UNIVERSITY VISION AND MISSION

VISION

B.S. Abdur Rahman Institute of Science & Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned University
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global Institutions of Excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation

VISION AND MISSION OF THE DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

VISION

The Department aspires to excel in, providing quality education, training and research in the area of Electronics and Instrumentation Engineering to meet the industrial and societal needs

MISSION

- To provide quality education in the field of Electronics and Instrumentation Engineering by offering Under Graduate, Post Graduate and Doctoral Programs
- To impart technical knowledge and hands on experience, leadership and managerial skills to meet the current industrial and societal needs
- To enhance problem solving capabilities through design projects, internship and industrial projects
- To maintain active linkages with industries and research institutions
- To develop analytical skills, leadership quality and team spirit through balanced curriculum and a judicial mix of co-curricular, extra-curricular and professional society activities
- To enrich the knowledge and skills of faculty through continuous learning and active research

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
B. Tech. (Electronics and Instrumentation Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide a strong foundation in Mathematics and Basic Sciences to analyse and solve Electronics and Instrumentation Engineering Problems
- To give a broad theoretical and practical knowledge related to instruments, Control Systems and Automation
- To enable the students to have proficiency in system design tools and software packages related to Electronics & Instrumentation Engineering
- To inculcate the necessary knowledge and skill to design, operate and maintain process automation systems
- To train students in real time implementation of process control stations using industry standard Distributed Control System professionally and ethically
- To train the students to acquire communication skills to have an effective interaction globally
- To train students to take up and execute a project as a team

PROGRAMME OUTCOMES

- Graduates will have ability to communicate effectively in global scenario
- Graduates will have ability to use the fundamental knowledge in Mathematics and Science to solve problems in Electronics and Instrumentation Systems
- With the analytical knowledge and software skill, the Graduates will be able to execute industrial projects
- Graduates will be able to effectively carry out design, operation and maintenance of process automation in industries
- Graduates will be able to work in team and uphold organisational principles.
- Graduates will take up managerial, professional, ethical, social and economic responsibilities

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

REGULATIONS 2013
FOR
B.TECH. DEGREE PROGRAMMES

REGULATIONS - 2013 FOR
B.TECH. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme.

ii) **"Branch"** means specialization or discipline of B.Tech Degree Programme like Civil Engineering, Mechanical Engineering, etc.,

iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.,

iv) **"University"** means B.S.Abdur Rahman University.

v) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of B.S. Abdur Rahman University.

vi) **"Dean (Student Affairs)"** means the Dean (Students Affairs) of B.S.Abdur Rahman University.

vii) **"Controller of Examinations"** means the Controller of Examination of B.S. Abdur Rahman University, who is responsible for conduct of examinations and declaration of results.

2.0 ADMISSION

2.1a) Candidates for admission to the first semester of the eight semester B.Tech. degree programme shall be required to have passed the Higher Secondary Examination of the (10+2) curriculum (Academic stream) prescribed by the appropriate authority or any other examination of any university or authority accepted by the University as equivalent thereto.

2.1b) Candidates for admission to the third semester of the eight semester B.Tech. programme under lateral entry scheme shall be required to have passed the Diploma examination in Engineering / Technology of the Department of Technical Education, Government of Tamil Nadu or any other examination of any other authority accepted by the University as equivalent thereto.

2.2 Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination prescribed by the

University for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for plus two academic stream.

2.3 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the University from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. degree programmes in various branches of Engineering and Technology, each distributed over eight semesters with two semesters per academic year.

B.TECH. DEGREE PROGRAMMES:

1. Aeronautical Engineering
2. Automobile Engineering
3. Civil Engineering
4. Computer Science and Engineering
5. Electrical and Electronics Engineering
6. Electronics and Communication Engineering
7. Electronics and Instrumentation Engineering
8. Information Technology
9. Manufacturing Engineering
10. Mechanical Engineering
11. Polymer Engineering

4.0 STRUCTURE OF THE PROGRAMME

4.1 Every Programme will have a curriculum with syllabi consisting of theory and practical courses such as,

i) Basic Sciences (BS)

ii) Humanities & Social Sciences (HS)

iii) Management Sciences (MS)

iv) Engineering Sciences Fundamentals (ESF)

v) Engineering Core Courses (EC)

vi) Professional Electives (PE)

vii) General Electives (GE)

viii) Workshop practice, laboratory work, industrial training, seminar presentation, project work, etc.

4.2 Each course is normally assigned certain number of credits :

one credit per lecture period per week

one credit per tutorial period per week

one credit for two to three periods and two credits for four periods of laboratory or practical courses

one credit for two periods of seminar / project work per week

one credit for two weeks of industrial internship

4.3 Each semester curriculum shall normally have a blend of lecture courses not exceeding seven and practical courses not exceeding four.

4.4 For the award of the degree, a student has to earn a minimum total credits specified in the curriculum of the relevant branch of study. This minimum will be between 175 and 185 credits, depending on the program.

4.5 The medium of instruction, examinations and project report shall be English, except for courses on languages other than English.

5.0 DURATION OF THE PROGRAMME

5.1 A student is ordinarily expected to complete the B.Tech. programme in eight semesters (six semesters in the case of a lateral entry scheme), but in any case not more than 14 continuous semesters reckoned from the date of first admission (12 semesters in the case of lateral entry student).

5.2 Each semester shall consist of a minimum of 90 working days or 450 periods.

5.3 Semester end examination will normally follow immediately after the last working day of the semester.

6.0 CLASS ADVISOR AND FACULTY ADVISOR

6.1 CLASS ADVISOR

A faculty member will be nominated by the HOD as Class Advisor for the whole class (2nd to 8th semester).

He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

However, for the first semester alone the class advisors and faculty advisors will be nominated by first year coordinator.

6.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the students will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment every semester.

7.0 COURSE COMMITTEE

Common course offered to more than one discipline or group, shall have a "Course Committee", comprising all the faculty members 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 / Dean (Academic Affairs), depending on whether all the faculty members teaching the common course belong to the same department / different departments.

8.0 CLASS COMMITTEE

During first semester, a common Class Committee will be constituted for all branches by the Dean (Academic Affairs). During other semesters, separate Class Committees will be constituted by the respective Head of the Department of the students

8.1 The first semester Class Committee composition will be as follows:

i) Coordinator for the first semester shall be the Chairman of the class committee

ii) Course coordinators of all common courses.

iii) Faculty members of all individual courses.

iv) One male and one female first semester student of each class of B.Tech, program to be nominated by the first semester coordinator

v) All first semester class advisors and faculty advisors

8.2 The composition of the class committee for each branch of B.Tech, from 2nd to 8th semester, will be as follows:

i) One senior faculty member preferably not teaching to the concerned class, appointed as Chairman by the Head of the Department

ii) Faculty members of individual courses

iii) Two students, (preferably one male and one female) of the class per group of 30 students or part thereof, to be nominated by the Head of the Department, in consultation with the faculty advisors.

iv) All faculty advisors and the class advisor of the class

v) Head of the Department

8.3 The class committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment will be decided for the first, second and third assessments. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

8.4 During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

8.5 The class committee, excluding the student members and the invited members, shall meet within 10 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide the grades for students in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator. If the course is common to more than one branch of study, grades for such courses shall be finalized in the course committee meetings in consultation with the Dean (Academic Affairs).

9.0 REGISTRATION AND ENROLMENT

9.1 Except for the first semester, every student shall register for the ensuing semester during a specified week before the semester end examination of

the current semester. Every student shall submit a completed Registration form indicating the list of courses intended to be enrolled during the ensuing semester. Late registration with the approval of Dean (Academic Affairs) along with a late fee will be permitted up to the last working day of the current semester.

9.2 From the second year onwards, all students shall pay the prescribed fees for the year on a specific day at the beginning of the semester confirming the registered courses. Late enrolment along with a late fee will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

9.3 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

9.4 A student should have registered and enrolled for all preceding semesters before registering for a particular semester.

10.1 CHANGE OF A COURSE

A student can change an enrolled course within 15 days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

10.2 WITHDRAWAL FROM A COURSE

A student can withdraw from an enrolled course at any time before the second assessment for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

11.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

A student can avail a onetime temporary break of study covering the current semester and/or next semester period with the approval of the Head of the Institution at any time before the start of third assessment of current semester, within the maximum period of 14 or 12 semesters as the case may be. If any student is debarred for want of attendance or suspended due to any act of indiscipline it will not be considered as break of study.

A student availed break of study has to rejoin only in the same semester from where he left.

12.0 CREDIT LIMIT FOR ENROLMENT & MOVEMENT TO HIGHER SEMESTER

12.1 A student can enroll for a maximum of 30 credits during a semester including redo courses.

12.2 The minimum credit requirement to move to the higher semester is

- Not less than a total of 20 credits, to move to the 3rd semester
- Not less than a total of 40 credits, (20 for lateral entry) to move to the 5th semester
- Not less than a total of 60 credits, (40 for lateral entry) to move to the 7th semester

12.3 However, a student who has secured "I" grade (due to shortage of attendance) in all the courses of a particular semester is not eligible to move to the next higher semester.

13.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

13.1 Every theory course shall have a total of four assessments during a semester as given below:

Assessment No.	Course Coverage in Weeks	Duration	Weightage of Marks
Assessment 1	1 to 4	1.5 hours	15%
Assessment 2	5 to 8	1.5 hours	15%
Assessment 3	9 to 12	1.5 hours	15%
Attendance #	-	-	5%
Semester End Exam	1 to 18 (full course)	3 hours	50 %

\# 76-80% - 1 Mark ; 81-85 - 2 Marks ; 86-90 - 3 Marks ; 91-95 - 4 Marks and 96 - 100 - 5 Marks

13.2 Appearing for semester end examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

13.3 Every practical course will have 60% weightage for continuous assessment and 40% for semester end examination. However, a student should have secured a minimum of 50% marks in the semester end practical examination.

13.4 In the case of Industrial training, the student shall submit a report, which will be evaluated along with an oral examination by a committee of faculty members, constituted by the Head of the department. A progress report from the industry will also be taken into account for evaluation.

13.5 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student(s), an oral examination (viva-voce) will be conducted as the semester end examination, for which one external examiner, approved by the Controller of Examinations, will be included. The weightage for periodic review will be 50% and remaining 50% for the project report and Viva Voce examination.

13.6 Assessment of seminars and comprehension will be carried out by a committee of faculty members constituted by the Head of the Department.

13.7 The continuous assessment marks earned for a course during his/her first appearance will be used for grading along with the marks earned in the semester-end examination / arrear examination for that course until he/she completes.

14.0 SUBSTITUTE EXAMINATIONS

14.1 A student who has missed, for genuine reasons, a maximum of one of the four assessments of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident or admission to a hospital due to illness, etc. by a committee constituted by the Dean of School for that purpose.

14.2 A student who misses any assessment in a course shall apply in a prescribed form to the Head of the department / Dean within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

15.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

15.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the University in approved events etc.) to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

15.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the class advisor. The class advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department. Thereupon, the Dean (Academic Affairs) shall announce, course-wise, the names of such students prevented from writing the semester end examination in each course.

15.3 A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

15.4 A student who is awarded "U" or “AB” grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course during summer term / regular semester. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the end-semester (re-do) examination. If any student obtained "U" grade during summer term course, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

15.5 If a student with "U" or “AB” grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will be awarded "I" grade in that course.

16.0 SUMMER TERM COURSES

16.1 A student can register for a maximum of three courses during summer term, if such courses are offered by the concerned department during the summer term. Students may also opt to redo such courses during regular semesters.

16.2 The Head of the Department, in consultation with the department consultative committee may arrange for the conduct of a few courses during the summer term, depending on the availability of faculty members during summer and subject to a specified minimum number of students registering for each of such courses.

16.3 However, in the case of students who have completed eighth semester, but having arrears in the earlier semesters in a maximum of two courses, summer courses may be offered, even if less than minimum students are registering for the course.

16.4 The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a summer term course or for substitute examination.

17.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

17.1 All assessments of a course will be made on absolute marks basis. However, the Class Committee without the student members and the invited members shall meet within 10 days after the semester-end examination and analyze the performance of students in all assessments of a course and award letter grade. The letter grades and the corresponding grade points are as follows:

Letter Grades	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
I	--
W	--
AB	--

"W" denotes withdrawal from the course

"I" denotes inadequate attendance in the course and hence prevented from writing semester-end examination.

"U" denotes unsuccessful performance in the course.

"AB" denotes Absent for the semester end examination

17.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student.

17.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department and declared by the Controller of Examinations.

17.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester-end theory examination answer scripts of courses, on payment of prescribed fees, through proper application to Dean (Academic Affairs). The concerned HOD shall constitute a revaluation committee consisting of Chairman of the class committee as convener, the faculty member of the course and a senior member of faculty knowledgeable in that course. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

17.5 After results are declared, grade sheets shall be issued to each student, which will contain the following details. The list of courses enrolled during the semester including summer term courses, if any, and the grade scored, the Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses, if any.

If Ci, is the number of credits assigned for the ith course and GPi is the Grade Point in the ith course

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i} \qquad Where\ \ n = number\ of\ courses$$

The Cumulative Grade Point Average CGPA shall be calculated in a similar manner, considering all the courses enrolled from first semester.

"I" and **"W"** grades will be excluded for calculating GPA .

"U", "I", "AB" and **"W"** grades will be excluded for calculating CGPA

17.6 After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA.

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in the first appearance and completing the programme within the normal 8 or 6 (for lateral entry) semesters
First Class	6.50 and above and completing the programme within a maximum of 10 or 8 (for lateral entry) semesters.
Second Class	All others

However, to be eligible for First Class with Distinction, a student should not have obtained U or I grade in any course during his/her study and should have completed the U.G. Programme within a minimum period covered by the minimum duration plus authorized break of study, if any (clause 11). To be eligible for First Class, a student should have passed the examination in all courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

18.0 ELECTIVE CHOICE: OPTION TO DO PROJECT ALONE IN FINAL SEMESTER

18.1 Apart from the various elective courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department, during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

18.2 In the curriculum of eighth Semester, along with the project work, if two elective courses alone are listed, then the Dean (Academic Affairs) may permit a

student, as per approved guidelines, on the recommendation of the Head of the department, to do a full semester major industrial project work. In such a case, the above two elective courses or any other two elective courses in lieu thereof have to be enrolled during any semester including the summer, preceding or succeeding the project work, if offered.

19.0 PERSONALITY AND CHARACTER DEVELOPMENT

19.1 All students shall enroll, on admission, in any of the personality and character development programmes, NCC / NSS / NSO / YRC / Rotaract and undergo practical training.

- **National Cadet Corps (NCC)** will have to undergo specified number of parades.
- **National Service Scheme (NSS)** will have social service activities in and around Chennai.
- **National Sports Organization (NSO)** will have sports, games, drills and physical exercises.
- **Youth Red Cross (YRC)** will have social service activities in and around Chennai.
- **Rotaract** will have social service activities in and around Chennai.

20.0 DISCIPLINE

20.1 Every student is required to observe disciplined and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

20.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HODs will be referred to a Discipline and Welfare Committee, nominated by the Vice-Chancellor, for taking appropriate action.

21.0 ELIGIBILITY FOR THE AWARD OF DEGREE

21.1 A student shall be declared to be eligible for the award of B.Tech. degree provided the student has:

i) successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 14 semester (12 semesters for lateral entry) from the date of admission, including break of study.

ii) no disciplinary action pending against him/her.

21.2 The award of the degree must have been approved by the University.

22.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

CURRICULUM AND SYLLABI FOR B.TECH. ELECTRONICS & INSTRUMENTATION ENGG (Eight Semesters / Full Time)

CURRICULUM

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	BS	MAB1181	Algebra, Geometry and Calculus	3	1	0	4
2	HS	ENB1181 FRB1181 ISB1181	English* French* Arabic*	3	0	0	3
3	BS	PHB1181	Physics	3	0	0	3
4	BS	CHB1181	Chemistry	3	0	0	3
5	ESF	GEB1101	Engineering Graphics	2	0	3	3
6	HS	SSB1181	Introduction to Economics	3	0	0	3
7	BS	PHB1182	Physics Lab	0	0	2	1
8	BS	CHB1182	Chemistry Lab	0	0	2	1
9	ESF	GEB1102	Basic Engineering Practices Laboratory	0	0	2	1
10	ESF	GEB1103	Computer Programming & Applications	2	0	2	3
							25

* Any one language

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	BS	MAB1282	Advanced Calculus	3	1	0	4
2	BS	CHB1287	Chemistry of Electronic Materials	3	0	0	3
3	HS	SSB1182	Sociology, Ethics and Human Values	3	0	0	3
4	ESF	GEB1211	Basic Engineering Mechanics	3	1	0	4
5	EC	EIB1211	Electrical Circuit Analysis	3	1	0	4
6	EC	EIB1212	Electron Devices	3	0	0	3

7	HS	ENB1282	Written communication	0	0	2	1
8	EC	EIB1213	Electrical Circuits and Devices Laboratory	0	0	3	1
9	BS	CHB1288	Chemistry for Electronic Materials Laboratory	0	0	2	1
							24

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	BS	MAB2181	Transforms and Applications	3	1	0	4
2	HS	SSB2181	Law for Engineers	3	0	0	3
3	EC	EIB2101	Analog & Linear Integrated Circuits	3	1	0	4
4	EC	EIB2102	Transducer Engineering	3	0	0	3
5	EC	EEB2181	Electrical Machines	3	0	0	3
6	EC	CSB2183	Object Oriented Programming	3	0	0	3
7	HS	ENB2181	Oral Communication	0	0	2	1
8	EC	EIB2103	Analog & Linear Integrated Circuits Laboratory	0	0	3	1
9	EC	EIB2104	Transducer Laboratory	0	0	3	1
10	EC	CSB2184	Object Oriented Programming Laboratory	0	0	3	1
							24

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	BS	MAB2283	Applied Numerical Methods	3	1	0	4
2	EC	EIB2211	Electrical Measurements and Instruments	3	0	0	3
3	EC	EIB2212	Electronic Instrumentation	3	0	0	3
4	EC	EIB2213	Digital Electronics	3	1	0	4

5	EC	EIB2214	Industrial Instrumentation - I	3	0	0	3
6	BS	LSB2181	Biology for Engineers	3	0	0	3
7	HS	ENB2282	Confidence Building & Behavioral Skills	0	0	2	1
8	EC	EIB2215	Digital Electronics Laboratory	0	0	3	1
9	EC	EIB2216	Industrial Instrumentation Laboratory -I	0	0	3	1
							23

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	EC	EIB3101	Control System	3	1	0	4
2	EC	EIB3102	Industrial Instrumentation - II	3	0	0	3
3	EC	EIB3103	Microprocessor and Microcontroller	3	0	0	3
4	EC	EIB3104	Industrial Drives and Control	3	0	0	3
5	MS	MSB3181	Management of Business organization	3	0	0	3
6	PE		Professional Elective I	3	0	0	3
7	HS	ENB3181	Career Building & People Skill	0	0	2	1
8	EC	EIB3105	Control system Laboratory	0	0	3	1
9	EC	EIB3106	Industrial Instrumentation Laboratory-II	0	0	3	1
10	EC	EIB3107	Microprocessor and Microcontroller Laboratory	0	0	3	1
							23

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	EC	EIB3211	Process Control	3	1	0	4
2	EC	EIB3212	Digital Signal Processing	3	1	0	4
3	EC	EIB3213	Instrumentation System Design	3	0	0	3
4	BS	GEB3201	Environmental Science & Engineering	3	0	0	3
5	PE		Professional Elective II	3	0	0	3

6	PE		Professional Elective III	3	0	0	3
7	EC	EIB3214	Process Control Lab	0	0	3	1
8	EC	EIB3215	Design Project Lab	0	0	3	1
							22

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	EC	EIB4101	Analytical Instrumentation	3	0	0	3
2	EC	EIB4102	Programmable Logic Controller and Distributed Control System	3	0	0	3
3	EC	EIB4103	Computer Control of Processes	3	1	0	4
4	PE		Professional Elective IV	3	0	0	3
5	PE		Professional Elective V	3	0	0	3
6	GE		General Elective I	3	0	0	3
7	EC	EIB4104	Mini Project / Design / Fabrication	0	0	2	1
8	EC	EIB4105	Programmable Logic Controller and Distributed Control System Laboratory	0	0	3	1
9	EC	EIB4106	Computer Control of Process Laboratory	0	0	3	1
							22

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PE		Professional Elective VI	3	0	0	3
2	GE		General Elective II	3	0	0	3
3	EC	EIB4211	Project	0	0	18	9
							15

Total Credits: 178

PROFESSIONAL ELECTIVES

Sl. No.	Course Group	Course Code	Course Title
			GROUP 1
1	PE	EIBX01	Biomedical Instrumentation
2	PE	EIBX02	Fiber Optic and Laser Instrumentation
3	PE	EIBX03	Introduction to MEMS
4	PE	EIBX04	Telemetry and Telecontrol
			GROUP 2
1	PE	EIBX05	Power Plant Instrumentation
2	PE	EIBX06	Sensors for Engineering Applications
3	PE	EIBX07	Ultrasonic Instrumentation
4	PE	EIBX08	Marine Control Engineering and Automation
			GROUP 3
1	PE	EIBX09	Embedded System and RTOS
2	PE	EIBX10	Robotics and Automation
3	PE	EIBX11	Applied soft computing for Instrumentation Engineers
4	PE	EIBX12	Computational Methods of Optimization
			GROUP 4
1	PE	EIBX13	Virtual Instrumentation
2	PE	EIBX14	VLSI Design
3	PE	EIBX15	Instrumentation and Control in Paper and Pulp Industries
4	PE	EIBX16	Instrumentation and Control in Petrochemical Industries
5	PE	EIBX17	Instrumentation and Control in Iron and steel Industries
			GROUP 5
1	PE	EIBX18	Fault Detection and Diagnosis
2	PE	EIBX19	Modern Control System
3	PE	EIBX20	Adaptive Control
4	PE	EIBX21	Intelligent Process Automation

GROUP 6

1	PE	EIBX22	Optimal Control
2	PE	EIBX23	Robust Control
3	PE	EIBX24	Advanced Control System
4	PE	EIBX25	Modeling and Simulation

GENERAL ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	Offering Department
1.	GE	GEBX01	Disaster Management	Civil
2.	GE	GEBX02	Nano Technology	Physics
3.	GE	GEBX03	Control Systems	EEE
4.	GE	GEBX04	Green Design and Sustainability	Civil
5.	GE	GEBX05	Knowledge Management	CSE
6.	GE	GEBX06	Appropriate Technology	Civil / Mechanical
7.	GE	GEBX07	System Analysis and Design	Mechanical
8.	GE	GEBX08	Value Analysis and Engineering	Mechanical
9.	GE	GEBX09	Optimization Techniques	Mathematics
10.	GE	GEBX10	Engineering System Modeling and Simulation	Mechanical
11.	GE	GEBX11	Supply Chain Management	CBS
12.	GE	GEBX12	Total Quality Management	Mechanical
13.	GE	GEBX13	Energy Studies	Mechanical
14.	GE	GEBX14	Robotics	Mechanical
15.	GE	GEBX15	Cyber security	IT
16.	GE	GEBX16	Usability Engineering	CSE
17.	GE	GEBX17	Industrial Safety	Mechanical

SEMESTER I

MAB1181 ALGEBRA, GEOMETRY AND CALCULUS

L	T	P	C
3	1	0	4

OBJECTIVES:

The course is aimed at

- developing the skills of engineering students in the basics of chosen topics of Mathematics that are imperative for effective understanding of engineering subjects.
- laying the foundation for learning further topics of Mathematics in higher semesters in a graded manner.
- enabling the learners to appreciate the important role of mathematical concepts in engineering applications.

MODULE I MATRICES **8**

Eigenvalue Problems – Eigenvalues and Eigenvectors of a real matrix, Engineering Applications –Properties of Eigenvalues and Eigenvectors – Cayley Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II VECTOR ALGEBRA **6**

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl.

MODULE III THREE DIMENSIONAL ANALYTICAL GEOMETRY **8**

Direction cosines & ratios – angle between two lines – equations of a plane – equations of a straight line - coplanar lines - shortest distance between skew lines – sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE IV DIFFERENTIAL GEOMETRY **7**

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes & evolutes – envelopes – properties of envelopes and evolutes.

MODULE V MULTI-VARIATE FUNCTIONS **8**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobians - Taylor's series expansion – maxima and minima – Lagrange's multiplier method.

MODULE VI ORDINARY DIFFERENTIAL EQUATIONS **8**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined co-efficients, method of variation of parameters.

L – 45; T – 15; Total Hours– 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., "Higher Engineering Mathematics" (42nd edition), Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V, "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.

