Processing operations - Assembly and inspection.

UNIT II SENSORS AND VISION SYSTEMS **9**

Types of sensors, tactile sensors, proximity sensors and speed sensors – Encoder, resolvers – Tactile sensors – Touch sensors – Force and torque sensors - Vision systems: Image processing and analysis,Segmentation,Feature extraction, Object Recognition.

UNIT III DRIVES AND CONTROL SYSTEMS **9**

Hydraulic and Pneumatic systems: cylinders, control valves, hydro motor. Types of mechanical power drive, rotary to linear motion conversion mechanisms. Robot end effectors. Servomotors – operation, stepper motors - control loops using current and voltage amplifier. Robot controllers - configuration of robot controller

UNIT IV TRANSFORMATIONS AND KINEMATICS **9**

Homogeneous coordinates – Coordinate reference frames – Homogeneous transformations for the manipulator – The forward and inverse problem of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D-H matrices – Controller architecture.

9

UNIT V CASE STUDIES

Robots in manufacturing and non-manufacturing application – robot cell design –selection of robot - factory automation – FMS and CIM. Application of robots in material handing, processing operations, assembly and inspection – future applications of robots.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Recent techniques for Industrial application - Principle of Robot Application and Application Planning-Justification Of Robotics-robot safety- Non Industrial Application.

TOTAL: 45

TEXT BOOK

1 Mikell P Groover, "Automation Production Systems and Computer Integrated Manufacturing", Prentice-Hall India, New Delhi.2007.

REFERENCES

1. Robert H.Bishop, "Mechatronics Hand book", 2nd Edition CRC press, 2007.
2. Lorenzo Sciavicco, Luigi Vilani,"Robotics: modeling and planning and control", Springer, 2007.
3. J.Norberto Pries, "Industrial robotics programming building application for the factories of the Future", Springer, 2007.
4. R.K.Mittal and IJ.Nagrath, "Robotics and Control", Tata McGraw- Hill, 2007.

13IC062 INSTRUMENTATION SYSTEM DESIGN 3 0 0 3

OBJECTIVES

- To learn the basic operation and working of flow and temperature trainer kit.
- To study about various modern instrumentation and control systems.
- To understand the different types of valves and its application.
- To study about the construction, characteristics and types of pump.

OUTCOMES

At the end of the course the student should be able to

- Analyze the operations and workflow of various systems.
- Design the current applications.
- Explore the various controllers in different applications.

UNIT I DESIGN OF FLOW AND TEMPERATURE **9**

Orifice meter - design of orifice for given flow condition - design of rotameter - design of RTD measuring circuit - design of cold junction compensation circuit for thermocouple using RTD - Transmitters – zero and span adjustment in D/P transmitters and temperature transmitters.

UNIT II DESIGN OF PRESSURE AND LEVEL SENSOR **9**

Bourdon gauges - factors affecting sensitivity - design of Bourdon tube -design of Air purge system for level measurement. Basics of Pressure and level sensors.

UNIT III DESIGN OF CONTROL VALVES **9**

Control valves - design of actuators and positioners - types of valve bodies - valve characteristics - materials for body and trim - sizing of control valves - selection of body materials and characteristics of control valves for typical applications.

UNIT IV DESIGN OF PUMPS **9**

Types of pumps - pump performance - pipe work calculation - characteristics of different pumps - pump operation - maintenance - instruments used in pumping practice - pump noise and vibration - selection of pumps.

Electronic P+I+D controllers - design - adjustment of set point, bias and controller settings.

UNIT V MICROPROCESSOR BASED DESIGN **9**

Design of logic circuits for alarm and annunciator circuits, interlocks - design of microprocessor based system for data acquisition - design of microprocessor based P+I+D controller.

UNIT VI STATE OF ART/ADVANCES (NOT FOR EXAMINATION)

Simulation of Room Air Supply and air handling – Design of Air Dryers.

TOTAL: 45

TEXT BOOK

1. Michael D.Whitt, “Instrumentation and Control System Design”, Second Edition, International Society of Automation (ISA), 2012.

REFERENCES

1. Johnson.C.D, “Process Control Instrumentation Technology”, Prentice Hall of India, 2006.
2. Liptak B. ‘Process Measurement and Analysis’, 3rd Edition Chilton book company Radnor, pennsylvania, 1995.
3. Tatamangalam R., ‘Industrial Instrumentation Principles and Design’, Springer Verlog, 2000.

13EC069 MICRO ELECTRO MECHANICAL SYSTEMS 3 0 0 3

OBJECTIVES

- To study the fundamentals of Microsystems.
- To study on the various components used.
- To understand the different types of fabrication techniques.
- To learn the working operation of finite element method.