OUTCOMES:

On completion of the course the students will be able to

- solve Eigenvalue and Eigenvector problems
- solve three dimensional geometry problems.
- use differential calculus for solving problems pertaining to engineering applications.

ENB1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable students to use language appropriately and effectively
- To help learners improve their vocabulary and to enable them speak fluently and appropriately in different contexts.
- To help students develop listening skills for academic and professional purposes
- To develop reading comprehension skills and enhance their ability to read official documents.
- To develop their creative thinking and practice creative writing.

MODULE I BASIC LANGUAGE SKILLS AND GRAMMAR 4

Conducting a language proficiency test in the language laboratory to assess the use of various parts of speech, vocabulary, phrasal verbs and idiomatic expressions of students.

MODULE II LISTENING 8

Listening to BBC radio plays and VOA special lessons to teach Phonetics, accent and intonation of spoken English

Appreciation and critical review of popular movies like 'My Fair Lady', 'Sound of Music'. (Excerpts from the movies) - Historical/popular speeches made by Winston Churchill, Abraham Lincoln (Gettysberg's Address), Swami Vivekananda.

MODULE III SPEAKING 8

(a) Self introduction – pair work – introducing one another – short conversations – exchanging opinions – agreement /disagreement

(b) Short presentation (extempore speech) based on visuals – Personal narrations

MODULE IV READING 8

Newspaper articles, circular, notices – Note making – vocabulary extension – Critical review of newspaper articles.

(a) Science fiction- Issac Asimov's "The Dead Past"(Abridged version) - Wings of Fire – Creative thinking – retelling a story with different ending; critical appreciation of plot and characters

MODULE V CREATIVE WRITING 8

(a) Writing slogans for Advertisements

(b) Writing descriptive paragraphs based on visuals

MODULE VI ENGLISH FOR ACADEMIC AND BUSINESS PURPOSES 9

(a) English for academic purpose: letters to the editor, letter seeking permission for industrial visit, letter inviting a dignitary for technical symposium

(b) English for Business purpose: Telephone etiquette – telephone conversations – taking and leaving phone messages.

Total Hours: 45

REFERENCES:

1. Mohan, Krishna, Meera Bannerjee, 'Developing Communication Skills', Macmillan India Ltd. Chennai (2001).
2. Sen , Leena 'Communication Skills' Prentice Hall, New Delhi (2004).
3. Rutherford , Andrea J. 'Basic Communication Skills For Technology' Pearson Education Asia (2002).
4. Grant Taylor, ' English Conversation Practice' Tata Mcgraw Hill , New Delhi (2001)
5. P.K.Dutt, G. Rajeevan and C.L.N. Prakash, 'A Course in Communication Skills', Cambridge University Press, India (2007).

OUTCOME:

- After completion of the course, students will have the ability to communicate correctly and effectively in academic and professional contexts through exposure and practice in LSRW skills.

FRB1181	FRENCH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve their proficiency in French language.
- To empower them for successful communication in their professional contexts.

DOSSIER 0 FENÊTRE SUR… 7

Contenus –l'alphabet - se présenter – les langues – les nationalités – les nombres de 0 à 60 – les adjectifs de nationalités – les verbes : s'appeler, être.

L'acte de parole

DOSSIER 1 LES UNS, LES AUTRES…. 12

Contenus - Les salutations (formelles et informelles) - les jours de la semaine – Les articles définis – les adjectifs possessifs – la négation (ne…..pas) – les verbes : avoir.

Demander quelque chose – les mois de l'année – les nombres de 70 à 99 – les articles indéfinis – l'adjectif interrogatif (quel, quelle)

Quelques événements culturels – donner des informations personnelles – indiquer ses gouts – l'expression des gouts – les prépositions (les noms de pays).

L'acte de parole

DOSSIER 2 ICI /AILLEURS 12

Contenus – Parler de sa ville – Donner/ Demander des explications – les prépositions de lieu – articles contractés – pourquoi / parce que

Auberges de jeunesse et hôtels – s'informer sur un hébérgement- quelques verbes et indications de direction – quelques formules de politesse.

Le code postal et les départements le libellé d'une adresse en France – Ecrire une carte postale – Dire le temps qu'il fait – les adjectifs démonstratifs - Formules pour commencer / terminer.

L'acte de parole

DOSSIER 3 SOLO OU DUO **14**

Contenus – Les animaux de compagnie les animaux préférés des Français - parler de sa profession – les professions - les activités sportifs - les noms animaux – les verbes : aimer , adorer, détester, faire, aller.

Nouveaux mode de rencontres – caractériser une personne (physique et psychologique) – les adjectifs qualificatifs – les pronoms toniques.

Les sorties – proposer, refuser, accepter une sortie – fixer un rendez-vous – inviter – Donner des instructions – L'impératif : 2^{e} personne – Le pronom on=nous – Les verbes : Pouvoir, vouloir, devoir.

L'acte de parole

L'examen oral

Total Hours: 45

TEXT BOOK:

1. Alter EGO I – Goyal – Langers (0 – 5 Lessons)

OUTCOMES:

On completion of the course,

- The students will be able to deal with their clients effectively at global level.
- Their proficiency in French Language will have improved.

ISB1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.

Listening and Reading.

Audio & Video aided listening, Tajweed listening,

Writing Arabic Alphabets (connected & unconnected).

Introducing words.

Reading simple sentences.

Learning names of the things in and around the class room.

Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs

Communicating Simple sentences.

Jumla' Ismiyya and Jumla' Fi'liyya

Situational Conversation:

Greetings, Introduction.

Classroom, College, Picnic.

Dining and Kitchen.

Reading skills.

Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.

Audio aids.

Writing Simple sentences.

Communicating ordinal and cardinal numbers.

Situational communication:

Playground, library.

Forms of plural – Sample sentences.

Introduction to tenses.

Exercises.

MODULE IV FUNCTIONAL ARABIC **8**

Communication:

Family, travel

Market, Prayer hall

Writing skills:

Note making.

Sequencing of sentences.

Developing answers from the questions.

Exercises.

MODULE V TECHNICAL ARABIC **8**

Importance of technical communication.

Reading and writing skills.

Audio & Video aided listening.

Introduction to Arabic terms related to administration.

Situation communication:

Air travel, Office administration,

passport, visa.

Exercises.

MODULE VI TECHNICAL ARABIC **7**

Situation communication:

Contractual work, machineries and equipments..

Computer, internet browsing.

Banking,

Exercises.

Total Hours: 45

TEXT BOOK:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

PHB1181	PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic physics concepts relevant to Engineering and Technology students.
- To get familiarize with solving problems in basic physics.
- To acquaint applications of physics for Engineering issues.

MODULE I PROPERTIES OF MATTER **7**

Elasticity – Stress strain diagram – Factors affecting elasticity – Twisting couple on a wire – Shaft – Torsion pendulum – Depression on a cantilever – Young's modulus by cantilever – Uniform and non-uniform bending – Viscosity.

MODULE II CRYSTAL PHYSICS **6**

Introduction – Space lattice – unit cell – Bravais lattices – Miller Indices for cubic crystals – Inter planar spacing in cubic lattice – Simple crystal structures – SC, BCC, FCC and HCP structures – Atomic radius, coordination number, Packing factor calculation – Crystal imperfections.

MODULE III QUANTUM PHYSICS **7**

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jeans law from Planck's theory – Compton effect – Theory and experimental verification – Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schroedinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box.

MODULE IV WAVE OPTICS **9**

Interference theory – Air wedge – Michelson interferometer – Diffraction – Fresnel and Fraunhofer diffraction - Polarization – Double refraction – Theory of plane polarized, circularly polarized and elliptically polarized light – Quarter wave plate, Half wave plate – Production and detection of plane, circularly and elliptically polarized lights – Photoelasticity – Photo elastic effect – Stress optic law – Effect of stressed model in a plane polariscope (qualitative) –Photo elastic bench.

MODULE V LASER & FIBRE OPTICS **9**

Principle of spontaneous emission and stimulated emission - Characteristics of laser light -Einstein's A & B coefficients (derivation) – Population inversion - pumping - Nd:YAG laser – CO2 laser – Applications – Material processing and holography (construction and reconstruction of hologram)- Optical fibre – Principle and propagation of light in optical fibers – Numerical aperture and acceptance angle – Types of optical fibers - applications – Fibre optic communication system (block diagram only)- Fibre optic sensors (displacement and pressure sensors (qualitative), Medical endoscope.

MODULE VI ULTROSONICS AND NDT **7**

Ultrasonics – Production – Magnetostriction and piezo electric methods – Properties of ultrasonic waves – Detection of ultrasonic waves – Applications –Ultrasonic interferometer- Acoustical grating – SONAR – Depth of sea – Measurement of velocity of blood flow – Non Destructive Testing (NDT) methods – Ultrasonic flaw detector – A,B & C scanning methods.

Total Hours: 45

TEXT BOOKS:

1. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.

REFERENCES:

1. Uma Mukherji, "Engineering Physics", Narosa Publishing House, New Delhi, 2007.
2. Charles Kittel, "Introduction to solid state physics", 7th Edition, John Wiley & sons (ASIA) Pvt. Ltd, 2008.
3. Avadhanulu M.N., "Engineering Physics", 1st Edition, S.Chand & Company Ltd., New Delhi, 2007.
4. Schiff, "Quantum Mechanics", 3rd Edition, Tata McGraw-Hill Education, 2010.
5. Rajendran V. and Marikani A., "Applied Physics for Engineers", 3rd Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2003.

6. William T. Silfvast, “Laser Fundamentals”, 2nd edition, Cambridge University Press, 2004.

7. Arumugam M., “Engineering Physics”, 5th Edition, Anuradha Agencies, 2003.

OUTCOMES:

At the end of the course, the students will be able to

- Apply the knowledge of properties of matter in Engineering Mechanics and Fluid Dynamics.
- Characterize Engineering materials
- Use Lasers for Fiber Optics Technology and Material Processing
- Do non-destrictive testing using Ultrasonic Techniques

CHB1181	CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make students conversant with the

- Water quality for potable and industrial purposes.
- Different engineering materials, their physico-chemical properties and specific applications.
- Concept of electrochemistry, corrosion and theories of corrosion.
- Principles of spectroscopy and applications.
- Basic principles of green chemistry and the need for green processes in industries.

MODULE I WATER TECHNOLOGY 8

Introduction – Impurities present in water – Hardness, Types of Hardness, Estimation of Hardness (EDTA method) (Problems) – Alkalinity, Estimation of Alkalinity – Disadvantages of hard water in industries – Conditioning methods: external treatment method: Ion exchange method – internal treatment: colloidal, phosphate, calgon, carbonate methods – drinking water standards (BIS) – treatment of domestic water: screening, sedimentation, coagulation, filtration, disinfection: by chlorination, UV treatment, ozonization – desalination and reverse osmosis (principle only).

MODULE II ENGINEERING MATERIALS 8

Abrasives: Moh's scale of hardness – natural abrasives: diamond, corundum, emery, garnets and quartz – artificial abrasives: silicon carbide, boron carbide.

Refractories: characteristics, classification – acidic, basic and neutral refractories, properties – refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling – general method of manufacture of refractories, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Nanomaterials: Definition – types of Nanomaterials; nanofilms, nanowires, carbon nanotubes, quantum dots and fullerenes (C_{60}) – Size and shape

dependent optical, electrical, thermal and mechanical properties; Synthesis of nanomaterials – Top down and bottom up approach; Applications of nanomaterials – Catalysis, Electronics and Telecommunication, Medicines, Composites and Energy.

MODULE III ELECTROCHEMISTRY AND CORROSION 9

Construction of a cell – Standard and single electrode potential – electrochemical series – EMF and its measurement – Nernst equation, application and problems – Types of electrodes: standard hydrogen electrode, calomel electrode, ion selective electrode - glass electrode and determination of pH using glass electrode – polarization, overvoltage, decomposition potential (statements only) – Conductometric and potentiometric titrations.

Corrosion: Definition – Dry corrosion and Wet corrosion with mechanisms – Factors influencing corrosion.

MODULE IV CHEMISTRY OF POLYMERS 6

Monomers – functionality – polymer – degree of polymerization – classification – Polymerization techniques: addition, condensation and co-polymerization with example – mechanism of polymerization: free radical, cationic and anionic mechanism – thermoplastics and thermosetting plastics with examples – compounding and moulding of plastics: injection moulding and compression moulding.

MODULE V SPECTROSCOPY 9

Electromagnetic spectrum – absorption of radiation – electronic, vibrational, translational and rotational – intensities of spectral lines – Beer-Lambert's Law (Problems) – Colorimetric analysis: estimation of concentration of a solution – Flame photometry: theory, instrumentation (block diagram only) and application – UV-Visible spectroscopy: Principles, instrumentation (block diagram only) and simple applications – IR spectroscopy – simple applications only.

MODULE VI GREEN CHEMISTRY 5

Introduction – Significance – Industrial applications of green chemistry; Green technology – Latest green laboratory technique for saving experimental resources and infrastructural framework; Principles of green chemistry – R4M4

model (Reduce, Reuse, Recycle, Redesign; Multipurpose, Multidimensional, Multitasking, Multi-tracking) – Life cycle analysis technique (cradle to grave approach)

Total Hours: 45

TEXT BOOKS:

1. Jain P.C and Renuka Jain, 'Physical Chemistry for Engineers', Dhanpat Rai and Sons, New Delhi. (2001).
2. Paul T. Anastas, John C. Warner, 'Green Chemistry: Theory and Practice', Oxford University Press, (1998).

REFERENCES:

1. Bahl B.S., Tuli and Arun Bahl, 'Essentials of Physical Chemistry', S. Chand and Company Ltd., New Delhi, (2004).
2. Kuriacose J.C. and Rajaram J, 'Chemistry in Engineering and Technology', Volume1, Tata McGraw- Hill publishing company, New Delhi, (1996).
3. Puri B.R., Sharma L.R. and Madan S. Pathania, 'Principles of Physical Chemistry', Shoban Lal Nagin Chand and Co., Jalandhar, (2000).

OUTCOMES:

At the end of the course, students will be able to

- estimate the degree of hardness in water; solve related problems and treatment methods for potable water.
- select materials for specific engineering applications.
- use electrochemistry principles to understand the mechanism of corrosion.
- analyze trace quantity of metals using instrumental methods.
- realise the need of green practices in industries.

GEB1101 ENGINEERING GRAPHICS **L T P C**
2 0 3 3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide an exposure to the appropriate standards for technical drawings
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, pictorial views and free hand drawing
- To introduce computerized drafting

MODULE I BASICS AND ENGINEERING CURVES **10**

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola

Special curves: Cycloid, epicycloid, hypocycloid, involutes, helix

MODULE II ORTHOGRAPHIC PROJECTION **8**

Orthographic projection – first angle, third angle projection methods, free hand sketching of orthographic views of simple machine parts as per first angle projection. Projection of points. Commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES **10**

Straight lines in first quadrant – true length and true inclinations, traces – rotating line and trapezoidal methods. Projection of plane lamina in first quadrant – trace of plane.

MODULE IV PROJECTION OF SOLIDS **10**

Projection of solids: Axis inclined to one reference plane only - prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **10**

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional views – true shape of sections - solids in simple position and cutting plane inclined to one reference plane only.

Development of surfaces: truncated solids - prism, pyramid, cone, cylinder, frustum of cone and pyramid.

MODULE VI PICTORIAL PROJECTIONS **12**

Isometric projection: isometric scale - isometric projection and view of prism, pyramid, cylinder, cone, frustums and truncated solids.

Perspective projection: prism, pyramid, cylinder, frustums – visual ray and vanishing point methods.

Total Hours: 60

TEXT BOOK:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 46th Edition, (2003)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2006)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

Students who complete this course will be able to:

- draw various views of engineering components
- graphically communicate their concepts and ideas on new designs

SSB1181 INTRODUCTION TO ECONOMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Primarily to give an overview of fundamentals of economics to the engineering students
- In particular
  - To introduce the basic concepts of demand, supply and equilibrium.
  - To familiarize on National Income concepts
  - To provide fundamental concepts of money, banking and exchange.
  - To give an idea on industrial sector, markets and trade.
  - To give an overview on five year plans, budget, policies and taxation.
  - To provide an overview of Indian economy and the role of engineers in economic development.

MODULE I INTRODUCTION **8**

Classification of economy – open and closed economy – sectors of economy – Basic principles of micro economics – supply ,demand and equilibrium, elasticity of demand- pricing models.

MODULE II NATIONAL INCOME DETERMINATION **7**

National Income concepts – GNP, GDP, disposable Income; Aggregate demand and Aggregate supply, macroeconomic equilibrium - concepts of MPS, APS, MPC APC, Inflation – prices indices WPI, CPI and Inflation control.

MODULE III MONEY AND BANKING **7**

Monetary system - Role of Central Bank – Monetary policy – Commercial banks, Development banks; Money market – the role of money.

MODULE IV INDUSTRY, MARKET AND TRADE **7**

Public and private sectors – Contribution to the national economy, Industrial policy. Markets – labor, capital and debt market. Trade: domestic and International trade.

MODULE V BUDGET, POLICIES AND INDICATORS 8

Economic development – Five year plans, Macro-economic indicators; Central budget: Government revenue-tax and non-tax revenue, government expenditures-plan and non-plan expenditures – Fiscal policy – The impact of the budget on the economy.

MODULE VI ECONOMIC GROWTH AND THE ROLE OF ENGINEERS 8

India Economy – the role of market in the Indian economy – Development in the post independence era – Growth of the economy, Globalization and liberalization – reforms made and their effects, challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

Total Hours : 45

REFERENCES:

1. Vanitha Agarwal, 'Macroeconomics: Theory and Practice', Pearson, (2010).
2. Dwivedi D.N, 'Macroeconomics: Theory and Policies', 3rd edn; McGraw Hill, (2010).
3. Samuelson,Paul A., 'Macroeconomics', 19th edn., TMH, (2009).
4. Gupta G.S, 'Macroeconomics: Theory and Applications', 3rd edn; TMH, (2007).

OUTCOMES:

- Students will have an exposure to the basic concepts of microeconomics and macroeconomics.
- Students will have gained knowledge in government budget, economic planning and its implementation, money, banking and trade.
- They will have learnt about the economic reforms introduced in Indian economy and the role of engineers towards the economic growth and development of the country.

PHB1182	PHYSICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the basic concepts of properties of matter, wave optics
- To understand the properties of ultrasonic and Laser.
- To understand the crystal growth technique.
- To correlate the experimental results with the theoretical values.

LIST OF EXPERIMENTS:

1. Torsional Pendulum- Determination of rigidity modulus of a given wire.
2. Determination of coefficient of viscosity of a liquid by Poiseuille's method .
3. Determination of Young's modulus of a beam using non – uniform bending method.
4. Determination of a thickness of a given wire – Air wedge.
5. Spectrometer- determination of wavelength of given source by using grating.
6. Determination of velocity of ultra sonic waves – Ultrasonic Interferometer.
7. Determination of numerical aperture and acceptance angle of an optical fiber.
8. Determination of particle size using Laser.
9. Growth of crystal by slow evaporation technique.
10. Determination of angle of divergence of Laser beam.
11. Photo electric effect experiment.

OUTCOMES:

On completion of this course, the student will know

- Properties of matter, wave optics and quantum physics
- Properties and application of Ultrasonic and Laser
- Principle and concept of crystal growth technique.

CHB1182	CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

To make students conversant with the

- estimation of hardness and TDS in water samples.
- Construction of cell and determination of EMF.
- Estimation of pH of solutions.
- Verification of Beer Lambert's law.

LIST OF EXPERIMENTS:

1. Estimation of hardness in domestic water.
2. Estimation of total dissolved solids (TDS) in domestic water
3. Construction and determination of emf of a cell.
4. Determination of single electrode potential.
5. Estimation of strong acid in the industrial effluents
6. Estimation of Fe^{2+} present in unknown sample – by Potentiometry
7. Verification of Beer-Lambert's law and estimation of Cu^{2+} present in unknown sample.
8. Estimation of Na and K present in the agricultural field – by flame photometry.
9. Study of effect of inhibitors in free radical polymerization (Demo)

OUTCOMES:

At the end of the course, students will be able to

- estimate the degree of hardness and TDS in water samples.
- construct and calculate EMF of cell.
- apply the concept of Beer lamberts law.

GEB1102	BASIC ENGINEERING PRACTICES LABORATORY	L T P C 0 0 2 1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mould preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC,MCCB,ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp.

ELECTRONIC ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Solderingand tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project

OUTCOMES:

Students who complete this course

- Should be able to appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Should be able to attend minor defects especially in items used in day to day life
- Should be aware of the safety aspects involved in using tools and instruments

GEB1103	COMPUTER PROGRAMMING & APPLICATIONS	L T P C 2 0 2 3

OBJECTIVES:

- Expose fundamental concepts and techniques in programming
- Give coverage on application logic in programming
- Focus on solving practical problems based on analyzing, designing, and implementing computer programs

MODULE I FUNDAMENTALS OF COMPUTERS **5**

Evolution – Generations - Classifications – Applications – Computer organization –Hardware in a typical computer Identification - Booting – Booting error messages - Number system - Number system conversions

MODULE II BASIC PROGRAMMING AND DEBUGGING **5**

Software types – Types of Operating systems - Software development steps – Information technology and internet - The programming tool - Structure of a basic program - Hello world program – Debugging it – Character set – Delimiters – Keywords, identifiers – Constants – Variables –- Tools and help features – Comments in a program

MODULE III INPUT AND OUTPUT **5**

Data types - Type conversions - Input/Output: Formatted functions – Unformatted functions – Library functions – Debugging the code – Systems software: Compiler – interpreter- linker – loader - Finding the correct answer given a code snippet and justifying it

MODULE IV PROBLEM SOLVING **5**

Problem solving techniques: Algorithm, flowchart – Pseudo-code – Examples of simple problems in algorithms and flowcharts – Sorting and Searching - Characteristics of a good program – Generations of programming language

MODULE V OPERATORS AND DECISION STATEMENTS **5**

Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators – If –if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement

MODULE VI ARRAYS AND LOOP CONTROL STATEMENTS 5

Arrays – Initialization – Definition – Characteristics – One dimensional array – Two dimensional arrays - Multi dimensional arrays – Predefined streams - Operation with arrays – Sorting and searching – Structures – Operations on structures

LIST OF EXPERIMENTS: 30

1. Computer organization –Hardware in a typical computer Identification – Booting - error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types Type conversions
5. Input/Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching

Total Hours: 60

TEXTBOOKS:

1. Ashok N Kamthane, “Computer Programming”, 2nd Edition, Pearson Education, 2012.
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, 7th Edition, Pearson, Education, 2012.

OUTCOMES:

Students who complete this course will be able to:

- Understand Modular design, logic flow, data abstraction
- Describe basic programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programmes developing cycle for different applications
- The students will be able to debug the programs while solving some practical problems in programming

SEMESTER II

		L	T	P	C
MAB1282	**ADVANCED CALCULUS**	**3**	**1**	**0**	**4**

OBJECTIVE:

The aim of the course is to

- train the students in additional areas of Engineering Mathematics, necessary for grooming them into successful engineers. The topics will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.

MODULE I DOUBLE INTEGRALS **7**

Double integration – Cartesian and Polar coordinates – change of order of integration – area as a double integral — change of variables between Cartesian and polar coordinates.

MODULE II TRIPLE INTEGRALS AND SPECIAL FUNCTIONS **7**

Triple integration in Cartesian coordinates - change of variables between cartesian, cylindrical and spherical polar coordinates - Beta and Gamma functions.

MODULE III VECTOR INTEGRATION **7**

Line, surface and volume integrals – Green's, Gauss Divergence and Stoke's theorems (without proof) – verification and evaluation of integrals using them.

MODULE IV ANALYTIC FUNCTION **8**

Analytic function - Necessary and Sufficient condition (Proof not included) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE V COMPLEX INTEGRATION **8**

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

MODULE VI PARTIAL DIFFERENTIAL EQUATIONS 8

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 partial differential equations of second and higher order with constant coefficients.

L – 45; T – 15; Total Hours- 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., "Higher Engineering Mathematics" (42nd edition), Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.

OUTCOMES:

On completion of the course the students will be able to

- solve integrals of higher orders.
- apply vector calculus for solving engineering problems.
- solve complex differentiation and integration problems related to engineering.
- formulate practical problems in terms of partial differential equations, solve them and physically interpret the results.