OUTCOMES

At the end of the course the student should be able to

- Analyse the concepts of various sensors.
- Conceptualize fabrication techniques.
- Use the numerical methods to solve equations.

UNIT I INTRODUCTION TO MICRO ELECTRO MECHANICAL SYSTEM 9

Microsystems versus MEMS-Micro fabrication-Smart Materials-Structures and Systems-Integrated Microsystems-Applications of Smart Materials and Microsystems.

UNIT II MECHANICS OF MICRO ELECTRO MECHANICAL SYSTEM DESIGN 9

Silicon Capacitive Accelerometer, Piezo resistive Pressure Sensor , Conductometric Gas Sensor, An Electrostatic Comb-Drive, A Magnetic Micro relay, Portable Blood Analyzer , Piezoelectric Inkjet Print Head, Micro mirror Array for Video Projection Smart Materials and Systems.

UNIT III MICRO FABRICATION TECHNIQUE 9

Silicon as a Material for Micromachining-Thin-Film Deposition-Lithography-Etching-Silicon Micromachining Specialized Materials for Microsystems- Advanced Processes for Micro fabrication.

UNIT IV MODELING OF SOLIDS IN MICROSYSTEMS 9

The Simplest Deformable Element: A Bar-Transversely Deformable Element: A beam-Energy Methods for Elastic Bodies-Heterogeneous Layered Beams-Bimorph Effect-Residual Stresses and Stress Gradients-Poisson Effect and the Anticlastic Curvature of Beams-Torsion of Beams and Shear Stresses-Dealing with Large Displacements-In-Plane Stresses.

UNIT V MODELING OF MICRO ELECTRO MECHANICAL SYSTEM THROUGH FINAL ELEMENT METHOD 9

Need for Numerical Methods for Solution of Equations: Variational Principles-Finite Element Method-Finite Element Model for Structures with Piezoelectric Sensors and Actuators-Analysis of a Piezoelectric Bimorph Cantilever Beam.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Semiconductor Devices-Electronics Amplifiers-Practical Signal Conditioning Circuits for Microsystem using simulation tools.

TOTAL: 45

TEXT BOOK

1. G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre : "Micro And Smart Systems" Wiley, India 2010.

REFERENCES

1. Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan, "Smart Material Systems and MEMS: Design and Development Methodologies", John Wiley & Sons Ltd, 2007.
2. Mohamed Gad-el-Hak**, "**MEMS Design and Fabrication", Second edition, CRC Press, 2010

13CS079 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 3 0 0 3

OBJECTIVES

- To study the basic concept of Artificial Intelligence.
- To have an idea about the various representation techniques used.
- To study the concept of expert systems.
- To learn about the various examples based on robotics.

OUTCOMES

At the end of the course the student should be able to

- Aware of the basic concepts of Artificial Intelligence.
- Outline the expert systems.
- Implement and sketch the above concepts in robotic applications.

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE **9**

Concept of AI, approaches – Application areas Problem formulation – Problem solving agents – Forward & Backward reasoning – Graphs & Trees – Measuring problem solving performance – Search Strategies – Genetic Algorithms, terminology.

UNIT II KNOWLEDGE REPRESENTATION **9**

Relational knowledge & Procedural knowledge Propositional Logic – Syntax & semantics – Inference rules – Inference methods – Knowledge engineering process – Handling uncertain knowledge – Bayesian networks – Learning – Pattern recognition.

UNIT III KNOWLEDGE BASED SYSTEMS **9**

Expert systems – Components, Characteristic features of expert systems – Rule based system architecture – Using domain knowledge – Expert system shell – Explaining the reasoning.

UNIT IV AI IN ROBOTICS **9**

State space search – Block word & robot example – Path selection – Monkey & Banana problem AND – OR graph – Means end analysis in a robotic problem – Robot problem solving as a production system – Triangle table – Robot learning – Robot task planning – Phases in task planning – Symbolic spatial relationships – Obstacle avoidance – Graph planning.

UNIT V MACHINE VISION **9**

Introduction – Functions in a vision system – Imaging devices – Lighting – A-D conversion – Quantization – Encoding image storage – Image data reduction – Segmentation techniques – Feature extraction – object recognition – training the vision system.

UNIT VI STATE OF ART/ ADVANCES (NOT FOR EXAMINATION)

Introduction to LISP: Syntax and Numeric Function-Basic List Manipulation Functions in LISP.

TOTAL: 45

TEXT BOOK

1. Stuart Russel, Peter Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, Prentice Hall, New Delhi, 2010.

REFERENCES

1. Michael, “Artificial Intelligence - A guide to intelligent systems” Pearson Education, Prentice Hall, New Delhi, 2008.
2. M. Tim Jones, “Artificial Intelligence – A Systems Approach”, Jones and Bartlett Publishers, LLC, 2009.