CHB1287 CHEMISTRY OF ELECTRONIC MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

The students will get basic knowledge about

- The types corrosion and the methods for the control of corrosion
- The various conventional and non-conventional energy sources and their applications in the present scenario
- Various types of batteries and sensing devices
- The photochemical processes and liquid crystals
- The various polymeric materials and their properties related to electronics and instrumentation
- The basic chemical instrumentation and their components

MODULE I CORROSION AND ITS CONTROL **8**

Introduction - atmospheric corrosion – galvanic series - types of corrosion: galvanic corrosion and differential aeration corrosion (water line corrosion, pitting corrosion and stress corrosion) - methods to control corrosion: selection of materials and proper designing, sacrificial anodic protection, impressed current cathodic protection - corrosion inhibitors - protective coatings - electroplating and electrolessplating

MODULE II ENERGY STORING DEVICES AND SENSORS **8**

Batteries: Introduction, types of batteries - Primary batteries: dry cells and alkaline batteries - Secondary batteries: lead acid storage cell, nickel-cadmium cell; lithium-titanium disulphide battery - Flow Cells: Hydrogen-oxygen fuel cell - photogalvanic cell and dye sensitized solar cell (DSSC)

Sensors: Types, working principle and applications.

MODULE III ENERGY SOURCES **8**

Introduction - conventional energy sources: fossil fuel energy: nuclear energy, nuclear fusion - nuclear fission - controlled and uncontrolled chain reactions with example, characteristics, mass defect (problems), heavy water - light water nuclear power plant

Non-conventional energy sources: solar energy and its applications (Solar devices)

Hydrogen as fuel - production of hydrogen: solar method, water splitting, reforming - storage of hydrogen

MODULE IV PHOTOCHEMISTRY AND LIQUID CRYSTALS 8

Photochemical reactions; Laws of photo chemistry: Grotthus-Draper law and Stark-Einstein law - Quantum efficiency: high and low quantum yield - Photochemical decomposition of HI - quantum yield and efficiency using chemical actinometer - photophysical processes: fluorescence, phosphorescence - photosensitization and quenching (photosynthesis in plants) - chemiluminescence - photoinhibitors - Radiation chemistry: principles of radiolysis, radiation dosimetry, units and Fricke dosimeter

Liquid crystal: Types, methods of preparation and applications.

MODULE V POLYMERIC MATERIALS 8

Engineering plastics – advantages - TEFLON, PMMA, polystyrene, polycarbonate, Bakelite, epoxy resins - effect of polymer structure on properties - polymer blends, alloys and composites - blending of rubber with plastics - laminates and fibre reinforced plastics - conducting polymers, polymers with piezoelectric, pyroelectric and ferroelectric properties, photonic polymers, photoresists and electrodeposition, electroluminescent polymers - polymers as insulators

MODULE VI BASIC CHEMICAL INSTRUMENTATION 5

Spectrometer and spectrophotometer - types of sources, monochromators, slits, reflectors and detectors used in UV-Vis, FT-IR, TG/DTA/DSC, GC, GC-MS, NMR and MRI.

Total Hours : 45

TEXT BOOKS:

1. B. Sivasankar, Engineering Chemistry, Tata McGraw-Hill Education, 2008.
2. P.C. Jain and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 2010.

REFERENCES:

1. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, Punjab, India, 2008.
2. C.P. Wong (Editor), Polymers for Electronic and Photonic Applications, Academic Press, 1993.
3. B.S. Bahl, G.D. Tuli and Arun Bhal, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2003.
4. G.D. Rai, Non-Conventional Sources of Energy, 1st Edition, Khanna Publishers, New Delhi, 2010.
5. O.G. Palanna, Engineering Chemistry, Tata McGraw-Hill Education, 2009.
6. J. Mendham, R.C. Denney, M.J.K. Thomas David and J. Barnes, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Prentice Hall India, Delhi, 2000.
7. Stanley R. Crouch, F. James Holler, Douglas A. Skoog and Donald M. West, Fundamentals of Analytical Chemistry, 8th Edition, Brooks/Cole Publishing Company, 2003.
8. Hobart Hurd Willard, Lynne Lionel Merritt, John Aurie Dean and Settle, Instrumental methods of analysis, 5th Edition, Wordsworth Publishing Company 1986.

OUTCOMES:

At the end of this course, the student will be able to

- Identify the types of corrosion and suggest some remedy for it
- Realize the limitations to the existing energy sources and the need for alternative energy sources
- Differentiate the types of batteries and their applications in day today activities
- Recognize the need for sensing devices and display units
- Know the properties and applications of polymer in their field of engineering
- The student will be aware of the basic instrumentation used in chemistry

SSB1182 SOCIOLOGY, ETHICS AND HUMAN VALUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give an overview of the fundamental of sociology.
- To expose how society developed in India, classes and impact.
- To introduce sociological aspects relating to industry
- To provide some basic concepts on ethics and human rights.
- To stress the role of engineer to the society, environment and sustainability.

MODULE I FUNDAMENTALS OF SOCIOLOGY **7**

Sociology - definition, evolution – scope – basic concepts – social process, sociological theories, social institutions, culture and social stratification – family – economic – politics – religion – education, state and civil society – social control.

MODULE II SOCIOLOGY IN INDIAN CONTEXT **7**

Development – Institutions, classes – women and society – impact of social laws, social change in contemporary India – secularism and communalism – social exclusion and inclusion.

MODULE III INDUSTRIAL SOCIOLOGY **7**

Definition and perspectives – industry in India – social groups in industry, behaviour pattern – group dynamics – focus groups – team – enhancing group behaviour.

MODULE IV INDUSTRIAL – SOCIETY INTERFACE **8**

Perspectives – social responsibilities – sociological effect on industrialization – urbanization, child labour, psychological impact, Impact of technology, modernization – globalization – challenges – role of engineers.

MODULE V ETHICS AND HUMAN VALUES **8**

Ethics and values – organizational values – personal worth, ethical behavior, professional ethics, whistle blowing, international ethics, corruption.

MODULE VI ENGINEERS AND SOCIETY **8**

Quality of life and society – engineer in economic development, technology development – invention, innovation and diffusion – appropriate technology – engineer's contribution, ecology and environment – sustainability – role of engineers.

Total Hours: 45

REFERENCES:

1. Samir Das Gupta and Paulomi Saha, An Introduction to Sociology, Pearson, Delhi, 2012.
2. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
3. Vidya Bhushan and D.R. Sachdeva, Fundamental of Sociology, Pearson, Delhi, 2012.
4. Deshpande, Satish, Contemporary India : A Sociological view, Viking (2002)
5. Thopar, Romila, Early India, Penguin (2003).
6. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 1996.

OUTCOMES:

- Students will have an exposure to the fundamentals and basic concepts of Sociology.
- Students will gain knowledge in Industrial Sociology.
- Students will have gained knowledge about the impact of technology, modernization, globalization and their contribution towards society.

GEB1211 BASIC ENGINEERING MECHANICS **L T P C**
3 1 0 4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give an exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS **7**

Introduction - Units and Dimensions - Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics -Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle

MODULE II EQUILIBRIUM OF PARTICLE **6**

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY **6**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment –Varignon's theorem - Equilibrium of Rigid bodies in two dimensions –Examples

MODULE IV PROPERTIES OF SURFACES **8**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section,

Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia.

MODULE V LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

MODULE VI FRICTION 8

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

Total Hours: 45

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students:

- should be able to resolve forces, moments and solve problems using various principles and laws
- should be able to understand the concept of equilibrium, kinetics and kinematics and capable of formulating the governing equations to practical problems and provide solutions for those equations

EIB1211 ELECTRICAL CIRCUIT ANALYSIS L T P C
3 1 0 4

OBJECTIVES:

- To develop practical abilities of students in Electrical Circuits
- Developing physical sense of theoretical laws by providing in-depth understanding
- Developing scientific approach by making emphasis on strong relationship between theory and practical

MODULE I BASIC CIRCUIT CONCEPTS 10

Circuit elements: Types – Active & Passive, Independent Sources-ideal & Practical - dependent sources, V-I relationship of circuit elements, R, G, L & C, Kirchoff's Laws, Analysis of series and parallel circuits: Voltage and current division, Network reduction; star/delta transformation, Source transformation. Sinusoidal voltage and current, Average and RMS values, form factor and Peak factor of waveforms.

MODULE II SINUSOIDAL STEADY STATE ANALYSIS 10

Concept of phasor, complex impedance (z) and admittance (y); Analysis of simple series and parallel circuits; Active power, reactive power, apparent power, power factor, concept of complex power, impedance and power triangles, energy associated with these circuits. Resonance in series and parallel circuits: Resonance conditions, characteristics, Q factor, half-power frequencies and bandwidth.

MODULE III CIRCUIT ANALYSIS & THEOREMS 10

Node voltage analysis, Mesh-current analysis, Theorems - Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem and Maximum power transfer theorem for variable resistance load, variable impedance load and variable resistance and fixed reactance load.

MODULE IV MAGNETIC CIRCUITS 10

Electromagnetism – magnetic materials – mmf, flux, flux density, field intensity, reluctance, permeability – composite magnetic circuits – comparison of

magnetic and electric circuits – magnetization (B-H) curves – use of B.H. curves for the solution of magnetic circuits – simple electromagnetic relays

MODULE V COUPLED CIRCUITS AND THREE PHASE CIRCUITS 10

Coupled circuits: mutual inductance, coefficient of coupling, dot convention; analysis of simple coupled circuits. Three phase circuits: phasor diagram of voltages & currents, Analysis of three phase 3-wire and 4-wire circuits - Star and delta connected balanced and unbalanced loads, power and power factor measurements in three phase circuits.

MODULE VI TWO PORT NETWORKS 10

Open Circuit Impedance (Z) Parameters-short Circuit Admittance (Y) Parameters, -Transmission (ABCD) Parameters and Inverse Transmission Parameters - Hybrid (h) Parameters and Inverse Hybrid Parameter - Conversion between parameters-interconnection of two-port networks.

Total Hours: 60

TEXT BOOKS:

1. William H.Hayt Jr, Jack E.Kemmerly, and Steven M.Durbin, 'Engineering Circuit Analysis', Tata McGraw Hill Publishing Co Ltd, New Delhi, 2002.
2. Joseph A.Edminister, Mahmood Nahvi, 'Electric Circuits', Schaum's Series, Tata McGraw Hill publishing Co. Ltd., New Delhi, 2001.
3. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.
4. A.Sudhakar & Shyanmugam S.Palli "Circuits & Network Analysis & Synthesis", 2nd Edition, Tata McGraw Hill, 1994.

REFERENCES:

1. R.C. Dorf, 'Introduction to Electric Circuits', John Wiley & Sons Inc, New York, 2nd Edition, 2003.
2. Charles K.Alexander, Mathew N.O. Sadiku, 'Fundamentals of Electric Circuit', McGraw Hill, N.Y, 2003.

OUTCOMES:

Students should be able to

- Identify and deal with basic components and instruments used in the day to day applications with the knowledge of the theorems
- Analyse magnetic and coupled circuits
- Synthesis electrical circuits

EIB1212 ELECTRON DEVICES L T P C
3 0 0 3

OBJECTIVES:

- To acquaint the students with construction, theory and characteristics of the following electronic devices
    1. P-N junction diode
    2. Bipolar transistor
    3. Field effect transistor
    4. LED,LCD and other photo electronic devices
    5. Power control and regulator devices
- To familiarize the student with the principle of operation, capabilities and limitation of various electron devices and their applications.

MODULE I SEMICONDUCTOR PHYSICS 6

Intrinsic semiconductors - Conductivity, atomic and crystal structure of germanium and silicon, covalent bonds, generation and recombination, effect of temperature on conductivity of intrinsic semiconductors, energy levels diagram of conductor, insulators and intrinsic semiconductors.

Extrinsic semiconductor materials- Doping of impurity, P and N type semiconductors and their conductivity, Minority and majority carriers; Drift and Diffusion currents. Mass Action Law, Continuity Equation, Hall Effect, Classification of resistors, colour coding, tolerance & various parameters related to resistors wire wound resistors, fixed & variable resistors. Special resistors LDR, VDR

MODULE II PN JUNCTION DIODES 6

Theory of PN junction, PN junction diode - The current components in p-n diode, Law of junction, Diode equation, Energy band diagram of p-n diode, Volt-ampere characteristics of p-n diode, Temperature dependence of V-I characteristic, Transition and Diffusion capacitances, Breakdown Mechanism in Semi Conductor Diodes.

– Mechanism of avalanche and Zener break down – Zener diode –theory , characteristics and applications.

MODULE III RECTIFIERS, FILTERS AND REGULATORS 9

Half wave rectifier, ripple factor, full wave rectifier, Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L- section filter, p- section filter, Multiple L- section and Multiple p-π section filter and comparison of various filter circuits in terms of ripple factors, clippers, clampers, voltage multipliers.

Simple circuit of a regulator using zener diode. Series and Shunt voltage regulators- Analysis and design- Protection circuits for voltage regulators.

MODULE IV BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS 9

Construction of PNP and NPN transistors – BJT current components – Emitter to collector and base to collector current gains – Base width modulation – CB and CE characteristics – Break down characteristics – JFET - Construction and Characteristics of IGBT – Relation between Pinch off Voltage and drain current – Derivation – MOSFETS - Enhancement and depletion types.

MODULE V SPECIAL DIODES & POWER CONTROL DEVICES 9

Theory, characteristics and application -Varactor diode – Backward diode – Tunneling effect in thin barriers – Tunnel diode – Photo diode- Schottky diodes

Power control devices – Characteristics and equivalent circuit of UJT – intrinsic standoff ratio – PNPN diode – Two transistor model, SCR, Triac, Diac.

MODULE VI CCD AND OPTOELECTRONIC DEVICES 6

Charge transfer and charge coupled devices – theory and applications. Semiconductor Opto electronic devices – LED, LASER diode, LCD, Photo diode, Photo transistor, Solar cell.

Total Hours: 45

TEXT BOOK:

1. Jacob Millman & Christos C. Halkias, “Electronic Devices and Circuits” Tata McGraw-Hill, 1991.

REFERENCES:

1. Nandita Das Gupta and Amitave Das Gupta, Semiconductor Devices – Modelling and Technology, Prentice Hall of India, 2004.
2. Donald A. Neaman, “Semiconductor Physics and Devices” 3rd Ed., Tata McGraw-Hill, 2002.
3. S.Salivahanan, N. Sureshkumar and A. Vallavaraj, Electronic Devices and Circuits, TMH, 1998.
4. S.M. Sze, Semiconductor Devices – Physics and Technology, 2nd Edn., John Wiley, 2002.
5. Ben. G. Streetman and Sanjay banerjee, Solid State Electronic Devices, Pearson

OUTCOMES:

At the end of this course, the students will be able to

- Analyze and design amplifier circuits, oscillators and filter circuits employing BJT, FET devices.
- Design a model using special diodes and power control devices
- Choose electronic devices for special applications

ENB1282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop their creative thinking skills and write reviews.
- To train them with the nuances of corporate correspondence
- To train them in writing official letters, technical reports and proposals.
- To expose them to the writing of Statement of Purpose.

MODULE I WRITTEN COMMUNICATION 4

Introduction - process of writing – ABC of academic and professional writing – Writing an article.

MODULE II CREATIVE WRITING 5

Writing stories based on visuals - Preparing an outline for a story - Writing critical reviews on an article / a paper

MODULE III CORPORATE CORRESPONDENCE 3

Tone in formal writing – e-mail writing, memo, fax, agenda and minutes writing.

Lab: viewing e-mail etiquette, format and conventions of writing memo.

MODULE IV OFFICIAL LETTERS 6

Writing Statement of purpose, Letter of Application and Resume – Assessing one's strengths and weaknesses – peer evaluation.

Lab: Resume writing – Viewing different types – Functional, Chronological - Writing one's resume using wiki, Letter calling for interview and seeking promotion.

MODULE V TECHNICAL WRITING I 6

Describing an experiment, writing instructions and recommendations, Feasibility report and progress report, Synopsis – Group assignment – case study.

MODULE VI TECHNICAL WRITING II **6**

Writing a technical proposal – Format – cover page, executive summary, timeline chart, budget estimate, drafting, conclusion,.

Total Hours: 30

REFERENCES:

1. Riordan & Pauley. 'Report Writing Today'. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
2. Gerson, Sharon & Steven M. Gerson, 'Technical Writing: Process and Product' Pearson Education, New Delhi. 2004.
3. M Ashraf Rizvi 'Effective Technical Communication'. Tata McGraw-Hill Education, 2005.
4. Sharma, R.C. & Krishna Mohan, "Business Correspondence and Report Writing". Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002.
5. Anderson, Durston & Pool. "Thesis and Assignment Writing". 4th Edition. John Wiley & Sons. Australia. 2002.

OUTCOME:

- On completion of the course, the students will have the ability to write all kinds of formal correspondence like letters, reports and proposals.

EIB1213	ELECTRICAL CIRCUITS AND DEVICES LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVE:

- To gain practical knowledge about basic electrical circuits, useful theorems in circuit analysis and fundamental characteristics of electronic devices.

LIST OF EXPERIMENTS:

1. Study of laboratory equipments like CRO, function generator, Power supply , Multimeter etc.
2. Static characteristics of PN diode, LED.
3. Static characteristics of Zener diode-as a voltage regulator.
4. Single phase half wave and full wave rectifier with inductive and capacitive filter.
5. Clipping and clamping circuits
6. Static characteristics of transistor under CE, CC, CB configuration.
7. Static characteristics and parameter determination of IGBT.
8. Verification of ohms law, Kirchhoff's laws.
9. Verification of Thevenins and Norton's theorem.
10. Verification of superposition theorem
11. Verification of maximum power transfer theorem.
12. Measurement of self reactance of a coil.
13. Transient response of RL and RC circuits for Dc input.
14. Frequency response of series and parallel resonance circuit.

OUTCOMES:

At the end of the course the students will be able to

- Determine the characteristics of any basic electronic device in a circuit.
- Design circuits for verifying theorems in circuit analysis
- Understand transient analysis of AC circuits

CHB1288	CHEMISTRY FOR ELECTRONIC MATERIALS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To make students conversant with the practical experiments relevant to the theory.

LIST OF EXPERIMENTS:

1. Determination of dissolved oxygen in the given water sample
2. Study of corrosion of a metal in different corrosive medium
3. Electrodeposition of metal over an article
4. Preparation of polymers
5. Determination of viscosity average molecular weight of a polymer

OUTCOMES:

At the end of the course, the students will be able to

- Calculate the dissolved oxygen present in water sample and molecular weight of the polymer.
- Familiarize with different methods to control corrosion.
- Prepare different types of polymers.

SEMESTER III

MAB2181 TRANSFORMS AND APPLICATIONS L T P C
3 1 0 4

OBJECTIVES:

The course aims to

- Develop the skills of the students in the areas of boundary value problems and transform techniques.
- Acquire knowledge on different transforms like Laplace Transform, Fourier Transform and Z-Transform.

MODULE I LAPLACE TRANSFORM 8

Laplace transform – sufficient condition – Transforms of elementary functions - Properties – Transforms of Derivatives and Integrals – Initial and Final Value Theorem - Transform of Periodic functions - Inverse transforms - Convolution Theorem.

MODULE II FOURIER SERIES 7

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range sine series – Half-range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

MODULE III BOUNDARY VALUE PROBLEMS 8

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation– Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

MODULE IV FOURIER TRANSFORM 7

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

MODULE V Z -TRANSFORM AND DIFFERENCE EQUATIONS 7

Z-transform - properties – Inverse Z–transform – Convolution theorem - Formation of difference equations.

MODULE VI APPLICATIONS OF TRANSFORMS **8**

Applications of Laplace Transform in solving linear ordinary differential equations- Second order with constant coefficients, Simultaneous First order equations – Applications of Z–transform in solving difference equations using Z–transform.

Total Hours: 60

TEXT BOOKS:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. Kreyszig .E. “Advanced Engineering Mathematics”, 10th edition, John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2001.
2. Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.
5. Ramana B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

OUTCOMES:

At the end of the course, the students will be able to

- Solve engineering problems in the area of heat conduction, communication systems, electro-optics and electromagnetic theory using different transforms.
- Solve boundary value problems encountered in engineering practices.

SSB2181	LAW FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize with Indian Constitution and Governance of our country.
- To apprise on human rights, local and International and redressal mechanism.
- To provide important aspect of corporate laws
- To give an introduction of important industrial and labour laws of our country.
- To provide an exposure on laws on contracting and arbitration.
- To give an overview on intellectual property related laws.

MODULE I INDIAN CONSTITUTION **7**

Constitution – meaning and history – making of constitution – salient features, preamble, Citizenship, Fundamental rights, Fundamental duties, Equality and social justice, Directive principles, Constitutional amendments.

MODULE II GOVERNANCE AND POWERS VESTED **7**

Union executive, Legislature – Union – State and union territories, Union and state relations, powers vested with parliament and state legislature, emergency provisions - People's Representations Act – Election Commission – Election for parliament and state legislature, Judiciary.

MODULE III HUMAN RIGHTS **7**

Human rights – meaning and significance, International law on human rights, Covenant on civil and political rights; Covenant on Economic, social and cultural rights – protocol, UN mechanism and agencies, watch on human rights and enforcement – role of judiciary and commission, Right to information Act 2005– evolution – concept – practice.

MODULE IV CORPORATE AND LABOUR LAWS **7**

Corporate laws – meaning and scope – laws relating to companies, Companies Act 1956 – collaboration agreement for Technology transfer, Corporate liability– Civil and criminal – Industrial employment (standing orders) Act 1946, Industrial Disputes Act, 1947, Workmen's Compensation Act 1923, The Factories Act, 1948 – Industry related other specific laws.

MODULE V CONTRACTS AND ARBITRATION 9

Types of contract – standard form of contracts - General principles under Indian Contract Act, 1872 – protection against exploitation – judicial approach to contracts, Arbitration and conciliation – meaning, scope and types, model law, judicial intervention, international commercial arbitration – arbitration agreement, arbitration tribunal – powers and jurisdiction, enforcement and revision, Geneva Convention, Awards, Confidentiality.

MODULE VI LAWS RELATED TO IPR 8

IPR – Meaning and scope, International Convention – Berne and Parrys Conventions, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator, Securing of International patents.

Total Hours: 45

REFERENCES:

1. Jain M.P, “Indian Constitutional Law”, Wadhwa & Co., (2005)
2. Subhash G. & Kashyap, “Our Constitution : An introduction to India’s Constitution and Constitutional Law”, 3rd edition, National Book Trust, India (2001)
3. Agarwal H.D., “International Law and Human Rights”, Central Law Publications, (2008).
4. Meena Rao, “Fundamental Concepts in Law of Contract”, 3rd edition, Professional offset, (2006).
5. Ramappa, “Intellectual Property Rights Law in India”, Asia Law House (2010)
6. Avtar Singh, “Company Law”, Eastern Book Co., (2007).
7. Rustamji R.F., “Introduction to the Law of Industrial Disputes”, Asia Publishing House.
8. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

At the end of this course the student will be

- Familiar with Indian Constitution and Governance of our country, local and International redressal mechanism.
- Familiar with intellectual property related laws.
- Able to apply corporate laws, important industrial and labour laws of our country.
- Able to take up managerial, professional, ethical, social and economic responsibilities.

EIB2101 ANALOG AND LINEAR INTEGRATED CIRCUITS L T P C
3 1 0 4

OBJECTIVES:

- To provide basic knowledge about the characteristics of diodes and transistors
- To give adequate knowledge to design electronic circuits such as amplifiers, power converter circuits, oscillators, rectifiers and power supply circuits.
- To provide information to analyze and design analog electronic circuits by both small and large signal models.

MODULE I BIASING AND ANALYSIS OF SMALL-SIGNAL AMPLIFIERS 10

Fixed and self biasing of BJT & FET – Small signal analysis of CE, CC & Common source amplifiers – Cascade and Darlington connections - Bootstrapping technique - Cascade amplifier

MODULE II LARGE SIGNAL AMPLIFIERS 10

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.

MODULE III FEEDBACK AMPLIFIER AND OSCILLATORS 10

Characteristics of negative feedback amplifiers – Voltage / current, series/ shunt feedback Theory of sinusoidal oscillators – Phase shift and Wien bridge oscillators – Colpitts, Hartley and crystal oscillators.

MODULE IV CHARACTERISTICS OF OPAMP 9

IC fabrication - Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current – differential amplifier-CMRR; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator, integrator etc.

MODULE V WAVEFORM GENERATORS AND DATA CONVERTERS 9

Sine wave generator, Square wave generator, Triangular wave generator, Saw tooth wave generator. D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

MODULE VI APPLICATIONS OF OP-AMP AND SPECIAL ICs 12

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, Precision rectifier, peak detector, S/H circuit, Comparators. 555 Timer circuit – Functional block, characteristics & applications; 565-phase lock loop circuit functioning and applications,

Total Hours: 60

TEXT BOOKS:

1. Robert. L. Boylestad & Lo Nashelsky, "Electronic Devices & Circuit Theory", 8th edition, Pearson Education, Third Indian Reprint, 2002 / PHI.
2. Ramakant A.Gayakward, "Op-amps and Linear Integrated Circuits", 4th edition, Pearson Education, 2003 / PHI.
3. D.Roy Choudhary, Sheil B.Jani, "Linear Integrated Circuits", 2nd edition, New Age, 2003.

REFERENCES:

1. Robert F.Coughlin, Fredrick F.Driscoll, "Op-amp and Linear ICs", Pearson Education,4th edition, 2002 / PHI.
2. David A. Bell, "Electronic Devices & Circuits", Prentice Hall of India/Pearson Education, 4th Edition, Eighth printing, 2003.
3. Jacob Millman & Christos.C.Halkias, "Integrated Electronics: Analog and Digital Circuits and System", Tata McGraw Hill, 1991.

OUTCOMES:

On completion of this course the student will be able to

- Acquire the overall knowledge about the operation, characteristics, limitations and applications of amplifiers, oscillators, rectifiers and power supply circuits.
- Design and analyse various analog electronic circuits.
- Design signal conditioning circuits for specific applications.

EIB2102 TRANSDUCER ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To give knowledge about basic measurement Systems and Units & standards.
- To provide an introductory knowledge about transducers.
- To give adequate knowledge about the characteristics of transducer.
- To have in depth knowledge about Resistive, capacitive and inductive transducers.
- To introduce basic knowledge about other types of transducers like piezoelectric, magnetostrictive transducers and smart transducers.

MODULE I SCIENCE OF MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS 7

Importance of measurement – Methods of measurement – Functional blocks of a measurement system - Units and standards – Errors - Classification of errors – Error analysis – Statistical methods – Calibration methods – Odds and uncertainty.

MODULE II CHARACTERISTICS OF TRANSDUCER 9

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

MODULE III VARIABLE RESISTANCE TRANSDUCER 7

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

MODULE IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS 8

Induction potentiometer – Variable reluctance transducers – EI pick up – LVDT– Capacitive transducer and types – Capacitor microphone – Frequency response.

MODULE V OTHER TRANSDUCERS **7**

Piezoelectric transducer, magnetostrictive – IC sensor – Digital transducers– Smart sensor – Fibre optic transducer.

MODULE VI NANOTRANSDUCERS **7**

Introduction to nano materials – Nano transducers - Nanometer precision position measurement, electrically controlled nano actuators. Optoelectronic devices based on Nanoparticles.

Total Hours: 45

TEXT BOOKS:

1. E.A. Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw Hill, New York, 2004.
2. S. Ranganathan, “Transducer Engineering”, Allied Publishers Pvt. Ltd., 2005.
3. A.K. Sawhney, “A course in Electrical & Electronic Measurement and Instrumentation”, Dhanpat Rai and Co (P) Ltd., 2004.

REFERENCE BOOKS

1. D. Patranabis, “Sensors and Transducers”, Prentice Hall of India, 1999.
2. John P. Bentley, “Principles of Measurement Systems”, 3rd edition, Pearson Education,2000.
3. Hermann K.P. Neubert, “Instrument Transducers”, Oxford University Press, 2000.
4. D.V.S Murthy, “Transducers and Instrumentation”, Prentice Hall of India, 2001.

OUTCOMES:

After completion of this course the students will be able to.

- Learn about types of transducers like RTD, Thermistors, LVDT and Strain Gauge etc.
- Acquire adequate knowledge in using transducers for various industrial applications.
- Apply the acquired knowledge in transducer which is stepping stone for contro systems and mini project.
- Effectively use the relevant details of sensors pertaining to process industries.

EEB2181	ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on

- Basic concepts of electrical circuits and their solutions
- Performance of Electrical machines, methods of speed control and their applications

MODULE I DC CIRCUITS **8**

Electric current – Electromotive force and Potential-Resistance-Ohm's Law – Resistance in series and parallel – Definitions of Important terms relating to Network-Kirchhoff's Laws – Solution of network by Mesh Current method and Node Voltage Method-Work-Power and Energy- Superposition Theorem-Thevenin's and Norton Theorem-Maximum Power transfer Theorem

MODULE II AC CIRCUITS AND MAGNETIC CIRCUITS **8**

Generation and Equations of AC Voltage and Current-Basic definitions related to AC wave form-RMS, Average and Peak value – Concept of phasor representation - Single Phase RLC circuits – Series and parallel circuits – Power – Real, Reactive and Apparent Powers-Simple problems - Resonance.

Magnetic Circuits - Definitions related to magnetism and electromagnetism - Simple Magnetic circuits – B-H curves – Hysteresis and Eddy current losses – problems

MODULE III DC MACHINES **7**

DC Generator – Construction and Working principle – EMF equation –Types -Characteristics and applications- DC motor- Working principle – types – characteristics – Speed Control -starters for DC Motors-Applications.

MODULE IV TRANSFORMERS **7**

Transformer-Working Principle – EMF equation- Transformation ratio-Construction – Transformer on No Load and on Load –Shifting impedances in a transformer – Equivalent Circuit –Tests on transformers- Efficiency and Losses-Three Phase Transformer Connections.

MODULE V INDUCTION MOTORS **8**

Three Phase Induction Motor – Construction – Types- Principle of Operation – Torque equation - Torque Slip Characteristics – Conditions for starting torque and maximum torque-starters for three phase induction motors- Applications.

Single Phase Induction Motors-Double Field Revolving Theory-Types of single phase induction motors.

MODULE VI SPECIAL MACHINES **7**

Stepper Motor-Permanent Magnet Stepper Motor-Variable Reluctance Stepper Motor-Hybrid Stepper Motor-Servo mechanism-DC Servo motors-AC Servo motors-Switched Reluctance Motors Permanent Magnet DC Motor-Brushless DC motor- Repulsion Induction motor – Single phase synchronous motors - Reluctance motor, Hysteresis motor-applications

Total Hours: 45

REFERENCES:

1. William H. Hayt Jr, Jack E. Kemmerly, and Steven M. Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2002
2. S.K.Bhattacharya, “Electrical Machines”, Tata Mc Graw Hill Publishing company Limited, New Delhi, 2005.
3. D.P.Kothari and I.J.Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill Publishing Co Ltd, 2nd Edition, 2002.
4. Vincent Del Toro, “Electrical Engineering Fundamentals”’, PHI, 1972.

OUTCOMES:

At the end of the course, the student will be able to know

- The fundamentals of Electrical circuits, Analysis and their solution
- The operating principles of electric machines and their applications.

CSB2183 OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To prepare students to get full use of code reusability using Generic programming while coding.

MODULE I PRINCIPLES OF OBJECT ORIENTED PROGRAMMING 7

Object oriented programming paradigm - Basic concepts of object oriented programming - Benefits of OOP - Object-oriented languages - Applications of OOP - Structure of a C++ program- Operator and control structures- Functions.

MODULE II CLASSES AND OBJECTS 8

Class Definition, Classes and Objects - attributes -Access specifiers, Data Members, Member Functions, Private and Public Members, Array within a class - Structure & classes, Union & Classes, Friend function, Inline function, Scope resolution operator, Static class members, Static data member, Static member function, Passing objects to function, Returning objects. Constructors – Parameterized constructors - Multiple constructors in a class - Constructors with default arguments - Copy constructor - Dynamic constructors – Destructors.

MODULE III OPERATOR OVERLOADING AND INHERITANCE 8

Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators - Rules for overloading operators - Type Conversions - Defining derived classes - Single inheritance - Multilevel inheritance - Multiple inheritance - Hierarchical inheritance - Hybrid inheritance

MODULE IV POINTERS, VIRTUAL FUNCTIONS AND POLYMORPHISM 7

Pointers to Objects - this Pointer- Pointers to Class Members – Virtual base classes - Abstract classes - Pointers to derived classes - early Binding, Polymorphism with pointers -Virtual functions - Pure virtual functions.

MODULE V TEMPLATES AND EXCEPTION HANDLING 8

Templates - class template - function template - Standard Template Library – Exception handling.

MODULE VI FILE HANDLING AND BASIC I/O OPERATIONS 7

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.

Total Hours: 45

TEXT BOOKS:

1. Matt Weisfeld, “Object-Oriented Thought Process”, 4th Edition, Pearson Education, 2013.
2. E.Balagurusamy, “Object Oriented Programming with C++”, 5th Edition, Tata McGrawHill, 2011.

REFERENCES:

1. B. Trivedi, “Programming with ANSI C++”, Oxford University Press, 2007.
2. Subhash K U, “Object Oriented Programming with C++”, 4th Edition, Pearson Education, 2010.
3. Herbert Schildt, “C++ - The Complete Reference”, 4th Edition, Tata McGraw Hill, 2003.
4. Stroustrup, “The C++ Programming language”, 3rd Edition, Pearson Education, 2004.

OUTCOMES:

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

- Program applications based on the object oriented programming.
- Gain the knowledge of different type of programming concepts and their industrial applications.

ENB2181 ORAL COMMUNICATION L T P C
0 0 2 1

OBJECTIVES:

- To help the students acquire efficiency in Spoken English with due importance to Stress, Accent and Pronunciation.
- To hone the listening skills and understand native accent.
- To enable them to make presentations effectively.
- To develop their ability to persuade and convince people to accept a point of view.
- To prepare them for Placement Interviews, Group discussions etc.

MODULE I **8**

(i) Oral Communication – Implications in real life and work place situations

(ii) One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking

(iii) Prepared presentations and extempore presentations

(iv) Group project – presentation on any social issue. The group will have to research on the history of the problem, its cause, impact and outcome hoped for and then make a presentation

(v) Recording presentations and feedback - Peer and faculty evaluation

MODULE II **2**

Listening to ESL Podcast – Viewing Multimedia – Listening to BBC News - Received Pronunciation (RP)/ VOA/ NDTV – exposure to paralinguistic features.

MODULE III **4**

Developing persuasive skills - Selling a product – marketing skills – the topics will be on advertising, convincing someone on social issues such as preservation of water, fuel, protection of environment, gender discrimination.

MODULE IV **4**

Debates on pros and cons on topics of relevance like Nuclear Energy, Appropriate Technology, Internet, and Social Media. This will be followed by Peer and Faculty feedback

MODULE V **6**

Brainstorming – Think pair and share activity – Discussion etiquette – Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter) Peer and faculty feedback

MODULE VI **6**

Interview Skills - Assessing one's strengths and weaknesses, SWOC Analysis, Mock interview – Verbal and Non-verbal Communication – Types of Job Interview – Telephone Interview, Stress Interview.

Total Hours: 30

REFERENCES:

1. Hancock, Mark. "English Pronunciation in Use", Cambridge University Press, UK. 2005.
2. Anderson, Kenneth & et.al. "Study Speaking : A Course in Spoken English for Academic Purposes", 2nd Edition, Cambridge University Press, UK. 2004.
3. Hurlock, B. Elizabeth, "Personality Development", Tata McGraw Hill, New York. 2004.

OUTCOME:

- On completion of the course, the students will have the ability to speak confidently and effectively in Presentations and Group Discussions.

EIB2103 ANALOG & LINEAR INTEGRATED CIRCUITS LABORATORY **L T P C 0 0 3 1**

OBJECTIVES:

- To familiarize the students with the analysis and design of basic Transistor, amplifier circuits, power supply and oscillators
- To study and verify the characteristics of Op-Amp.
- To design and verify the linear and non-linear applications of Op-Amp
- To verify the operation of special purpose ICs namely 555 timer and PLL

LIST OF EXPERIMENTS:

1. Study of BJT Biasing Circuit – Fixed Bias, self Bias and Voltage Divider Bias.
2. Study of FET Biasing Circuits - Fixed Bias, self Bias and Voltage Divider Bias.
3. Shunt and Series voltage regulator
4. Design and testing of an emitter follower and FET amplifier
5. Design and testing of RC coupled transistor amplifier
6. Design and testing of Hartley and Colpitts Oscillators
7. Design and testing of a Push-Pull power amplifier.
8. Study of Op-Amp (Characteristics of “Op-Amps and linear Applications)
9. Study of Comparator using Op-Amps.
10. Waveform generation using Op-Amps(Square and triangle wave)
11. Timer IC application – Study of NE/SE 555 timer in Astable, Monostable operation
12. Study of VCO and PLL ICs

OUTCOMES:

On completion of this course the student will have skills to

- Design simple amplifier circuits.
- Analyse and design Voltage regulators
- Design simple linear integrated circuits like comparator, Astable and Monostable multivibrator using Op-Amp.
- Design waveform generation circuits.

EIB2104	TRANSDUCER LABORATORY	L T P C 0 0 3 1

OBJECTIVES:

- To provide practical knowledge in sensors and transducers.
- Emphasis on characteristics and response of various transducers like resistive, inductive and capacitive type.

LIST OF EXPERIMENTS:

1. Characteristics of LDR
2. Characteristics of Temperature Transducers
3. Step Response of RTD and Thermocouple
4. Characteristics of Load Cell
5. Characteristics of Capacitive Transducer
6. Characteristics of Strain Gauge
7. Characteristics of LVDT
8. Hall Effect Voltage Sensor
9. Hall Effect Current Sensor
10. Loading Effect of Potentiometer
11. Piezoelectric Transducer
12. Digital Transducer (Shaft Angle Encoder)

OUTCOMES:

After completion of this course the students will have

- An enhanced knowledge in characteristics of various transducers like resistive, inductive and capacitive type.
- Skills to use transducer for Instrument and control systems applications.

CSB2184	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To implement the basic concepts of object oriented programming using java concepts.
- To understand fundamentals of object-oriented programming in classes, invoking methods and functions.
- Learn to create packages, interfaces and threads using java and oops concepts.
- To design and develop programs with Graphical User Interfaces capabilities.

LIST OF EXPERIMENTS:

1. Programs Using Functions
   a. Implementation of call by value method
   b. Implementation of call by Reference method
   c. Implementation of call by Address method
2. Programs Using Classes and Object
   a. Student details – Primitive data members and member functions
   b. Item Purchase – Array as data members
   c. Counter – Static member function
   d. Banking Program using constructors
   e. String Class – Pointer as Data members
3. Compile Time Polymorphism
   a. Overloading Unary Operator
   b. Overloading Binary Operator
   c. Implementation of Friend class

OUTCOMES:

After completion of this course the students will be able to

- Understand the object-oriented approach in programming.
- Analyze and design a computer program to solve real world problems based on object-oriented principles.
- Write simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles.

SEMESTER IV

MAB2283 APPLIED NUMERICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVE:

- This course gives a complete procedure to solve problems in engineering numerically, where analytical method fails to give solution.

MODULE I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS **7**

Linear interpolation methods (method of false position) – Newton's method – Statement of Fixed Point Theorem – Fixed point iteration – x=g(x) method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods- Iterative methods – Gauss Jacobi and Gauss - Seidel methods- Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method.

MODULE II INTERPOLATION AND APPROXIMATION **7**

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas - Relations between operators ($E, \nabla, \mu, \Delta, \Delta$)

MODULE III NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION **8**

Derivatives from difference tables – Divided differences and finite differences– Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson's rules.

MODULE IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS **8**

Numerical solution of first and second order ordinary differential equations by Taylor series method - Euler Method - Modified Euler's Method - Runge – Kutta Method of order four.

MODULE V NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 7

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

Total Hours: 60

TEXT BOOK:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.

REFERENCES:

1. Grewal, B.S., "Numerical methods in Engineering and Science", 7th Edition, Khanna Publishers, 2007
2. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
3. P. Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- Solve system of equations and eigenvalue problem of a matrix numerically.
- Use interpolation and find intermediate values for given data.
- Find numerical solution of differential equations in engineering problems.

EIB2211 ELECTRICAL MEASUREMENTS AND INSTRUMENTS **L T P C 3 0 0 3**

OBJECTIVES:

- Understand and learn the different principles and instruments adopted for measurement of current, voltage, power, energy etc.
- Study different methods available for measurement of passive elements like resistance, inductance and capacitance.

MODULE I MEASUREMENT OF CURRENT AND VOLTAGE 9

Galvanometers – Ballistic, D'Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type & thermal type meter, rectifier type – Extension of range and calibration of voltmeter and ammeter – Errors and compensation.

MODULE II MEASUREMENT OF POWER AND ENERGY 7

Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading – Induction type KWH meter – Calibration of wattmeter, energy meter.

MODULE III POTENTIOMETERS 6

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications.

MODULE IV BRIDGES 10

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

A.C bridges – Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Hay's bridge – Schering bridge – Anderson bridge – Owen bridge - Heaviside bridge Campbell bridge to measure mutual inductance– Bridge sensitivity. Errors, Wagner Earthing Device.

MODULE V MAGNETIC MEASUREMENTS 6

Flux meter, B-H Curve, Hysteresis loop, Permeameters, AC Testing of Magnetic materials, Separation of iron losses, iron loss measurement by Wattmeter and Bridge methods.

MODULE VI INSTRUMENT TRANSFORMERS 7

Theory and construction of current and potential transformers, ratio and phase angle errors and their minimization, Characteristics of CTs. & PTs., Testing of CTs & PTs.

Total Hours: 45

TEXT BOOKS:

1. E.W.Golding & F.C.Widdis, "Electrical Measurements & Measuring Instruments", A.H.Wheeler & Co, 1994.
2. A.K. Sawhney, "Electrical & Electronic Measurements and Instrumentation", Dhanpath Rai & Co (P) Ltd, 2004.

REFERENCES:

1. J.B.Gupta, "A Course in Electronic and Electrical Measurements and Instrumentation", S.K. Kataria & Sons, Delhi, 2008.
2. S.K.Singh, "Industrial Instrumentation and control", Tata McGraw Hill, 2003.
3. H.S.Kalsi, "Electronic Instrumentation", Tata McGraw Hill, 1995.
4. Martia U. Reissland, "Electrical Measurement", New Age International (P) Ltd., 2001.

OUTCOMES:

After completion of this course the students will be able to

- Apply the knowledge about the instruments to use them more effectively
- Select the kind of instrument suitable for typical measurements.

EIB2212 ELECTRONIC INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide adequate knowledge about the operation of electronic instruments.
- Exposure is given to the students about signal generators and analyzers.
- In depth knowledge is given to students about cathode ray oscilloscope.
- Emphasis is laid on display and recording devices.

MODULE I ANALOG METERS **7**

D.C, A.C voltmeters, ammeters, multimeter, power meter, Q-meter, true RMS meter, vector impedance meter, vector voltmeter, component measuring instrument.

MODULE II SIGNAL GENERATORS **8**

Sine wave generator – Frequency synthesized sine wave generator – Sweep frequency generator, pulse and square wave generator – Function generator– Audio Frequency generator – Noise generator.

MODULE III ANALYZERS **6**

Wave analyzer – Applications – Harmonic distortion analyzer – Spectrum analyzer – Digital Fourier Analyzers - Applications.

MODULE IV OSCILLOSCOPE **8**

General purpose oscilloscope - Oscilloscope techniques – Special oscilloscopes – Storage oscilloscopes – Sampling oscilloscope – Digital CRO.

MODULE V DIGITAL INSTRUMENTS **8**

Digital method for measuring frequency, period, phase difference, pulse width, time interval, total count – Digital voltmeter – Types – Automatic polarity indication, automatic ranging, auto zeroing – DMM.

MODULE VI DISPLAY AND RECORDING DEVICES **8**

Bar graph display – Segmental and dot matrix display – X-Y recorders, magnetic tape recorders – Digital recording – Data loggers.

Total Hours: 45

TEXT BOOKS:

1. Kalsi. A. “Electronic Instrumentation and Measurements”, Prentice Hall of India
2. Albert D. Helfrick & William D. Cooper, “Modern Electronic Instrumentation & Measurement Techniques”, Prentice Hall of India, 2002.
3. A.J. Bouwens, “Digital Instrumentation”, Tata McGraw Hill, 1997.

REFERENCES:

1. B.M.Oliver and J.M.cage, “Electronic Measurements & Instrumentation”, McGraw Hill International Edition, 2009.
2. Joseph. J. Carr, “Elements of Electronic Instrumentation & Measurements”, 3rd edition, Pearson Education, 2003.
3. C.S. Rangan, G.R. Sarma, V.S.V. Mani, “Instrumentation Devices & Systems”, Tata McGraw Hill, 2008.
4. D. A. Bell, “Electronic Instrumentation and Measurements”, Prentice Hall of India,
5. Rajendra Prasad, “Electronic Measurements and Instrumentation”, Khanna Publishers, Delhi, 2003.
6. B.R. Gupta, “Electronics and Instrumentation”, S. Chand Co. (P) Ltd., Delhi, 2003.

OUTCOME:

- Students will be able to effectively use the measuring instruments in core industries.

EIB2213	DIGITAL ELECTRONICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide knowledge on various number systems and to simplify the mathematical expressions using Boolean functions – simple problems.
- To impart implementation of combinational circuits.
- To learn the design of various synchronous and asynchronous circuits.
- To expose the students to various memory devices.

MODULE I NUMBER SYSTEMS & BOOLEAN ALGEBRA 9

Number systems and data representation, Binary, Octal, Hexadecimal representations and their conversions, Signed numbers and floating point number representation. Codes, Basic logic operations, Boolean algebra, De-Morgan theorems, Algebraic reductions, NAND and NOR based logic, Digital logic gates.

MODULE II GATE – LEVEL MINIMIZATION & GATE LEVEL IMPLEMENTATION 9

Canonical logic forms, extracting canonical forms, Karnaugh maps and Tabular methods, don't care conditions, minimisation of multiple output functions. NAND and NOR implementation of Boolean functions – Two –Level Implementation and Multilevel implementation.

MODULE III COMBINATIONAL CIRCUITS 12

Synthesis of combinational functions – Arithmetic circuits-Adder, carry look-ahead adder, number complements subtraction using adders, signed number addition and subtraction, BCD adders. Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates & multiplexers.

MODULE IV SEQUENTIAL LOGIC CIRCUITS 12

Flip flops - SR, D, JK and T. Analysis of synchronous sequential circuits – Design of synchronous sequential circuits - State diagram; state reduction; state assignment, Counters – synchronous, a synchronous, up-down and Johnson counters; shift registers.

MODULE V ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Analysis of asynchronous sequential machines – Transition Table, Flow Table, Race conditions, stability considerations. Asynchronous design problem.

MODULE VI PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES 9

Memories – ROM, PROM, EPROM, PLA, PLD, And FPGA, digital logic families – TTL, ECL, And CMOS

Total Hours: 60

TEXT BOOKS:

1. M.M. Mano, "Digital Design", 5th Edition, Prentice Hall of India, 2003.
2. Floyd, "Digital Fundamentals", 4th Edition, Universal Book Stall, New Delhi, 1992.
3. J.P. Uyemura, "A First Course in Digital Systems Design", Brooks/Cole Publishing Co. (Available from Vikas Publishing House in India).

REFERENCES:

1. J.M. Rabaey, "Digital Integrated Circuits: A Design Perspective", 2nd Edition, Prentice Hall of India, 2005.
2. D. Hodges and H. Jackson, "Analysis and Design of Digital Integrated Circuits", 2nd Edition, McGraw Hill, 1988.
3. N.H.E. Weste, and K. Eshraghian, "Principles of CMOS VLSI Design: A Systems Perspective", 2nd Edition, Pearson Education Inc., (Asia), 2002.

OUTCOMES:

At the end of the course students will be able to,

- Acquaint with the basic concepts of digital electronics.
- Implement the logics in combinational circuits.
- Design the synchronous and asynchronous circuits.

EIB2214 INDUSTRIAL INSTRUMENTATION – I L T P C
3 0 0 3

OBJECTIVES:

To provide sound knowledge about various techniques used for the measurement of Industrial Parameters.

- Introduction to Load cells, torque meter and various velocity pickups.
- Exposure to various accelerometer pickups, vibrometers, density and viscosity measuring instruments.
- To provide an adequate knowledge about pressure measuring instruments.
- To provide an idea about the temperature standards, calibration and signal conditioning used in RTD's.
- To provide knowledge regarding characteristics of thermocouples and signal conditioning modules.
- To learn about measuring high temperatures with pyrometers.

MODULE I MEASUREMENT OF FORCE, TORQUE AND VELOCITY 7

Electric balance – Different types of load cells – Magnets - Elastic load cells – Strain gauge load cell – Different methods of torque measurement – Strain gauge, relative regular twist – Speed measurement – Revolution counter-Capacitive tacho-drag cup type tacho – D.C. and A.C. tacho generators – Stroboscope.

MODULE II MEASUREMENT OF ACCELERATION, VIBRATION, DENSITY AND VISCOSITY 7

Accelerometers – LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers. – Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometers – Calibration of vibration pickups – MODULEs of density, specific gravity and viscosity used in industries – Baume scale, API scale – Pressure head type densitometer – Float type densitometer – Ultrasonic densitometer – Bridge type gas densitometer – Viscosity - Saybolt viscometer, Redwood Viscometer – Rotometer type.

MODULE III PRESSURE MEASUREMENT 10

MODULEs of pressure – Manometers – Different types – Elastic type pressure

gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezoresistive pressure sensor - Measurement of Vacuum – McLeod gauge – Thermal conductivity gauges - Ionization gauge – Testing and calibration of pressure gauges – Dead weight tester. Differential Pressure Transmitter, Low Pressure Measurement.

MODULE IV TEMPERATURE MEASUREMENT 7

Definitions and standards – Primary and Secondary fixed points – Calibration of thermometer, different types of filled in system thermometer – Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – three lead and four leas RTDs.

MODULE V THERMOCOUPLES 7

Thermocouples – Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning of thermocouples output – Thermal block reference functions – Commercial circuits for cold junction compensation – Response of thermocouple – special techniques for measuring high temperature using thermocouples.

MODULE VI PYROMETERS – HIGH TEMPERATURES MEASUREMENTS 7

Radiation Method of Temperature Measurements – Radiation Fundamentals– Total Radiation & Selective radiation Pyrometers – Optical pyrometer – Two colour radiation pyrometers.

Total Hours : 45

TEXT BOOKS:

1. E.O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill Publishing Company, 2008.
2. R.K. Jain, "Mechanical and Industrial Measurements", Khanna Publishers, New Delhi, 1999.
3. D.S. Kumar, "Mechanical Measurements and Control", 3rd edition, Metropolitan books, 1979.

4. Jone's “Industrial Technology”, Vol.2, Butterworth – Meineman, International Edition, 2003.

REFERENCES:

1. D.Patranabis, “Principles of Industrial Instrumentation”, Tata McGraw Hill Publishing Company Ltd, 1996.

2. A.K. Sawhney and P. Sawhney, “A Course on Mechanical Measurements, Instrumentation and Control”, Dhanpath Ral and Co., 2004.

3. B.C.Nakra & K.K.Chaudary, “Instrumentation Measurement & Analysis”, Tata McGraw Hill Publishing Ltd., 2004.

4. S.K. Singh, “Industrial Instrumentation and Control”, Tata McGraw Hill, 2003.

5. D.P. Eckman, “Industrial Instrumentation”, Wiley Eastern Ltd.

OUTCOMES:

After completion of this course the students will be able to

- Know relevant details pertaining to Process Industries.
- Select transducers like LVDT, Strain gauge and load cells etc to identify applications in various process Industries.
- Effectively carry out operation and maintenance of pressure, temperature and flow instruments in process industries.

LSB2181 BIOLOGY FOR ENGINEERS

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to introduce basic biological concepts to the engineering students to promote cross-breeding of ideas. In particular,

- To provide an overview of cell structure and function.
- To give basic idea on biochemistry related to biological aspects.
- To introduce genes, their structure, inheritance and about living organisms.
- To give an understanding on metabolism, respiration, etc.
- To inform students of engineering about the interface of biology and engineering.

MODULE I BASICS OF CELL STRUCTURE AND FUNCTION 7

Cells as unit of life – basic chemistry of cell – cell structure and functions – Prokaryotic and Eukaryotic cells, cell wall, plasma membrane, endoplasmic reticulum, nucleus, chromosomes- cell division – mitosis, meiosis.

MODULE II BIOCHEMISTRY 8

Biomolecules – introduction – pH and biological buffers – carbohydrates- mono, di, oligo and polysaccharides, lipids- phospholipids, glycolipids, sphingolipids, cholesterol, steroids, prostaglanin – proteins – types – glycoproteins, lipoproteins – structures - primary, secondary, tertiary and quarternary – Nucleic acids – RNA – Types – tRNA, mRNA, giRNA, miRNA, DNA – rDNA, gDNA, cDNA.

MODULE III GENETICS 7

Genes – structure and functions – behavior, dominance and epigenetics, evolution – inheritance – reproduction and gene distribution – genome of living organisms – plants – bacteria and viruses – animals – humans, genetic engineering and cloning.

MODULE IV MICROBIOLOGY 8

Microbiology – basis of microbial existence – microbial diversity – classification and nomenclature of micro-organisms- impact of microorganisms in industry, agriculture and health, industrial microbiology – primary and secondary

screening of micro-organisms, fermentation processes, bioreactors, microbial ecology – microbial bio-remediation – epidemiology and public health.

MODULE V METABOLISM **7**

Metabolic processes – bio-membranes, diffusion, absorption, osmo-regulation, photosynthesis, respiration, digestion and excretion.

MODULE VI BIOLOGY AND ENGINEERS **8**

Application of biology in engineering– living things as the solutions (bionics) – living things as models (biometrics) – bio-technology – biomedical engineering – effect of human action on living things – right balance – bioinformatics – bionanotechnology – sensors, biosensors, biochips-ethics in biology.

Total Hours : 45

REFERENCES:

1. Johnson, Arthur T., “Biology for Engineers”, CRC Press, FL, 2011.
2. Campbell and Recee, “Biology”, Pearson, Benjamin Cummins Pub. 8th edition, 2008.
3. Scott Freeman, “Biological Sciences”, Prentice Hall, 2002.

OUTCOMES:

After finishing this course students will be able to

- understand basics of biological processes, composition of cell contents.
- understand applications of microbes in industrial manufacturing of proteins, antibodies and antibiotics.
- understand cloning and genetic engineering.
- identify the genes in different genome (plants, microbes, animals, human) and compare the genes by bioinformatics approaches.

ENB2282	CONFIDENCE BUILDING AND BEHAVIORAL SKILLS	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To enable the students to develop communication skills for verbal communication in the work place.

TOPICS OUTLINE:

This course is practical oriented one and exercises will be given to the students group users /individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member and coordinated by the overall course coordinator.

LAB ACTIVITIES:

- Introduction: Soft skills definition, examples
- Verbal communication: Case study, communication and discussion
- Prepared speech
- Impromptu speech
- Debate: Case studies - Attitude and Behavior: role play and exploration
- Ability to ask for help – communication and team work
- Manners and etiquette
- Organization and Planning
- Time keeping
- Conduct in workplace
- Conscientiousness
- Work output
- Professionalism
- Motivation
- Ownership of tasks
- Adaptability/flexibility

ASSESSMENT:

The assessment will be continuous and portfolio based. The students must produce the record of the work done through the course of the semester in the individual classes. The portfolio may consist of a) the individual task outline and activities, b) worked out activities c) Pre-designed sheets which may be provided by the Faculty member. The portfolio will be used by the Faculty member for assessment. The course coordinator in consultation with the course committee shall decide at the beginning of the semester, the number of exercises, method of assessment of each and the weightage for the end semester assessment.

OUTCOMES:

After completion of this course the students will be able to:

- Develop verbal communication skills
- Debate with other students confidently
- Communicate effectively their ideas

EIB2215 DIGITAL ELECTRONICS LABORATORY L T P C
0 0 3 1

OBJECTIVES:

- To study Boolean function and implementation using basic gates.
- To design and implement combinational and sequential circuits using basic gates and specialized ICs

LIST OF EXPERIMENTS:

1. Simplification (K-map and Quine –McClusk method) and Realization of a Boolean function exhibiting prime and essential prime implicants.
2. Realization of Boolean function demonstrating the conversion between canonical forms.
3. Designing and implementation of Adders and Subtractors using logic gates.
4. Design and implementation of code converters using logic gates
5. BCD to excess-3 code and vice – versa
6. Binary to gray and vice – versa
7. To exhibit the use of IC 7483 as 4–bit binary Adder/ Subtractor and BCD adder
8. To design and implement a 2 Bit Magnitude Comparator using logic gates and 8 Bit Magnitude Comparator using IC 7485
9. Design and implementation of encoder and decoder using logic gates and study of IC 7445 and IC 74154
10. Design and implementation of Multiplexer and De-multiplexer using logic gates and study of IC 74150 and IC 74154
11. Implementation and study of SR, JK, D, T Flip Flops.
12. Design and implementation of 3-Bit synchronous counter
13. Construction and verification of Asynchronous counters
14. Implementation of universal shift registers using Flip-Flops.

OUTCOMES:

On Completion of this course the student will be able to formulate

- The design, implementation and operation of combinational circuits like adders, subtractors, code converters, multiplexer – demultiplexer, encoder – decoder and magnitude comparator.
- The design, implementation and operation of sequential circuits like flip flops, counters and shift registers.
- Select and integrate digital circuits for mini projects.

EIB2216	INDUSTRIAL INSTRUMENTATION LABORATORY- I	L T P C 0 0 3 1

OBJECTIVES:

- To provide good hands on experience on industrial instruments.
- To familiarize with pressure Instruments, vacuum Instruments, pyrometers.
- They may able tackle any problem when working in core industry.
- To expose the students pertaining to various lab instruments which they will come across in the Industry.

LIST OF EXPERIMENTS:

1. Measurement of Pressure using Diaphragms, Bellow and Bourdon.
2. Measurement of acceleration, velocity displacement using Accelerometer.
3. Measurements of force using load cell & strain gauge
4. Torque measurement.
5. DC & AC position control system.
6. Vacuum pressure measurement
7. IR spectrophotometer
8. UV-visible spectrophotometer
9. Study of stroboscope
10. Signal conditioning of RTD
11. Cold junction compensation of thermocouple.
12. Radiation pyrometer.

OUTCOMES:

After completion of this course the students will be able to

- Know various instruments pertaining to process industries.
- Acquire knowledge in load cell, strain gauge and torque measurements.
- Acquire knowledge in spectrometer, measurement of temperature and related cold junction compensation and high temperature measurement using radiation parameter.
- This will be a stepping stone for the student to work in process industries.

SEMESTER V

EIB3101 CONTROL SYSTEM

L	T	P	C
3	1	0	4

OBJECTIVES:

- To prepare the student to understand the open loop and closed loop systems.
- To acquaint the student to understand time domain and frequency domain analysis of control systems required for stability analysis.
- To provide the student to learn the compensation technique that can be used to stabilize the control systems.

MODULE I **12**

System Analysis – Systems, subsystems, and stochastic and deterministic systems - Principles of automatic control -Open loop and closed loop systems - Principles of superposition and homogeneity. Transfer Function Approach – Mathematical models of physical systems and transfer function approach - Impulse response and transfer function -Determination of transfer functions for simple electrical, mechanical, electromechanical, hydraulic and pneumatic systems - Analogous systems -Multiple-input-multiple-output systems

MODULE II **6**

Block diagrom algebra - block diagram reduction - signal flow graphs - mason's gain formula.

MODULE III **9**

Time response – Types of test inputs - I and II order system responses - Error coefficients – Generalized error series - Steady state error - Time domain specifications - Computer simulation.

MODULE IV **9**

Frequency response - Frequency domain specifications - Bode plot- Polar plot - Determination of phase margin and gain margin - Constant M and N circles - Nichols chart - Determination of closed loop response from open loop response - Computer simulation.

MODULE V **12**

Concepts of stability – Location of roots in s-plane for stability – Routh Hurwitz criterion – Root locus techniques – Construction – Nyquist stability criterion - Computer simulation.

MODULE VI **12**

PID controllers - Performance criteria - Selection of controller modes – Lag, Lead, and Lag-Lead networks – Compensator design for desired response using Root locus and Bode diagrams - Computer simulation.

Total Hours: 60

TEXT BOOKS:

1. Gopal, M., “Control Systems, Principles and Design”, Tata McGraw-Hill Public. Co., 2nd Edition, New Delhi, 2012.
2. Nagrath, I.J. and Gopal, M., “Control System Engineering”, 4th edition, New-age International (P) Ltd., New Delhi, 2006.

REFERENCES:

1. Ogata, K., “Modern Control Engineering”, Prentice Hall of India Ltd., 4th Edition, New Delhi, 2006.
2. Kuo, B.C., “Automatic Control Systems”, Prentice Hall of India Ltd., New Delhi, 2003.

OUTCOMES:

On completion of the course the student will be able to

- Use the knowledge in control system to solve problems in Electronics and fundamental Instrumentation Systems.
- Coordinate physical systems with mathematical model.
- Execute industrial projects.

EIB3102 INDUSTRIAL INSTRUMENTATION – II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on density, viscosity, humidity and moisture measurements.
- To familiarize with area flow meters, mass flow meters and calibration techniques.
- To expose various types of level measurements adopted in industrial environment.

MODULE I MEASUREMENT OF DENSITY AND VISCOSITY 7

MODULEs of density, specific gravity and viscosity used in industries – Baume scale, API scale – Pressure head type densitometer – Float type densitometer– Ultrasonic densitometer – Bridge type gas densitometer – Viscosity – Saybolt viscometer, Redwood Viscometer

MODULE II MEASUREMENT OF HUMIDITY & MOISTURE 8

Humidity terms – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer – Dew cell – 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.

MODULE III VARIABLE HEAD FLOW METERS AND VARIABLE AREA METERS 8

Flow measurement: Introduction, definitions and MODULEs, Reynolds number. Theory of fixed restriction variable head type flow meters –Orifice plate – Venturi tube – Flow nozzle – Dall tube – Pitot tube- Installation of head flow meters – Piping arrangement for different fluids. Rota meter– Theory and installation.

MODULE IV QUANTITY FLOW METERS AND MASS FLOW METERS 7

Positive displacement flow meters – Constructional details and theory of operation of nutating disc, oval gears and helix type flow meters- Angular momentum mass flow meter – Coriolis mass flow meters – Thermal mass flow meters - Calibration of flow meters – Dynamic weighing method

MODULE V ELECTRICAL TYPE FLOW METER 7

Principle and constructional details of electromagnetic flow meter – Different types of excitation schemes used-Ultrasonic flow meters – transit time-frequency difference type – Vortex shedding flow meter –– Solid flow rate measurement– Guidelines for selection of flow meter.

MODULE VI LEVEL MEASUREMENT 8

Gauge glass techniques – Float type level indication – Different schemes – Level switches, level measurement using displacer and torque tube – Bubble system. Boiler drum level measurement – Differential pressure method – Hydra step systems – Electrical types of level gauges using resistance, capacitance, nuclear radiation sensors.

Total Hours : 45

TEXT BOOKS:

1. E.O. Doebelin, “Measurement Systems – Application and Design”, Tata McGraw Hill publishing company, 2004.
2. R.K. Jain, “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 2010.
3. D.S.Kumar, “Mechanical measurements and control”, 3rd edition, Metropolitan
4. Liptak, B.G., “Mechanical and Industrial Measurements” Khanna Publishers, Delhi, 1999.

REFERENCES:

1. S.K. Singh, “Industrial Instrumentation and Control”, Tata McGraw Hill, 2003.
2. D.P. Eckman, “Industrial Instrumentation”, Wiley Eastern Ltd.,
3. D. Patranabis, “Principles of Industrial Instrumentation”, Tata McGraw Hill Publishing Company Ltd, 1996.
4. A.K. Sawhney, “A Course on Mechanical Measurements, Instrumentation and Control”, Dhanpath Rai and Co, 2004.

OUTCOMES:

- The students will get the relevant knowledge and will be able to select mechanical flow meters, mass flow meters and electrical type meters with different techniques for solid and liquid level measurements, humidity moisture, viscosity and density measurements which will be suited to the industrial requirement.

EIB3103 MICROPROCESSOR AND MICROCONTROLLER **L T P C**
3 0 0 3

OBJECTIVES:

During the course the student will be able

- To know the concept of microprocessors and microcontroller.
- To acquire knowledge on interfacing devices.
- To learn about simple applications of microcontroller.
- To familiarize with advanced processors.

MODULE I ARCHITECTURE OF 8085 & 8051 **7**

Introduction to concept of microprocessor - 8085 microprocessor architecture - comparison between microcontroller and microprocessor. Intel 8051 microcontroller - architecture, pin diagram, special function registers, stack, external memory - interface with 8051, I/O ports.

MODULE II 8051 INSTRUCTION SET **9**

8051 instruction set – Moving data – Introduction – Address modes – External data moves – Code memory data moves – Push & pop – Data exchanges – Logical operations – Introduction – Byte level logical operation – Bit level – Rotate and swap – Arithmetic operation – Introduction – Flags – Increment & decrement – Addition – Subtraction – Multiplication & division – Decimal arithmetic – Jump and call instructions – Introduction – Range – Short and long absolute range – Jumps – Calls –Stack –Interrupts and returns – Detailed interrupts.

MODULE III 8051 TIMERS, INTERRUPTS, AND SERIAL PORTS **7**

ON – Chip Timers – Modes of operation – mode 0 – mode 1 – mode 2 – mode 3, On chip serial port – Features mode 0 – mode 1 – mode 2 – mode 3 – Interrupts – Timer Flag – Serial port Interrupt – External Interrupts – Reset – Interrupt control – Interrupt Priority – Interrupt Destinations.

MODULE IV PERIPHERAL INTERFACING DEVICES **8**

Interfacing Serial I/O (8251) - parallel I/O (8255) –Keyboard and Display controller (8279)–ADC/DAC Interfacing Bus – RS232C-RS485-GPIB

Introduction, Generation of I/O Ports, Sample-and-Hold Circuit and Multiplexer, Programmable Interval timers (Intel 8253, 8254), Printer Interface.

MODULE V APPLICATIONS OF 8051 7

Application – Stepper motor control, speed and position control of dc motors, closed loop control of servo motor, control of physical parameters like temp, pressure, flow and level, case study-home protection system, Traffic light control, washing machine control

MODULE VI ADVANCED MICROPROCESSOR AND MICROCONTROLLER 7

Advanced Microprocessor Architectures- 286, 486, Pentium; Introduction to RISC processors; ARM microcontrollers, core 2 duo processor, i7 core processor

Total Hours: 45

TEXT BOOKS:

1. Ramesh .S.Gaonkar, “Microprocessor architecture, programming and applications with the 8085”, 5th Edition, Prentice Hall, 2010
2. Ayala, “The 8051 Microcontroller” 3rd Edition
3. Subrata Ghoshal, “8051 Microcontroller Internals, Instructions, Programming and Interfacing”, Pearson press.
4. Satish shah, “8051 Microcontroller MCS51 family and its variants”, Oxford.

REFERENCES:

1. Mohammed Ali Mazidi, “The 8051 Microcontroller and embedded systems using Assembly and C”
2. N. Senthil Kumar, “Microprocessors and controllers”

OUTCOMES:

After completion of the course the students will be able to

- Understand the functional block diagram; interrupt structure and multiprocessor configuration of microcontroller.
- Develop the programming skills with simple arithmetic and control instructions.
- Familiar with Interfacing IC’s PPI, A/D and D/A converter with microcontroller.
- Develop the programming skills pertaining to waveform generation, closed loop control of servo motor and to execute industrial projects.

EIB3104 INDUSTRIAL DRIVES AND CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an overview of different types of power semi-conductor devices and their switching characteristics.
- To make the students to understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the characteristics of DC and AC drives
- To learn the different modulation techniques of pulse width modulation
- To provide knowledge about the practical application for power electronics converters in conditioning the power supply.

MODULE I POWER DEVICES **6**

Power diode – Power transistor – Power MOSFET – SCR – TRIAC – GTO – IGBT – Protection circuits for power devices.

MODULE II CONVERTERS **8**

Introduction to half wave, full wave rectifiers – Single phase and three phase half controlled and fully controlled converters – Dual converters – Introduction to cyclo converters and AC controllers.

MODULE III INVERTER AND CHOPPER **8**

Commutation – Single and three phase Voltage Source Inverter (VSI) – Current Source Inverter (CSI) - Series and Parallel Inverter – Voltage control using PWM – DC Choppers: Class A, B, C, D, and E.

MODULE IV DC AND AC DRIVES **9**

Steady state characteristic of DC motors – Control of DC motor using converters and choppers – Regenerative and dynamic braking – Closed loop control scheme – Speed-torque characteristic of induction motor – Static stator voltage control – V/f control – Static rotor resistance control – Slip power recovery scheme – Self control of synchronous motor.

MODULE V POWER ELECTRONIC APPLICATIONS 8

Electric vehicle - Voltage regulators – Online and offline UPS – Switched mode power supply – Principle and application of induction and dielectric heating.

MODULE VI CASE STUDY 6

Mini Project Model – Hardware Fabrication of: Chopper, Inverter, Converter, AC and DC Drives

Total Hours: 45

REFERENCES:

1. G. K. Mithal, “Industrial Electronics”, Khanna Publishers, Delhi, 2008.
2. F. D. Petruzulla, “Industrial Electronics”, McGraw Hill, Singapore, 1996.
3. M. H. Rashid, “Power Electronics Circuits, Devices and Application”, PHI, 3rd edition, 2004.
4. G. M. Chute and R. D. Chute, “Electronics in Industry”, McGraw Hill Ltd, Tokyo, 1995.

OUTCOMES:

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

- Get practical exposure in industrial drives and control
- Select drives for various applications.

MSB3181 MANAGEMENT OF BUSINESS ORGANISATION **L T P C**
3 0 0 3

OBJECTIVES:

- To give an exposure to principles of management and organizational structures
- To introduce concepts of operation and material management
- To provide an understanding of management of human resources.
- To impart some basic knowledge on marketing, pricing and selling.
- To give an overview of accounting and management of finance.

MODULE I PRINCIPLES OF MANAGEMENT **7**

Functions of management – planning – organizing – staffing – direction – motivation – communication – coordination – control, organizational structures – line – line and staff – matrix type, functional relationships – span of control, Management by Objectives (MBO) – Forms of Industrial ownership

MODULE II OPERATIONS MANAGEMENT **8**

Introduction to operations management – functions of production/operations management – types of production, Overview of facility location – lay out planning, introduction to production planning and control, work study, quality assurance, lean manufacturing and six sigma, plant maintenance and management.

MODULE III MATERIALS MANAGEMENT **8**

Materials Planning - types of inventory, Purchasing function – source selection– negotiation – ordering, Stores management – functions - types of stores – overview of inventory control, Introduction to newer concepts: MRP-I – MRP-II– ERP – JIT.

MODULE IV HUMAN RESOURCE MANAGEMENT **7**

Human Resource Management – objectives – role of Human Resource Manager –manpower planning – selection and placement – training – motivation – performance assessment - Introduction to grievances handling and labour welfare.

MODULE V MARKETING MANAGEMENT 7

Marketing – concept and definition – Elements of marketing mix – PLC - Steps in new product development – Pricing objectives and methods – Advertising types/media – Steps in personal selling – Sales promotion methods - Distribution channels: functions, types

MODULE VI FINANCIAL MANAGEMENT 8

Financial management functions – introduction to financial accounts, financial performance – profit and loss account statement – balance sheet, budgetary control – meaning – uses – limitations – types of costs – basics of depreciation methods – break-even analysis – meaning – assumption – uses and limitations, working capital – meaning and relevance – Use of operating ratios

Total Hours: 45

REFERENCES:

1. Bhushan Y.K., "Fundamentals of Business Organisation and Management", Sultan Chand & Co., 2003.
2. Banga & Sharma "Industrial Engineering & Management", 11th edition, Khanna Publications, 2007.
3. Khanna, O.P., "Industrial Engineering & Management", Dhanpat Rai Publications, 2004.
4. S.N.Maheswari, "Principles of Management Accounting" 16th edition S.Chand & Company Ltd., 2007.

OUTCOMES:

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

- Gain basic knowledge of the concepts of management and the functions of management.
- Practice fundamentals of the functional areas of management viz., operations management, materials management, marketing management, human resources management and financial management.

ENB3181 CAREER BUILDING & PEOPLE SKILLS

L	T	P	C
0	0	2	1

OBJECTIVES:

To prepare the students for building their competencies and career building skills.

COURSE OUTLINE:

This course is practical oriented one and exercises will be given to the students group users /individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member and coordinated by the overall course coordinator.

LAB ACTIVITIES:

- Preparation for the placement
- Group discussions: Do's and Don'ts – handling of Group discussions – What evaluators look for.
- Interview – awareness of facing questions – Do's and Don'ts of personal interview.
- Selection of appropriate field vis-à-vis personality / interest.
- Preparation of Resume–Objectives, profiles vis-à-vis companies requirement.
- Enabling students to prepare for different procedures / levels to enter into any company – books / websites to help for further preparation.
- Technical interview – how to prepare and face it.
- Workplace skills
- Presentation skills
- Oral presentations
- Technical presentations
- Business presentations
- Technical writing Interpersonal relationships – with colleagues - clients – understanding one's own behavior – perception by others.

ASSESSMENT:

As the course is practical one, it will be assessed using a portfolio based assessment. The students must in consultation with the Faculty member, plan a portfolio of evidence for the above mentioned activities. The students must develop a résumé or résumés that promote own ability to meet specific job requirements and plan their portfolio in a format appropriate to industry they wish to target. The case studies will contain direct observation of the candidate developing career plans, résumés and skills portfolio, reflect written or oral questioning to assess knowledge and problem-solving activities to assess ability to align career aspirations with realistic career goals. The course coordinator in consultation with the course committee will decide the number of exercises and mark to be awarded for each beside the weightage for the end semester assessment.

OUTCOMES:

The course will help the students to

- Develop team work skills
- Take part effectively in various selection procedures followed by the recruiters.

EIB3105	CONTROL SYSTEM LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- This practical course gives the hands on experience to find the transfer function, simulation of standard signals, response of first and second order systems.
- To provide knowledge in controllers and compensation networks

LIST OF EXPERIMENTS (using Matlab wherever applicable)

1. Transfer function of armature controlled DC motor & generator.
2. Transfer function of field controlled DC motor.
3. Synchro as an error detector.
4. Simulation of error detector , summing point & take off point.
5. Simulation of standard test signals - Step, Ramp and parabolic.
6. Characteristics of stepper motor.
7. Step response of a first order system.
8. Response of a first order system to standard test signals.
9. Frequency response of the given system.
10. On-Off control of a simple thermal system.
11. Position Control System.
12. Controller Characteristics - P, PI, PD & PID.
13. Response of Lead network & Lag network.

OUTCOMES:

The student will be able to

- Design a controller including tuning and simulation for a specific application
- Analyze the first order and second order systems in time and frequency domain related to industrial applications.

EIB3106 INDUSTRIAL INSTRUMENTATION LABORATORY- II

L	T	P	C
0	0	3	1

OBJECTIVES:

- This practical course gives the hands on experience of all the field instruments like rotameter, level transmitters, conductivity meters etc including calibration detecting errors.
- The training gained by the student in this area will be helpful and beneficial for them in any industrial establishment.

LIST OF EXPERIMENTS:

1. Determination of Discharge coefficient of Orifice plate
2. Measurement of flow rate using Orifice, Venturi.
3. Level Measurement using DP transmitter.
4. Electrical level measurement using resistance and capacitance methods
5. Measurement of conductivity of test solutions.
6. Measurement of pH values of test solutions.
7. Calibration of temperature transducers
8. Calibration of pressure gauges
9. Characteristics of P /I and I /P Converters.
10. Determination of Viscosity using Saybolt and Redwood Viscometer
11. Study of P&I diagrams.
12. Study of IR spectrophotometer.
13. Study of smart transmitter and smart valve positioner.

OUTCOME:

- Students will be able to apply knowledge gained to effectively carry out operation and maintenance of process instrumentation in core industries.

EIB3107 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

- To familiarize the students to use assembly language for programming a microcontroller
- To impart the students to understand the hardware and software components of a microcontroller-based system to implement system level features.
- To teach students both hardware and software aspects of integrating digital devices (such as memory and I/O interfaces) into microcontroller-based systems.
- To provide students the operating principles and hands-on experience with, common microcontroller peripherals such as UARTs, timers, and analog-to-digital and digital-to-analog converters.

LIST OF EXPERIMENTS:

1. Arithmetic operations using 8051
   a. Addition and subtraction of 8-bit numbers
   b. Addition and subtraction of 16-bit numbers
   c. Multiplication and division of 8-bit numbers
   d. To find Largest and Smallest number in a number series
   e. To arrange the number series in ascending and descending order.
2. Logical operations using 8051
3. To transfer a block of data from one memory zone to the others.
4. Code conversion of Decimal number to HEXA and HEXA to Decimal number

APPLICATION PROGRAMS USING 8051

5. Stepper motor interfacing with 8051
   a. for full and half step rotation
   b. for rotating motor in clockwise and anticlockwise direction
6. Write a program to transmit ASCII character continuously with 9600 based by polled operation using 8251.

7. Interfacing of D/A converter MODULEs with 8051 to generate the following waveform and to measure the time period and frequency of each waveform.
   a. Saw tooth waveform
   b. Triangular waveform
   c. Square waveform
8. Interface 8253 to generate 1 MHZ square wave.
9. Interfacing traffic light control system
10. Interface 8279 with 8051 to perform the following functions
    a. To display different alphabets and numbers in the 7 segment display
    b. to read various keys form the keyboard
11. Build a Home security system with 4 sensor and 2 alarms interfaced to 8051

OUTCOMES:

- The students will effectively carryout programming of microcontroller interfacing for industrial applications.

SEMESTER-VI

		L	T	P	C
EIB3211	**PROCESS CONTROL**	**3**	**1**	**0**	**4**

OBJECTIVES:

- To provide students with the theories and knowledge of process control systems and necessary skills required for an instrumentation engineer.
- To describe the needs and incentives for controlling a process.
- To develop mathematical model of system from the mathematical equations describing dynamics of the process.
- To analyze control loop characteristics
- To apply computer based hardware and software tools for process control (MATLAB).

MODULE I INTRODUCTION TO PROCESS CONTROL 6

Need for process control, Process characteristics- Self regulating process, continuous and batch processes, degrees of freedom, piping and Instrumentation diagram. Modeling of liquid, thermal, pressure, chemical process, interacting and non- interacting processes. Servo and regulator operations. Simulation of mathematical modeling of processes using Control system toolbox.

MODULE II BASIC CONTROL ACTIONS 8

Discontinuous: ON/OFF, Multiposition Control, Floating Control. Continuous: Proportional, integral, derivative mode. Composite controller modes: P-I, P-D, P-I-D. Auto/Manual transfer, Bumpless transfer. Response of controllers for different test inputs. Selection of control modes for processes like level, pressure, temperature and flow. Electronic controllers to realize various control actions. Design of electronic PID for different processes using SIMSCAPE.

MODULE III OPTIMUM CONTROLLER SETTINGS 8

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. Tuning of composite controllers for various processes using Control system toolbox.

MODULE IV PID ENHANCEMENTS 7

Different forms of industrial PID controllers- Practical aspects of PID control: proportional band, issues in implementing an industrial PID controller-

Proportional kick, Integral wind-up, derivative kick and its prevention, reverse acting controller. Implementing PID enhancements in SIMULINK.

MODULE V FINAL CONTROL ELEMENT 8

Pneumatic and electric actuator. Valve positioner. Control valves: construction details, types, Selection, Performance, sizing And characteristics(inherent and installed).control valve terminology : rangeability, turndown, valve coefficient, Air-to-open, Air-to-close, direct acting ,reverse acting, fail safe conditions, cavitations, flashing and noise, their effects and remedies. Control valve design for specific applications (liquid, gas and slurries), testing of control valves.

MODULE VI ADVANCED CONTROL TECHNIQUES 8

Cascade control, Feed forward control, feedback- feedforward control, Ratio control, Selective Control, Split range control- Basic principles, Design Criteria, Controller Algorithm and Tuning, Implementation issues. Case studies- advanced control schemes for level, thermal and chemical process.

Total Hours: 60

TEXT BOOKS:

1. Stephanopoulis. G, “Chemical Process Control”, Prentice Hall of India, New Delhi, 2006.
2. Eckman. D.P., “Automatic Process Control”, Wiley Eastern Ltd., New Delhi, 1993.

REFERENCES:

1. Pollard A., “Process Control”, Heinemann educational books, London, 1971.
2. Harriott. P., “Process Control”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.

OUTCOMES:

At the end of this course, the students will

- Become familiar with process control tools and he/she will be in a position to measure, acquire and control the process parameters in process industries.
- Have ability to formulate mathematical descriptions of control loops, and to develop system model equations according to various constraints.
- Be able to mimic a physical system using MATLAB.
- Have the ability to use modern engineering tools for control loop analysis, tuning, and troubleshooting.
- Have knowledge of contemporary control technologies, and have recognition of the need for life-long learning.

EIB3212 DIGITAL SIGNAL PROCESSING L T P C
3 1 0 4

OBJECTIVES:

- To introduce signals, systems, time and frequency domain concepts and the associated mathematical tools that are fundamental to all DSP techniques.
- To provide a thorough understanding and working knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.
- To study the effect of finite word lengths and applications of DSP

MODULE I DISCRETE TIME SIGNALS AND SYSTEMS 12

Discrete time signals and systems: Linear time invariant (LTI) systems– Convolution and interconnection of LTI systems – Casual LTI systems – Stability– Recursive and non Recursive Systems – Implementation – Correlation of discrete time signals – Auto correlation and Cross correlation of sequences– Z transform – Properties – Analysis of LTI systems in Z domain. Signal processing toolbox.

MODULE II FREQUENCY DOMAIN ANALYSIS 9

Frequency domain Analysis: Fourier Analysis of Continuous time periodic and a periodic signals – Power density spectrum – Fourier series and transform for discrete time signals – Frequency domain characteristic of LTI systems – System function and frequency response Function – Computation.

MODULE III DISCRETE FOURIER TRANSFORM 12

Introduction to Discrete Fourier Transform, Direct computation of DFT, Properties of DFT- Efficient computation of DFT - FFT algorithms – Radix -2 FFT algorithms - Decimation in Time - Decimation in Frequency algorithms, Computing Inverse DFT Computation of FFT,IDFT using MATLAB toolbox.

MODULE IV DESIGN OF DIGITAL FILTERS-FIR FILTER 9

FIR Filters: Symmetric & Antisymmteric FIR filters - Design of Linear phase FIR filters using windows – Frequency sampling realization structures for FIR filters.

MODULE V DESIGN OF DIGITAL FILTERS- IIR FILTER 9

IIR Filters: System Design of Discrete time IIR filter from continuous time filter - Butterworth filter design using Impulse invariance and bilinear transformation, realization structures for IIR filters

MODULE VI APPLICATIONS OF DSP 9

Sampling theorem - Reconstruction of a Signal from its samples, aliasing - Sampling rate conversion - Interpolation and Decimation - Decimation and Interpolation by an integer factor - Quadrature Mirror Filter banks, Sub-band Coding, few applications using sub-band coding. FIR adaptive filters -adaptive filter based on LMS adaptive algorithm - Adaptive echo cancellation-Adaptive noise cancellation, Model of Speech Wave Form –Vocoder.

Total Hours : 60

TEXT BOOK:

1. John G.Proakis and Dimitus G.Manolakis, “Digital Signal Processing, Principles, Algorithms and applications”, 3rd edition, Prentice Hall of India, New Delhi, 2008.

REFERENCES:

1. Sanjit K.Mitra, “Digital Signal Processing”, Tata McGraw Hill, New Delhi, 2001.
2. Alan V Oppenheim, Ronald W Schafer, John R Back, “Discrete Time Signal Processing”, 2nd edition, PHI, 2000.
3. Johny R.Johnson, “Introduction to Digital Signal Processing”, Prentice Hall of India/Pearson Education, 2002.

OUTCOMES:

At the end of this course the students will be able to

- Identify various discrete time systems as linear, time-invariant, causal, and memory-less.
- Use knowledge and skill to design, analyze and process signals for different industrial and medical applications.

EIB3213 INSTRUMENTATION SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course will provide a basic understanding of instrumentation system design and implications of working with process control systems
- To provide the various methods of signal transmission, selection and implementation.
- To provide knowledge in selection of the equipment used in current loops, temperature measurement, pressure measurement, level measurement, flow measurement, output devices.

MODULE I INTRODUCTION **5**

Introduction to Instrumentation System Design (ISD), Scope of ISD in Process Industry, An overview of General transducer Design, Selection of Transducer, General procedure for Testing of transducer.

MODULE II DESIGN USING OPERATIONAL AMPLIFIER **8**

Design using operational Amplifier and PCB Design: Design of instrumentation amplifiers – multivibrators – comparators – active filter: low and high pass.

MODULE III DESIGN OF SIGNAL CONDITIONING CIRCUITS AND SYMBOLS **8**

Design of signal conditioning circuits and symbols: Design of bridge circuits for strain gauge - design of RTD – design of reference junction compensation for thermocouple –thermistor based temperature measurement.

MODULE IV INSTRUMENTATION CONTROLLERS **8**

Instrumentation controllers: Design of ON/OFF controller design - design of pneumatic – electronic controller – PID controllers Orifice Sizing: design of square root extractor – Orifice sizing for Liquid, Gas and steam applications.

MODULE V CONTROL VALVE SIZING AND ANNUNCIATORS **8**

Control valve sizing and Annunciators: Choice of valve body, materials – flow – lift characteristics – control valve sizing procedure. Cavitation and flashing – Selection criteria. Annunciators & Data Loggers: Annunciators - PLC as an annunciator – Data loggers

MODULE VI PCB DESIGN **8**

PCB Design: PCB board design guide lines – layout scheme – single and multi layer PCB.

Total Hours: 45

TEXT BOOKS:

1. B. G. Liptak, “Instrument Engineers Handbook”, Vol. I and II, 3rd edition, Chilton and Book Company, 2010.
2. D. M. Considine, “Process/Industrial Instruments and Control Handbook”, 4th Edition, McGraw-Hill Inc., 1999.
3. C. D. Johnson, “Process Control Instrumentation Technology”, 4th Edition, PHI, 2005.

REFERENCES:

1. Andrew and Williams, “Applied Instrumentation in Process Industries”, Vol. I, II, III, IV, Gulf Publishing Company, 1979.
2. John P. Bentley, “Principles of Measurement Systems”, Addison-Wesley publication, 1999.
3. T.R.Padmanabhan, “Industrial Instrumentation: Principles and Design”, Springer-Verlag Publications, 1999.
4. B. C. Nakra and K. K. Choudhari, “Instrumentation: Measurement and Analysis”, Tata McGraw Hill pub, 2008.

OUTCOMES:

At the end of the course, the students will possess knowledge and achieve skills on the following:

- Be able to interpret and formulate design specifications for instrumentation systems.
- Be able to design, construct, and verify an instrumentation system to meet desired specifications, with the aid of computer-aided design techniques.

GEB3201 ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**
3 0 0 3

OBJECTIVES

- To impart the basic scientific knowledge on the environment and human impacts on various elements of environment and assessment tools.

MODULE I PHYSICAL ENVIRONMENT **8**

The Earth's surface - the Interior of Earth – Plate Tectonics – Composition of the Crust: Rocks – formation & types, Soils – formation & components – soil profile. The atmosphere – structure & composition – weather & climate – tropospheric airflow. The hydrosphere – water budget – hydrological cycle – Rainwater & precipitation, River Water & solids, Lake Water & stratification, Seawater & solids, soil moisture & groundwater. Bioelement cycling – The Oxygen cycles – the carbon cycle – the nitrogen cycle – the phosphorous cycle – the sulfur cycle sodium, potassium & magnesium cycles.

MODULE II BIOLOGICAL ENVIRONMENT **7**

Cellular basis of life – prokaryotes & eukaryotes – cell respiration – photosynthesis – DNA & RNA – genetically modified life. Population dynamics – population – population growth – survival & growth curves – population regulation – future of human population. Biological communities - Five major interactions: competition, predation, parasitism, mutualism and commensalism – Concepts of habitat & niche – natural selection – species richness & species diversity – ecological succession & climax. Ecosystem & Biomes – Food Chains & food webs – biomagnifications – ecological pyramids - Trophic levels – Energy flow in ecosystem – ecosystem stability – Terrestrial & aquatic biomes.

MODULE III IMPACTS ON NATURAL RESOURCES & CONSERVATION **9**

Biological resources – nature & importance – direct damage – introduced species – Habitat degradation, loss and fragmentation – Values of biodiversity – hotspots of biodiversity, threats to biodiversity- endangered and endemic species of India- conservation of biodiversity, in-situ and ex-situ conservation. Land Utilization – past patterns of land use – Urban & Industrial development – deforestation, salinisation, soil erosion, and desertification – Modern Agriculture & Impacts. Major extractive industries – metals & ores – building materials – peat – fossil fuels (coal, oil, natural gas). Waste management –

types of solid wastes – disposal options – reduce recovery & reuse – waste minimization, cleaner production technology.

MODULE IV IMPACTS ON WATER & AIR AND CONSERVATION 8

Water pollution – organic oxygen demanding wastes – anthropogenic phosphate & eutrophication - Ground water contamination – Usage of fertilizer and pesticides– acid rain –acid mine discharges – toxic metals – organochlorines – endocrine disrupting substances- treatment process – Rain water harvesting and watershed management- manmade radionuclide's – thermal pollution. Atmospheric pollution – primary & secondary pollutants – anthropogenic, xenobiotic, synergism, sources & sink, residence time, levels & impacts of major pollutants – processes leading to smog, acid rain, global warming, stratospheric ozone depletion. Noise pollution and abatement.

MODULE V IMPACTS ON ENERGY AND CONSERVATION, ENVIRONMENTAL CRISIS 8

Energy – Renewable and non renewable energy resources – thermal power plants – nuclear fuels, fossil fuels, solar energy, wind energy, wave energy, tidal energy, ocean thermal energy, hydropower, geothermal energy, biomass energy . Environment crisis – state of environment in developed and developing countries- managing environmental challenges for future – disaster management, floods, earthquake, cyclone and landslides.

MODULE VI EIA & SUSTAINABILITY 5

Environmental Impact Assessment – Impacts: magnitude & significance – steps in EIA – methods – precautionary principle & polluter pays principle – role of NGOs & Public – value education –Environment protection act (air, water, wild life) and forest Conservation act. Concept of Sustainability – Sustainable Development – Gaia Hypothesis - Traditional Knowledge for sustainability.

Total Hours: 45

REFERENCES:

1. Andrew R W Jackson & Julie M Jackson, "Environmental Science (The Natural Environment and Human Impact)", Pearson Education Limited, Harlow, Essex, England

2. G Tyler Miller, “Environmental Science (Working with the Earth)”, Jr., Thomson Brooks/Cole

3. David McGeary & Charles C Plummer, “Physical Geology, Earth Revealed”, WCB McGraw Hill

4. Bryan G. Norton, “Sustainability: A Philosophy of Adaptive Ecosystem Management” Publication Date: November 1, 2005 | ISBN-10: 0226595218 | ISBN-13: 978-0226595214

5. Larry W. Canter, “Environmental Impact Assessment”, McGraw-Hill

6. James Lovelock, “The Revenge of Gaia: Why the Earth is Fighting Back – and How we Can Still Save Humanity” 2006.

7. James Lovelock, “Gaia: A New Look at Life on Earth”, Publication Date: November 23, 2000 | ISBN-10: 0192862189 | ISBN-13: 978-0192862181.

OUTCOMES:

- Student would have gained basic scientific knowledge on the environment and human impacts on various elements of environment and assessment tools.

EIB3214	PROCESS CONTROL LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To derive an empirical linear model for a real process by generating experimental data and its analysis.
- To design, tune and implement SISO controllers for a real process.

LIST OF EXPERIMENTS:

1. Study of interacting and non-interacting systems.
2. Response of different order processes with and without transportation lag.
3. Response of P+I+D controller.
4. Characteristics of control valve with and without positioner.
5. Closed loop response of flow control loop.
6. Closed loop response of level control loop.
7. Closed loop response of temperature control loop.
8. Closed loop response of pressure control loop.
9. Tuning of PID controller.
10. Response of cascade control system.

OUTCOMES:

On completion of the course the student will have

- The ability to apply current knowledge and adapt to engineering applications of mathematics, science, engineering and technology.
- an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,
- an ability to identify , analyze, and solve technical problems in core industries

EIB3215	DESIGN PROJECT LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

To provide hands on experience to design instrumentation amplifiers, active filters, converters, DPS, function generators and signal conditioning circuits

LIST OF EXPERIMENTS:

1. Introduction to circuit connection in PCB
2. Design of instrumentation amplifiers
3. Design of active filters
4. Design of V/I and I/V converters
5. Design of regulated power supply
6. Design of DPS
7. Design of Function Generator
8. Design of linearising circuit and cold – junction compensation circuit for thermocouples
9. Design of signal conditioning circuits for strain gauge and RTD
10. Design of PID controllers (using operational amplifier and microprocessor)
11. Piping and Instrumentation Diagram – case study
12. Preparation of documentation of instrumentation project (process flow sheet, instrument index sheet and instrument specifications sheet
13. Preparation of project scheduling (Job scheduling, installation procedure and safety regulations)

OUTCOMES:

The students will be able to

- Design instrumentation amplifiers, signal conditioning units, controllers
- Prepare data sheets and documentation for instrumentation projects.

SEMESTER-VII

EIB4101 ANALYTICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide various techniques and methods of analysis which occur in the various regions of the spectrum.
- To give unique methods of separation of closely similar materials, using gas chromatography.
- To study important methods of analysis of industrial gases.
- To provide the important radio chemical methods of analysis. NMR & ESR techniques.

MODULE I FUNDAMENTALS OF ANALYTICAL INSTRUMENTS 6

Introduction to Analytical Instruments – Sample preparation – Sample Handling techniques – Standards – performance requirements of analytical instruments: Errors in chemical analysis – performance parameters – Instrument calibration techniques: Calibration curve method, Standard Addition method and Internal standard method – Validation- Electromagnetic radiation, spectrum - Beers Lambert's Law – Deviation from Beer's Law

MODULE II SPECTROPHOTOMETERS (VISIBLE- ULTRAVIOLET) 6

Absorption Instruments – Radiation sources: Blackbody sources, Discharge Lamps, Lasers – Optical filters: absorption filters, Interference filters – Monochromators: Prism monochromators, Diffraction gratings, Holographic gratings – Detectors: Photovoltaic, Photoemissive, Photomultiplier tube, silicon diode detectors –UV–VIS absorption spectroscopy - principle of single beam and double beam photometer – Single beam Null type spectrophotometers – Double beam ratio recording spectrophotometers – application of UV – VIS spectrophotometers.

MODULE III SPECTROPHOTOMETERS (INFRA RED) 6

Infrared Spectroscopy - Radiation sources – Detectors: Quantum Type Detector, thermal Detectors – Types of Infrared spectrophotometers – FTIR spectrophotometers – Flame photometers – Emission system: Fuel Gases and their regulation, atomizer, Burner, Flame – Atomic absorption spectrophotometers – Sources and Detectors.

MODULE IV CHROMATOGRAPHY 9

Chromatography - Basic Definitions - Gas chromatograph: Basic parts, Carrier Gas / Mobile phase, Sample Injection system, Chromatographic column – Detectors: Thermal Conductivity detector, Flame Ionization detector, Flame photometric detector, Photo-ionization detector, electron capture detector –

Liquid Chromatographs – Types of Liquid chromatography: Column, thin layer, paper partition – HPLC – Detectors: Refractive index detectors, Thermal detectors, Electrical Conductivity detectors - application of chromatography in typical industry.

MODULE V INDUSTRIAL GAS ANALYSERS 9

Oxygen analyzer: Paramagnetic and diamagnetic – Infrared Gas analyzer – Thermal conductivity Analyzers - Carbon Monoxide analyzer – Sulphur dioxide analyzer – Nitrogen Oxides analyzer – Hydrocarbons analyzer – Dissolved oxygen analyzer – Sodium analyzer - Silicon analyzer.

MODULE VI ELECTROMAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES 9

Nuclear Magnetic Resonance Spectroscopy: Principle of NMR – Types of NMR Spectrometers – Constructional Details of NMR spectrometer – Constructional Details of ESR spectrometer – SEM : Basic principle and applications – TEM: Basic principle and applications – Mass spectrometers: Basic principle Types, Components and applications

Total Hours: 45

TEXT BOOKS:

1. R.S. Khandpur, “Handbook of Analytical Instruments”, Tata McGraw Hill publishing Co. Ltd., 2008.
2. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, “Instrumental Methods of Analysis”, CBS publishing & distribution, 1995.

REFERENCES:

1. Robert D. Braun, “Introduction to Instrumental Analysis”, McGraw Hill, Singapore, 1987.
2. G.W. Ewing, “Instrumental Methods of Analysis”, McGraw Hill, 2008.
3. D.A. Skoog and D.M. West, “Principles of Instrumental Analysis”, Holt, Saunders Publishing, 1985.

OUTCOMES:

At the end of the course, the student will be

- Familiar with the basics of analytical instrumentation, various techniques and methods of analysis which occur in the process industries
- Acquire knowledge of analysis of industrial gases, NMR & ESR techniques that are useful in structure determination
- Able to select analyses, equipment and methods for analysing samples.

EIB4102 PROGRAMMABLE LOGIC CONTROLER AND DISTRIBUTED CONTROL SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn concept of PLC and the Programming using Ladder logic.
- To study about industrial DCS.
- To have an exposure to HART and foundation fieldbus.

MODULE I PROGRAMMABLE LOGIC CONTROLLER (PLC) BASICS 8

Evolution of PLCs — Sequential and programmable controllers, PLC hardware components – Basics of PLC programming-developing fundamental PLC wiring diagrams and ladder programs-programming timers and counters.

MODULE II PLC INTERMEDIATE FUNCTIONS 8

Program control instructions-Data manipulation Instructions-Arithmetic instructions - Sequencer instructions- Design of interlocks and alarms using PLC.

MODULE III COMMUNICATION IN PLCS 8

Requirement of communication networks for PLC — connecting PLC to computer - PLC applications in Industrial Automation.PLC installation and Trouble shooting.

MODULE IV DISTRIBUTED CONTROL SYSTEM 7

Introduction to DCS-Evolution, Architectures-Hybrid, centralized computer control, Generalized DCS. Architectures-Comparison, Local control MODULE, LCU-Configurations, Comparison, Process interfacing issues, Communication facilities

MODULE V INTERFACES IN DCS 7

Operator interfaces-Low level and High level operator interfaces, Operator displays, Engineering interfacing- Low level and High level engineering interfaces, Case studies — Factors to be considered in selecting DCS.

MODULE VI HART AND FIELD BUS 7

HART: Introduction — Evolution of signal standard — HART Communication

protocol — Communication modes — HART networks — HART and OSI model — Field bus: Introduction— General field bus architecture — basic requirements of field bus standard — Field bus topology –Interoperability and Interchangeability.

Total Hours : 45

TEXT BOOKS

1. Petrezeulla, “Programmable Controllers”, 10th edition , Mc-Graw Hill, 2010.
2. Michael P.Lucas, “Distributed Control System”, Van Nastrand Reinhold Company, New York,1986.
3. Romilly Bowden, “HART application Guide, HART Communication Foundation”, 1999.
4. Berge, J., “Field Buses for Process Control: Engineering, Operation, and Maintenance”, ISA Press, 2004.

REFERENCES

1. G.K.Mc-Millan, :Process/Industrial Instrument and controls and handbook”, Mc Graw Hill, New York, 1999.
2. Hughes T, “Programmable Logic Controllers”, ISA Press, 1989.
3. W. Bolton, “PLC”, Elsevier Newnes

OUTCOMES:

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

- Get the appropriate knowledge and skills in Industrial automation systems with the use of DCS, PLCs.
- Design control system using DDC.
- Implement appropriate industrial automation systems.

EIB4103 COMPUTER CONTROL OF PROCESSES

L	T	P	C
3	1	0	4

OBJECTIVE:

- To provide knowledge on discrete time systems and control, control algorithms, digital controller, identification, predictive and adaptive control.

MODULE I DISCRETE TIME SYSTEMS AND CONTROL 12

Continuous and discrete systems sample data system- Z transform – inverse Z transform- selection of sampling period – mathematical representation of sampler- transfer function of zero order hold and first order hold device-Pulse transfer function – open loop and closed response of linear sample data control system for step input – stability analysis: Jury's test and bilinear transformation- State space representation of sample data systems

MODULE II DIGITAL CONTROL ALGORITHMS 10

Deadbeat Algorithm – Dahlin's method – ringing – Kalman's approach – discrete equivalent to an analog Controller – design for load changes. PID Algorithms - Velocity & Position forms of Digital PID Controller – tuning techniques. Selection of sampling time. Dead time Compensation – Smith Predictor Algorithm.

MODULE III COMPUTER AS A CONTROLLER 10

Basic building blocks of computer control system- Data Acquisition systems- Direct Digital Control – Introduction to AI and expert control system – Design of computerized multiloop controller.

MODULE IV MODEL IDENTIFICATION 10

Modelling and identification – ARMAX model structure – Model structure selection – Least square method of estimating the model parameters – Extended least square method – Real time identification.

MODULE V PREDICTIVE CONTROL 8

Introduction - Model predictive control – Dynamic matrix control – Model algorithmic control – Generalised predictive control.

MODULE VI ADAPTIVE CONTROL 10

Introduction Adaptive control – Gain scheduling – Self tuning regulator – Model reference adaptive control – Design of model reference controller.

Total Hours: 60

TEXT BOOKS:

1. P.B. Deshpande and RH. Ash, “Elements of Computer Process Control”, Instrument Society of America. 1981.
2. M.Chidambaram, “Computer control of processes”, Alpha Science International Ltd, 2002.
3. Shanthisasidharan, “Computer control of process”, CBA Publishers, 2011.

REFERENCES:

1. B.W.Bequette. “Process control” Prentice Hall Inc. 2006.
2. C.L. Smith, “Digital Computer Process Control”, Intext Educational Publishers, 1972.
3. Vance Vandoren, “Techniques for Adaptive Control” BH publishers, 2003.

OUTCOMES:

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

- Design digital control systems using state space techniques
- Analyse digital systems using control algorithms
- Mathematically formulate, model and identify digital control systems using predictive and adaptive control

EIB4104	DESIGN / FABRICATION PROJECT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To design, develop, and deploy advanced state-of-the-art instrument systems and custom application software in support of the ongoing experimental research efforts.
- To provide in-house solutions to assist the researcher through a complete life cycle of system development.
- To gain competency in analyzing experimental data and in comparing the results to data and theories in the literature.
- To acquire more knowledge in designing of hardware as well as applications of softwares like CAD tool, Matlab, LabVIEW & embedded C.
- To apply basic and contemporary science, engineering, and experimentation skills to identifying manufacturing problems and developing practical solutions.

COURSE OUTLINE

Project shall be carried out in the following areas,

- Design/ fabrication of sensors and transmitters,
- Microcontroller based digital control system design,
- Embedded system design for automation,
- Micro-electronics and VLSI Design,
- Applications of Digital image processing for process industries,
- Analysis and design of advanced process control techniques,
- Medical imaging and instrumentation,
- Microsensors and Microactuators design and
- MEMS in instrumentation and biomedical.

SOFTWARE:

MATLAB/SIMULINK, PSPICE, LabVIEW and CAD tool, embedded C, MEMS software

OUTCOMES:

On completion of the course the student will be able to

- Apply knowledge of mathematics, science, and engineering
- Design, model, analyze, and improve a manufacturing process or system utilizing modern technologies.
- Design and conduct experiments, as well as to analyze and interpret data
- Identify, formulate, and solve engineering problems
- Use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Understand professional and ethical responsibilities and the impact of engineering towards societal and global context.
- Function on multi-disciplinary teams and to communicate effectively.

EIB4105	PROGRAMMABLE LOGIC CONTROLLER AND DISTRIBUTED CONTROL SYSTEM LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn concept of PLC and the Programming using Ladder logic.
- To study about industrial DCS.
- To have an exposure to HART and Foundation Field bus.

LIST OF EXPERIMENTS:

1. Development of Ladder program for simple on-off applications.
2. Development of Ladder program for Timing and counting applications.
3. Programming of HMI interfacing with PLC.
4. Develop and simulate programming using FBD in Siemens PLC.
5. Communicate PLC with DCS.
6. Configuring Screens and Graphics (DCS).
7. Tag Assignments to Field Devices in DCS.
8. DCS based PID control for temperature loop.
9. DCS based PID control for level loop.
10. DCS based PID control for pressure loop.
11. To design and develop a front panel using SCADA for level process monitoring and control.
12. To simulate the conveyer based lifting system using SCADA.

OUTCOMES:

- The students will get the appropriate knowledge and skills in Industrial automation systems with the use of DCS, PLCs, and Industrial Field Instruments and they will effectively setup up appropriate industrial automation systems.

EIB4106	COMPUTER CONTROL OF PROCESS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand the mathematical model, transfer function and state space approach for different processes
- To model and identify the process
- To auto tune the controller parameters
- To design state feedback controllers and observers for processes
- To perform stability analysis of multivariable processes

LIST OF EXPERIMENTS:

1. Simulation of
   a. Mass Spring Dashpot system
   b. DC Motor
   c. Level Process
2. Control of a process using
   a. Dead beat algorithm
   b. Dahlin's algorithm using simulation
   c. Position Form
   d. Velocity Form
3. Online Identification of process parameters from experimental data by least square estimate method.
4. Controller tuning for various processes – using Ziegler-Nichols rule
5. Controller tuning for various processes – using Cohen and Coon rule
6. Auto tuning using Relay Feedback
7. Study of first order and second order system responses-measurement of system parameters
8. Given the transfer function of the system. Check the stability of a system. Report whether the system is stable, unstable, or marginally stable.

9. Given the state space of the system. Check the stability of the system using Phase Portrait and Eigen value investigation
10. Simulation of Artificial Neural Networks –use any software
11. State variable analysis
    a. Controllability
    b. Observability
12. Design of state feedback Controller
    a. Pole Placement Technique
    b. Ackermann's Formula
13. Design of observer
    a. State Observer
    b. Neural Network Based Observer
    c. Fuzzy Observer
14. Simulation of advanced control schemes
    a. Feed-forward
    b. Cascade
    c. Ratio control
15. Development of VI for various process with display, visual and sound alarms

OUTCOMES:

On completion of the course the student will be able to

- Identify and model the process
- apply transfer function and state space approach for controller design
- Perform stability analyses of the system
- Design advanced control schemes, conventional and intelligent observers.

PROFESSIONAL ELECTIVES

GROUP 1

EIBX01 BIO MEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an acquaintance of the physiology of the heart, lung, brain and biopotentials.
- To introduce the student to the various electrodes and amplifiers and typical 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 and latest knowledge of medical assistance / techniques and therapeutic equipments.
- To provide awareness of electrical safety of medical equipments

MODULE I PHYSIOLOGY AND BASIC CONCEPTS OF MEDICAL INSTRUMENTATION **5**

Generalized Medical Instrumentation system – Medical and physiological parameters - Nervous system: Functional organisation of peripheral nervous system – Structure of nervous system, neurons - synapse – transmitters and neural communication – Cardiovascular system – respiratory system - Resting and Action Potential – Bio potentials

MODULE II ELECTRO – PHYSIOLOGICAL MEASUREMENTS **5**

Electrodes – Limb electrodes – floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Blood glucose sensors - Practical hints in using electrodes. Bio potential amplifiers: Basic requirements– ECG preamplifiers and ECG isolation amplifiers

MODULE III ORIGIN OF BIOPOTENTIALS **10**

Electrocardiogram (ECG) –Electroencephalogram (EEG) – Electromyogram (EMG) – Electroretinogram (ERG) – Lead systems and recording methods – Typical waveforms – case study of ECG, EEG.

MODULE IV NON-ELECTRICAL PARAMETER MEASUREMENTS 10

Measurement of blood pressure: Direct and indirect measurement – Blood flow meters – Cardiac output – Heart rate – Heart sounds – Pulmonary function measurements: lung volume spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analyzers :finger-tip oxymeter - BSR, GSR measurements .

MODULE V ASSISTING AND THERAPEUTIC EQUIPMENTS 10

Computer tomography – PET - MRI – Ultrasonography – Endoscopy – Mammography - Different types of biotelemetry systems - patient monitoring - Pacemakers – Defibrillators - Diathermy – Dialysers

MODULE VI ELECTRICAL SAFETY 5

Electrical safety in medical environment: Physiological effects of Electricity – micro and macro shock hazards – Protection against shock - Electrical Safety analyzers

Total Hours: 45

TEXT BOOK:

1. J.Webster, “Medical Instrumentation – Application and Design”, 4th Edition, John Wiley & Sons, 2009.

REFERENCES:

1. R.S.Khandpur, “Hand Book of Bio-Medical Instrumentation”, 12th reprint, Tata McGraw Hill Publishing Co Ltd., 2008.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, “Bio-Medical Instrumentation and Measurements”, 2nd edition, Pearson Education, 2008 / PHI.
3. M.Arumugam, “Bio-Medical Instrumentation”, Anuradha Agencies, 2009.
4. L.A. Geddes and L.E.Baker, “Principles of Applied Bio-Medical Instrumentation”, John Wiley & Sons, 1975.

OUTCOMES:

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

- Analyze typical waveforms of bio potentials of the human system
- They will be able provide safety during measurement.
- Capable of pursuing biomedical engineering and biotechnology at master level programme.
- Able to apply the knowledge of biomedical for designing biomedical equipments.

EIBX02 FIBRE OPTICS AND LASER INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge about the characteristics, losses and fabrication of optical fibres.
- The impart knowledge of optical fibre as a sensor for different applications.
- To provide the use of laser for various measurements and applications

MODULE I OPTICAL FIBRES AND THEIR PROPERTIES **7**

Principles of light propagation through a fibre – Fibre materials and their characteristics-Different types of fibres and their properties - Transmission characteristics of optical fibre- Absorption losses -Scattering losses - Dispersion- Optical fibre measurement.

MODULE II OPTICAL SOURCES AND DETECTORS **7**

Introduction to Optical sources LED-structures, Types, characteristics, Applications, LD. Optical detectors, PIN structures, Types, characteristics, Applications, APD -, Wavelength Division Multiplexing.

MODULE III INDUSTRIAL APPLICATIONS OF OPTICAL FIBRES **9**

Fibre optic sensors- Fibre optic instrumentation system-Different types of modulators –Detectors-Application in instrumentation- Interferometer method of measurement of length-Moiré fringes-Measurement of pressure, Temperature, current, Voltage, liquid level and strain–Fibre optic gyroscope–polarization.

MODULE IV LASER FUNDAMENTALS **8**

Fundamental characteristics of laser-Three level and four level lasers-Properties of lasers-Laser modes-Resonator configuration-Q-switching and mode locking-Cavity dumping-Types of laser-Gas laser, solid laser, liquid laser, semi conductor laser.

MODULE V INDUSTRIAL APPLICATION OF LASER **7**

Laser for measurement of distance, length, velocity, acceleration, current, voltage, and atmospheric effect-Material processing-Laser heating, welding, melting and trimming materials, removal and vaporization.

MODULE VI HOLOGRAPHY & MEDICAL APPLICATIONS OF LASER 7

Holography- Basic principle, methods-Holographic interferometer and applications –Holography for non destructive testing-Holographic components-Medical application of lasers-laser and tissue interaction-Removal of tumors of vocal cards-Plastic surgery-Endoscopy.

Total Hours: 45

TEXT BOOK:

1. Gerd Keiser, “Optical Fibre Communications”, McGraw-Hill, International Edition, 2010.

REFERENCES:

1 D.C.O’shea, Russel Callen, “Introduction to lasers and their applications”, Mc Millan, 1977.

2 John and Harry, “Industrial lasers and their applications”, McGraw Hill, 1974.

3 John senior, “Optical communications”, PHI

4 Thyagarajan.K, Ajoy k Ghata, “Laser theory and applications”, Plenna press, 1981

5 John F Ready, “Industrial applications of lasers”, Academic press, 1978.

6 Monte Ross, “Laser applications”, McGraw Hill, 1968.

7 Ghatak A.K. and Thiagarajan K, “Optical electronics foundation book”, TMH, New Delhi, 1991.

8 John Palais, “Fibre Optic Communications”, Pearson Education.

OUTCOME:

- Students will be able to select suitable optical and laser instruments for various engineering and biomedical applications.

EIBX03 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide knowledge on Micro electro mechanical systems, basic mechanics for design and modeling.

MODULE I INTRODUCTION TO MEMS **8**

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication

MODULE II MECHANICS FOR MEMS DESIGN **8**

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

MODULE III ELECTRO STATIC DESIGN **8**

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. Bistable actuators.

MODULE IV CIRCUIT AND SYSTEM ISSUES **8**

Electronic Interfaces, Feedback systems, Noise, Circuit and system issues, Case studies – Capacitive accelerometer, Piezo electric pressure sensor.

MODULE V INTRODUCTION TO OPTICAL AND RF MEMS **8**

Optical MEMS - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF MEMS – design basics, case study – Capacitive RF MEMS switch, performance issues.

MODULE VI MODELING OF MEMs **5**

Modelling of MEMS systems, CAD for MEMS. Modelling the dynamics of MEMs resonators.

Total Hours: 45

TEXT BOOK:

1. Stephen Santuria," Microsystems Design", Kluwer publishers, 2000.

REFERENCES:

1. Nadim Maluf, "An introduction to Micro Electro Mechanical System Design", Artech House, 2000
2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

OUTCOMES:

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

- Select Micro electro mechanical systems for specific application,
- Identify specific sensor for design pertaining to different applications
- Model Micro electro mechanical systems using CAD software.

EIBX04 TELEMETRY AND TELECONTROL L T P C
3 0 0 3

OBJECTIVES:

- To provide knowledge on telemetry fundamentals, landline, radio, optical and biotelemetry
- To make the students to understand telecontrol methods

MODULE I TELEMETRY FUNDAMENTALS AND CLASSIFICATION 8

Fundamental concepts – Significance, Principle, functional blocks of Telemetry and Telecontrol system - Methods of telemetry – Electrical, Pneumatic, Hydraulic and Optical Telemetry – State of the art-Telemetry standards.

MODULE II LANDLINE TELEMETRY 8

Electrical Telemetry-Current Systems – Voltage Systems - Synchro Systems– Frequency systems – Position and Pulse systems – Example of a landline telemetry system.

MODULE III RADIO TELEMETRY 8

Block diagram of a Radio Telemetry system – Transmitting and receiving techniques – AM, FM, PM, Multiplexing and demultiplexing – Transmitting and receiving techniques – Digital coding methods – Advantages of PCM, PWM, PM, FSK – Delta modulation – coding and decoding equipment – Example of a radio telemetry system.

MODULE IV OPTICAL TELEMETRY 8

Optical fibers for signal transmission – Sources for fiber optic transmission – Optical detectors – trends in fiber – optic device development – Example of an optical telemetry system.

MODULE V TELECONTROL METHODS 8

Analog and Digital techniques in telecontrol, telecontrol apparatus – Remote adjustment, Guidance and regulation – Telecontrol using information theory – Example of a telecontrol system.

MODULE VI BIO TELEMETRY METHODS **5**

Bio telemetry – single channel telemetry – multi channel telemetry – telemetry for biomedical applications.

Total Hours: 45

REFERENCES:

1. Gruenberg. L “Handbook of telemetry and remote control”, McGraw Hill, New York, 1987.
2. Swobodoa. G., “Telecontrol methods and applications of Telemetry and Remote Control”, Reinhold Publishing Corp., London, 1988.
3. Young R.E., “Telemetry Engineering”, Little Books Ltd, London 1988.

OUTCOMES:

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

- Apply the concepts to design a radio telemetry system
- Design a biotelemetry system
- Choose optical cables to meet specific requirement

GROUP 2

EIBX05 POWER PLANT INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an overview of different methods of Power Generation, with a particular emphasis on thermal power Generation.
- To get knowledge about the various measurements involved in power generation plants.
- To provide knowledge about the different types of analysers used for analysis.
- To impart knowledge about the different types of controls and control loops.
- To familiarize the student with the methods of monitoring different parameters like speed, vibration of turbines and their control.

MODULE I OVERVIEW OF POWER GENERATION 7

Brief survey of methods of power generation – Hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – Thermal power plants – Block diagram – Details of boiler processes – P & I diagram of boiler – Cogeneration.

MODULE II MEASUREMENTS IN POWER PLANTS 8

Measurements – Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum level measurement – Smoke density measurement – Dust monitor

MODULE III ANALYSERS IN POWER PLANTS 8

Flue gas oxygen analyser – Analysis of impurities in feed water and steam – Dissolved oxygen analyser – Chromatography – pH meter – Fuel analyser – Pollution monitoring instruments, conductivity meter; Silica Analyser.

MODULE IV CONTROL LOOPS IN BOILER & PROTECTION 8

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

MODULE V TURBINE MONITORING **7**

Speed, vibration, shell temperature monitoring and control – Lubricant oil temperature control – Cooling system

MODULE VI TURBINE CONTROL & PROTECTION **7**

Steam pressure control, L.P.Heater, H.P. Heater, Condenser Hotwell Control, Interlocks In turbine operation.

Total Hours: 45

TEXT BOOKS:

1. Sam G.Dukelow, “The Control of Boilers”, Instrument Society of America, 1991.
2. P.K.Nag, “Power Plant Engineering”, Tata McGraw Hill, 2001.
3. “Modern Power Station Practice” Vol. 6, Instrumentation controls and Testing, Pergaman Press.

REFERENCES:

1. S.M.Elonka and A.L.Kohal, “Standard Boiler Operations”, Tata McGraw Hill, New Delhi, 1994.
2. R.K.Jain, “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 1995.
3. E.Al. Wakil, “Power Plant Engineering”, Tata McGraw Hill, 1984.

OUTCOMES:

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

- Apply effectively the different methods of Power Generation in operation and maintenance of power generation in a core industry.
- Monitor and analyze different parameters like speed, vibration of turbines and their control.
- Control the power plant using control loops effectively.

EIBX06 SENSORS FOR ENGINEERING APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide knowledge on measurement using resistance strain gauge, motion sensors, heat and temperature detectors and electronics sensors

MODULE I STRAIN AND PRESSURE MEASUREMENT **8**

Resistance strain gauge, piezoelectric pressure gauge, characteristics. Electronic circuits for strain gauge, load cells. Interferometer, Fibre-optic methods. Pressure gauges Aneroid capacitance pressure gauge, ionization gauge, using the transducers for applications.

MODULE II MOTION SENSORS **8**

Capacitor plate sensor, Inductive sensors, LVDT Accelerometer systems, rotation sensors drag cup devices, piezoelectric devices. Rotary encoders.

MODULE III LIGHT RADIATION **8**

Color temperature, light flux, photo sensors, photomultiplier, photo resistor and photoconductors, photodiodes, phototransistors, photovoltaic devices, fiber-optic applications, light transducer, solid-state, transducers liquid crystal devices.

MODULE IV HEAT AND TEMPERATURE **8**

Bimetallic strip, Bourdon temperature gauge, thermocouples, Resistance thermometers, thermistors, PTC thermistors, bolometer, Pyroelectric detector.

MODULE V ELECTRONIC SENSORS **8**

Proximity detectors – Inductive and capacitive, ultrasonic, photo beam detectors Reed switch, magnet and Hall-effect modules, Doppler detectors, liquid level detectors, flow sensors, smoke sensors.

MODULE VI CASE STUDY **5**

Typical application of Sensors in chemical industries, petrochemical industries, iron and steel industries and biomedical applications.

Total Hours: 45

REFERENCES:

1. Doebelin, E O, “Measurement Systems, Application and Design” , McGraw Hill, 5th Edition, 2004.
2. Jack P Holman, “Experimental Methods for Engineers”, 7th edition, McGraw Hill, USA, 2001.
3. Ian R Sinclair, “Sensors and Transducers”, 3rd edition, Newnes publishers, 2001.
4. Robert G Seippel, “Transducers, Sensors and Detectors”, Reston Publishing Company, US.

OUTCOMES:

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

- Apply the common methods for converting a physical parameter into an electrical quantity for measurement of temperature, strain, motion, position and light for industrial applications.

EIBX07 ULTRASONIC INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge about the basic principles and generation of ultrasonic waves.
- To provide the various testing method and measurement of ultrasonic waves.
- To impart knowledge on applications of ultrasonic waves in medical field, Imaging field and nondestructive testing.

MODULE I ULTRASONIC WAVES **8**

Principles and propagation of various waves. Characterization of Ultrasonic transmission– reflection and transmission coefficients, intensity and attenuation of sound beam. Power level.

MODULE II GENERATION OF ULTRASONIC WAVES **9**

Magnetostrictive Piezoelectric effects and Electrostriction. Search MODULE– types, construction, characteristics. Detection of ultrasound: kund's tube-koeing's tube-thermal detection .Multiple Element Ultrasound transducer-Piezoelectric ultrasound generator: Design and its frequency response .Focus transducer, Phase array transducer-Transducer damage.

MODULE III ULTRASONIC TEST METHODS **8**

Ultrasonic Test methods - Pulse echo, Normal beam transmission, Angular beam transmission techniques. Transit time, resonance, direct contact and immersion type, Ultrasonic methods of flaw detection-Acoustic Flaw detector.

MODULE IV ULTRASONIC MEASUREMENT **8**

Ultrasonic method of measuring thickness, Level, flow etc. Doppler Effect - Doppler flow meter-various types. Density measurement: Sludge densitometer-sonic densitometer-Microprocessor based sludge densitometer. Temperature Measurement: Ultrasonic thermometers-variable types.

MODULE V ULTRASONIC APPLICATIONS IN MEDICAL DIAGNOSIS **6**

Blood flow measurement-Beam deflection flow meter-Doppler flow meter- Fetal heart movement measurement-phonocardiography-Echocardiography-tissue destruction and Therapy.

MODULE VI INDUSTRIAL APPLICATIONS OF ULTRASOUND 6

Acoustical holography-Principle, various types. Interface Detection-Sound Navigation and Ranging- non destructive testing.

Total: 45 Hours

TEXT BOOKS:

1. James A. Zagzebski, “Introduction to Essential of ultrasound”, Mosby, Incorporated, 1996
2. Srinivasan M.R. “Physics for Engineers”, New Age International, 2009
3. Liptac, “Process Design and Instrumentation”, John wiley and sons, 2003
4. R.S.Khandpur, “Hand Book of Bio-Medical instrumentation”, Tata McGraw Hill Publishing Co Ltd.,2003.

REFERENCES:

1. Krauthsamer J and Krauthsamer H, “Ultrasonic Testing of Materials”, Springer Verlag, Berlin,New York.
2. Wells N T, “Biomedical Ultrasonic”, Academic Press, London, 1977.

OUTCOMES:

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

- Detect the defects in test specimen and capable of measuring various physical quantities using ultrasonic waves.
- Diagnose the medical related issues using ultrasonic waves.

EIBX08	MARINE CONTROL ENGINEERING AND AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on various controls systems and automation in ships
- To provide knowledge on marine steam plants and turbine in ships

MODULE I CONTROL SYSTEM **7**

Introduction to control terms, Block diagrams for control systems, Block diagram reduction, open loop and closed feedback control, comparison of closed and open loop, feed forward control. Feed forward modification. Regulators, Proportional plus integral plus derivative controls. Use of various control modes.

MODULE II GRAPHICAL REPRESENTATION OF SIGNALS **7**

Inputs of step, Ramp, Sinusoid, Pulse and Impulse, Exponential Function etc Error Detector, Controller output elements. Dynamics of a simple servomechanism for Angular position Control: Torque Proportional to error, Different responses of servomechanism

MODULE III PROCESS CONTROL SYSTEMS **9**

Automatic closed loop process. Control system Dynamic characteristics of processes. Dynamic characteristics of controllers. Electronic Instrumentation for measurement and control analog computing and simulation: Introduction, Basic concepts. Analog computers simulation. The use of Digital computer in the simulation of control system. Hybrid computers.

MODULE IV TRANSMISSION **9**

Pneumatic and electric transmission, suitability for marine use. Pneumatic and types of controllers hydraulic, electric and electronic controllers for generation of control action. Time function controllers. Correcting MODULEs: Diaphragm actuators, Valve positioners, piston actuators, and Electro pneumatic transducers. Electro- hydraulic actuators and Electric actuator control valves.

MODULE V APPLICATION OF CONTROLS ON SHIPS **7**

Marine Boiler - Automatic Combustion control, Air - Fuel ratio control, feed

water control single, two and three-element type, steam pressure control. Combustion chamber pressure control, fuel oil temperature control, Control in Main Machinery Units for temperature of lubricating oil, jacket cooling water.

MODULE VI MARINE STEAM PLANTS **6**

Reciprocating/Steam Engines: History of multiple expansion marine reciprocating engines &steam turbines. Description of different types of steam turbines. Layout of Plant: General layout of plant & description of a modern geared steam turbine installation including auxiliaries in modern use, open and closed feed system.

Total Hours: 45

TEXT BOOKS:

1. D.A. Taylor, “Marine Control Practice”, 2nd edition, Butter worth & Co (Publishers) Ltd., London, 1987.
2. Leslie Jackson, “Instrumentation and Control Systems”, 3rd edition, Thomas Reed Publication Ltd., London, 1992.
3. C. McBirnie, “Marine Steam Engines and Turbines”, 4th edition, Butter worth.

REFERENCES:

1. L.F. Adams, “Engineering Instrumentation and Control”, 1st Edition, English Language Book Society (ELBS), Hodder, Stoughton, Great Britain, 1984.
2. Peter Harriott, “Process Control”, 26th reprint, Tata Mc Graw Hill Publishing Co.Ltd.,2005 London 1980.

OUTCOMES:

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

- Control Pneumatic, Hydraulic and Electronics systems in ships.
- Design boilers and steam turbine in ships.

GROUP 3

EIBX09 EMBEDDED SYSTEMS AND RTOS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on ARM architecture, CPU, Peripherals, Operating system and Real time operating system of embedded systems

MODULE I ARM INTRODUCTION **8**

Introduction - The ARM Architecture Overview - Instruction set Summary - Processor operating states- Memory formats - Memory Interface - Bus interface signals - Addressing signals Addressing timing - Data Timed Signals- Debug interface - Debug systems - Debug interface signals - ARM7TDMI Core and system state - About Embedded ICE-RT Logic – Instruction Set.

MODULE II LPC2148 ARM CPU **8**

Introduction: - Architectural Overview - Memory Mapping -Block Diagram - System control block functions: PLL - Power Control - Reset - VPB Divider - Wakeup Timer - Memory Acceleration Module - Timer0 and Timer1- PWM - RTC - On Chip ADC - On Chip DAC- Interrupts- Vector Interrupt Controller.

MODULE III LPC 2148 – PERIPHERALS **8**

General Purpose Input/output Ports (GPIO) - Universal Asynchronous Receiver/ Transmitter (UART) - I^2C Interface – Multimaster and Multislave communication- SPI Interface - SSP Controller – USB 2.0 Device Controller.

MODULE IV OPERATING SYSTEM OVERVIEW **8**

Introduction OS – Function of OS – Defining an RTOS – Differences in Embedded Operating Systems – Introduction to Kernel – Resources – Shared Resources - Defining a Task – Task States -Multitasking - Scheduling and Scheduling Algorithms - Context Switching – Clock Tick – Timing of Task.

MODULE V μC/OS – II **8**

Introduction – Features and Goals of μC/OS – II – Requirements of μC/OS – II - Support Devices for μC/OS – II – File Structure in μC/OS – II - Task Management Functions – Creating a Task - Time Management Functions – OS Delay Functions - Implementation of Scheduling and rescheduling.

MODULE VI REAL-TIME OPERATING SYSTEM **5**

Introduction to RTOS; RTOS- Inter Process communication, Interrupt driven Input and Output - Nonmaskable interrupt, Software interrupt; Thread – Single, Multithread concept; Multitasking Semaphores.

Total Hours: 45

REFERENCES:

1. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2013.
2. Andrew N. Sloss, “ARM System Developer’s Guide”, 2010.
3. David Seal, “ARM Architecture Reference Manual”, Prentice Hall PTR, 1996.
4. Steve Furbe, “ARM System-on-Chip Architecture” 2nd edition, Pearson Education Limited, 2000.
5. MicroC/OS – II The Real Time Kernel, Jean J. Labrosse, CMP Books, 2002.
6. Qing Li and Caroline Yao, “Real Time Concepts for Embedded Systems” CMP Books, 2003.
7. Dr. K.V.K.K PRASAD, “Embedded / Real Time Systems : Concepts , Design & Programming”, New Edition, Dreamtech (2003).

OUTCOMES:

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

- Design, execute and evaluate projects on embedded platforms.
- Apply the knowledge of embedded systems for research and development.

EIBX10	ROBOTICS AND AUTOMATION	L	T	P	C
	(Pre Requisite: Mathematics, Control Systems)	3	0	0	3

OBJECTIVES:

- To introduce the basic concepts, parts and types of robots
- To make the student familiar with the various drive systems for robot, sensors and their applications and programming.
- To impart knowledge about the various kinematics, dynamics and control of robots

MODULE I INTRODUCTION TO ROBOTICS 6

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications - History of Robots – Classifications – Various fields of Robotics .

MODULE II SENSORS AND PROGRAMMING LANGUAGES 7

Actuators – Sensors – Manipulators The mechanics and mechanics of manipulators: Description of position and orientation - Forward kinematics of manipulators – End effectors – Application areas – Programming robots - Off-line programming and simulation - Robot programming languages – Three levels of robot programming.

MODULE III ROBOT KINEMATICS 8

Inverse kinematics of manipulators - Velocities, static forces, singularities Matrix representation – Homogeneous transformation – DH representation of standard robots – Inverse kinematics.

MODULE IV ROBOT DYNAMICS 7

Dynamics - Trajectory generation - Manipulator design and sensors - Velocity kinematics – Jacobian and inverse Jacobian – Lagrangian formulation – Eulers Lagrangian formulation – Robot equation of motion.

MODULE V TRAJECTORY PLANNING 8

Introduction – Path Vs trajectory – Joint-space Vs Cartesian-space descriptions – Basics of trajectory planning – Joint-space trajectory planning – Cartesian-space trajectories.

MODULE VI CONTROL AND APPLICATION OF ROBOTICS 9

Linear position control - Nonlinear position control - Force control - Linear control of robot manipulation – Second-order systems – trajectory following control – Modeling and control of single joint – Architecture of industrial robotic controllers – Robot applications.

Total Hours: 45

TEXT BOOK:

1. Craig, “Introduction to Robotics Mechanics and Control”, 2nd edition, Pearson Education, Asia, 2008.

REFERENCES:

1. Saeed B. Niku, “Introduction to Robotics Analysis, Systems, Applications”, Prentice Hall of India/Pearson Education, Asia, 2001.
2. K.S. Fu & Co., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill International Editions, Industrial Engineering Series, 1991.
3. R.D.Klafter, T.A. Chimielewski and M.Negin, “Robotic Engineering – An integrated Approach”, Prentice Hall of India, New Delhi, 1994.
4. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, “Industrial Robotics Technology Programming and Application”, McGraw Hill book company, 1986.

OUTCOMES:

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

- To design and develop robots for control applications
- To interpret the results of modeling and control of robotic controllers for industrial and biomedical applications.

EIBX11	APPLIED SOFT COMPUTING FOR INSTRUMENTATION ENGINEERS (Pre Requisite: Mathematics)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a basic understanding of artificial neural networks, fuzzy logic control and intelligent technique.
- To acquaint knowledge about these techniques to engineering problems, including control systems.

MODULE I NEURAL NETWORK ARCHITECTURE & LEARNING ALGORITHMS **8**

Introduction to neural networks: Introduction – Biological neuron – Artificial neuron – Neuron modeling – Learning rules – Single layer – Multi layer feed forward network – Back propagation – Learning factors- RBF- SVM.

MODULE II NEURAL NETWORKS FOR MODELING AND CONTROL **8**

Feedback networks – Discrete time hop field networks – Transient response of continuous time networks – Applications of artificial neural network - Process identification ,Schemes of neuro control– Neuro controller for inverted pendulum.

MODULE III INTRODUCTION TO FUZZY LOGIC **8**

Fuzzy sets- fuzzy relations - Fuzzy conditional statements- fuzzy learning algorithms- fuzzy rules- MAMDANI – TAKAGI SUGENO.

MODULE IV FUZZY LOGIC CONTROL SYSTEM **8**

Fuzzy logic controllers, fuzzification interface, knowledge/rule base, decision making logic, defuzzification interface, design of fuzzy logic controllers, case studies. Applications of FLC – Inverted pendulum – Image processing – Home heating system – Blood pressure during anesthesia.

MODULE V HYBRID CONTROL SCHEMES **8**

Neuro Fuzzy —ANFIS — Introduction to Evolutionary Algorithm — Optimization of membership function and rule base using GA — Particle Swarm Optimization – Ant colony optimization.

MODULE VI SOFT COMPUTING TOOL BOX **5**

Case study: Neural Network Tool Box familiarization — Application of Neural Network in Control. Simulation of using Fuzzy logic Tool Box.

Total Hours: 45

TEXT BOOKS:

1. Laurence Fausett, “Fundamentals of Neural Networks”, Prentice Hall, Englewood cliffs, N.J., 2004.
2. Jacek M.Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing House,Mumbai, 1997.
3. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill Inc.,1997.

REFERENCES:

1. Freeman Neural network: “Algorithms Applications and Programming Techniques”, Addison-Wesely, 1990.
2. Goldberg, “Genetic Algorithm in Search, Optimization, and Machine Learning”, Addison Wesley Publishing Company, Inc. 1989.
3. Tsoukalas L.H., and Robert E.Uhrig, “Fuzzy and Neural approach in Engineering”, John Wiley and Sons, 1997.
4. Millon W.T., Sutton R.S., and Webrose P.J., “Neural Networks for control”, MIT Press,1992.
5. MATLAB Neural Network Tool Box Manual.
6. MATLAB Fuzzy Logic Tool Box Manual.
7. R. Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence” PC Tools”, AP Professional, Boston 1996.

OUTCOMES:

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

- Design control systems using fuzzy logic and artificial neural networks.
- Interpret the results of Intelligent modeling for research and development.

EIBX12 COMPUTATIONAL METHODS OF OPTIMIZATION **L T P C**
3 0 0 3

OBJECTIVES:

- To understand basic models of computation and how to use them to analyze the efficiency of algorithms.
- To understand the fundamentals of a computer's architecture affect the performance of Algorithms
- To understand basic programming paradigms and the tools for implementations using these paradigms.
- To understand the data structures that are typically used in optimization algorithms.
- To learn to use basic programming environments and tools.

MODULE I INTRODUCTION TO OPTIMIZATION **7**

Engineering applications of optimization, Statement of an optimization problem, Classification of optimization problems, optimization techniques.

MODULE II LINEAR PROGRAMMING I **8**

Simplex Method: Standard form of linear programming problem, Geometry of linear programming problem, Definitions and Theorems, Solution of a system of linear simultaneous equations, Motivation to the simplex method, Simplex algorithm, The two phases of the simplex method.

MODULE III LINEAR PROGRAMMING II **7**

Revised Simplex method, Duality in linear programming, Decomposition Principle, Sensitivity or post optimal analysis, Transportation problem.

MODULE IV NONLINEAR PROGRAMMING I **8**

One Dimensional Minimization: Unimodal function, Elimination method, Interpolation methods - Unconstrained Optimisation Technique: Introduction, Direct search methods, Descent methods.

MODULE V NONLINEAR PROGRAMMING II **7**

Constrained Optimisation Techniques: Characteristics of a constrained problem, direct methods, Indirect methods.

MODULE VI DYNAMIC PROGRAMMING **8**

Introduction, Multistage Decision process, Concept of sub optimization and principle of optimality, Computational procedure in dynamic programming. Linear Programming as a case of dynamic programming, Continuous dynamic programming. Introduction to Genetic Algorithms and its use in optimisation.

Total Hours : 45

REFERENCES:

1. S. S. Rao, “Optimization theory and applications”, 2nd edition, Wiley Eastern Limited, New Delhi, 1989.
2. M. Wagner, “Principles of Operation Research”, 2nd edition, Tata McGraw hill, 1983

OUTCOMES:

The students will be able to

- Convert written descriptions into optimization problems.
- Solve optimization problems using software techniques.
- Effectively use computational methods of optimization for R&D.

GROUP 4

EIBX13 VIRTUAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To review background information required for studying virtual instrumentation.
- To study the basic building blocks of virtual instrumentation.
- To study the various techniques of interfacing of external instruments of PC.
- To study the various graphical programming environment in virtual instrumentation.
- To study a few applications in virtual instrumentation.

MODULE I REVIEW OF DIGITAL INSTRUMENTATION 6

Representation of analog signals in the digital domain – Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

MODULE II FUNDAMENTALS OF VIRTUAL INSTRUMENTATION 8

Concept of virtual instrumentation – PC based data acquisition – Typical on board DAQ card – Resolution and sampling frequency - Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

MODULE III CLUSTER OF INSTRUMENTS IN VI SYSTEM 8

Interfacing of external instruments to a PC – RS232, RS 422, RS 485 and USB standards - IEEE 488 standard – ISO-OSI model for serial bus – Introduction to bus protocols of MOD bus and CAN bus.

MODULE IV GRAPHICAL PROGRAMMING ENVIRONMENT IN VI 9

Concepts of graphical programming – Lab-view software – Concept of VIs and sub VI - Display types – Digital – Analog – Chart – Oscilloscopic types – Loops – Case and sequence structures - Types of data – Arrays – Formulae nodes –Local and global variables – String and file I/O.

MODULE V ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI 9

Fourier transform - Power spectrum - Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – P-I-D controller - CRO emulation - Simulation of a simple second order system – Generation of HTML page.

MODULE VI CASE STUDY 5

Design of level, pressure, temperature transmitter using VI.

Total Hours: 45

TEXT BOOKS:

1. S. Gupta and J.P Gupta, “PC Interfacing for Data Acquisition and Process Control”, Instrument society of America, 1994.
2. Peter W. Gofton, “Understanding Serial Communications”, Sybex International.
3. Robert H. Bishop, “Learning with Lab-view”, Prentice Hall, 2003.

REFERENCES:

1. Kevin James, “PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control”, Newness, 2000.
2. Gary W. Johnson, Richard Jennings, “Lab-view Graphical Programming”, McGraw Hill Professional Publishing, 2001.

OUTCOMES:

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

- Use the PC to mimic real instruments with their dedicated controls and displays with the added versatility that come with LabVIEW software.
- Apply the Virtual instrumentation to take corrective action in process industries as well as research and development.

EIBX14 **VLSI DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the steps involved in the fabrication of MOS transistors and study the second order effects of MOS transistors.
- To introduce lambda based design rules to draw the layout for the transistors.
- To study the concepts of structured design of combinational logic.
- To study the design of PLD's and FPGA.
- To study the fundamentals of VHDL.

MODULE I BASIC MOS TRANSISTOR **8**

Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – Second order effects – MOS Transistor Model.

MODULE II NMOS & CMOS INVERTER AND GATES **8**

NMOS & CMOS inverter – Determination of pull up / pull down ratios – Stick diagram – lambda based rules – Super buffers – BiCMOS & steering logic.

MODULE III SUB SYSTEM DESIGN & LAYOUT **8**

Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

MODULE IV DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAY LOGIC **8**

NMOS PLA – Programmable Logic Devices - Finite State Machine PLA – Introduction to FPGA.

MODULE V VHDL PROGRAMMING **8**

RTL Design – Combinational logic – Types – Operators – Packages – Sequential circuit – Sub-programs – Test benches. (Examples: address, counters, flip-flops, FSM, Multiplexers / Demultiplexers).

MODULE VI APPLICATIONS **5**

Application of SPGA for Petro chemical, Process control, Industrial and bio medical application.

Total Hours: 45

TEXT BOOKS:

1. D.A.Pucknell, K.Eshraghian, “Basic VLSI Design”, 3rd edition, Prentice Hall of India, New Delhi, 2008.

2. Eugene D.Fabricius, “Introduction to VLSI Design”, Tata McGraw Hill, 1990.

REFERENCES:

1. N.H.Weste, “Principles of CMOS VLSI Design”, Pearson Education, India, 2002.

2. Charles H.Roth, “Fundamentals of Logic Design”, Jaico Publishing House, 1992.

3. Zainalatsedin Navabi, “VHDL Analysis and Modelling of Digital Systems”, 2nd Edition, Tata McGraw Hill, 1998.

4. Douglas Perry, “VHDL Programming by example”, Tata McGraw Hill, 3rd Edition, 2003.

OUTCOMES:

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

- Differentiate the front end and back end design steps in the VLSI design flow.
- Draw the layout diagram for any CMOS circuits based on lambda based design rules.
- Design the combinational or sequential circuits using different programming techniques of VHDL.

EIBX15 INSTRUMENTATION AND CONTROL IN PAPER AND PULP INDUSTRIES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an overview of description and paper making process.
- To have an adequate knowledge about different types of instrumentation used in paper industry.
- To familiarize the students into control application in paper industry.
- To have an idea about computer applications relevant to paper industry.

MODULE I FLOW DIAGRAM AND DESCRIPTION OF THE PROCESSES **8**

Raw materials - pulping process - chemical recovery process - paper making process - converting.

MODULE II MEASURING INSTRUMENTS **8**

Measurements of basic weight - density - specific gravity - flow - level and solids - pressure - temperature – interlocks.

MODULE III ANAYLITCAL INSTRUMENTS **7**

Consistency, moisture, pH, Oxidation reduction potential, Graphic displays

MODULE IV TYPICAL CONTROL SYSTEMS **8**

Blow tank controls - digester liquor feed pump controls - brown stock washer level control - stock chest level control - basic weight control - dryer temperature control.

MODULE V CONTROL APPLICATIONS IN PAPER & PULP INDSUTRIES **7**

Dissolving rank density control - white liquor classifier density control - white liquor flow control - condensate conductivity control.

MODULE VI COMPUTER APPLICATIONS **7**

Computer applications in paper industries – Computer application in pulp industries.

Total Hours : 45

REFERENCES:

1. B.G. Liptak, “Instrumentation in the Processing Industries”, Ghilton Book Co., 1973.
2. D.M. Considine, “Handbook of Applied Instrumentation” McGraw-Hill Book Company, 1964.
3. S.K. Singh, “Industrial Instrumentation and Control”, Tata McGraw Hill, 2nd Edition, ninth reprint, 2007.

OUTCOMES:

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

- To implement the concept of different measurement techniques and control systems in paper, pulp making Industry.
- To implement the methods of computer control in paper and pulp industry.

EIBX16	INSTRUMENTATION AND CONTROL IN PETROCHEMICAL INDUSTRIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize the students with raw material pertaining to making of petroleum process
- To get knowledge about various operations.
- To expose to measurement, automation and control system in respect of petrochemical industry.
- To provide an overview of computer application in petrochemical industry.

MODULE I PETROLEUM PROCESSING 8

Petroleum exploration – recovery techniques – oil – gas separation processing wet gases – refining of crude oil.

MODULE II UNIT OPERATIONS IN PETROLEUM INDUSTRY 8

Thermal cracking – catalytic cracking – catalytic reforming – polymerisation – alkylation – isomerization – production of ethylene, acetylene and propylene from petroleum.

MODULE III CHEMICALS FROM PETROLEUM PRODUCTS 8

Chemical from petroleum – methane derivatives – acetylene derivatives – acetylene derivatives – ethylene derivatives – propylene derivatives – other products.

MODULE IV MEASUREMENTS IN PETROCHEMICAL INDUSTRY 6

Parameters to be measured in refinery and petrochemical industry – selection and maintenance of measuring instruments – intrinsic safety of instruments.

MODULE V CONTROL LOOPS IN PETROCHEMICAL INDUSTRY 10

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.

MODULE VI CASE STUDY **5**

Unique problem solving in petrochemical industries.

Total Hours: 45

TEXT BOOKS:

1. Waddams A.L, “Chemical from petroleum”, Butter and Janner Ltd., 1968
2. Balchan.J.G. and Mumme K.I., “Process Control Structures and Applications”, Van Nostrand Reinhold Company, New York, 1988.

REFERENCES:

1. Austin G.T.Shreeves, “Chemical Process Industries”, McGraw Hill International student edition, Singapore, 1985.
2. Liptak B.G., “Instrumentation in Process Industries”, Chilton Book Company, 1994.

OUTCOMES:

At the end of the course, the student will be able

- To implement the concept of different measurement techniques and control systems in Petrochemical Industry.
- To implement the methods of computer control in petrochemical industry.

EIBX17 INSTRUMENTATION AND CONTROL IN IRON AND STEEL INDUSTRIES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To familiarize the students with raw material pertaining to making of iron, equipments like blast furnace etc.
- To get knowledge about various process involved in iron making.
- To impart knowledge about measuring instruments pertaining to blast furnace, oxygen plant, cold rolling mill, hot rolling mill.
- To expose to automation and control system in respect of steel industry.
- To provide an overview of computer application in iron industry.

MODULE I FLOW DIAGRAM AND DESCRIPTION OF THE PROCESSES **7**

Raw materials preparation, iron making, blast furnaces, stoves, raw steel making, basic oxygen furnace, electric furnace.

MODULE II CASTING OF STEEL **8**

Primary rolling, cold rolling and finishing.

MODULE III INSTRUMENTATION **7**

Measurement of level, pressure, temperature, flow, density, weight, thickness and shape, Information & graphic display system, alarms.

MODULE IV ANALYTICAL INSTRUMENTS **8**

Oxygen flue gas, pH, conductivity, pollution monitoring instruments, dust monitor

MODULE V CONTROL AND SYSTEMS **8**

Blast furnace stove combustion control system, gas and water controls in BOF furnace. Sand casting old control.

MODULE VI COMPUTER APPLICATIONS **7**

Model calculation and logging, rolling mill control, annealing process control. Computer (center utilities dispatch computer).

Total Hours: 45

TEXT BOOKS:

1. Tupkary R.H, “Introduction to Modern Iron Making”, 2nd edition, Khanna Publishers, New Delhi, 1986

2. Tupkary R.H., “Introduction to Modern Steel Making”, 4th edition, Khanna Publishers, New Delhi, 1989.

REFERENCES:

1. Liptak B. G, “Instrument Engineers Handbook”, Volume 2, Process Control, 3rd edition, CRC press, London, 1995

2. Considine D.M, “Process / Industrial Instruments and Control Handbook”, 4th edition, McGraw Hill, Singapore, 1993 – ISBN-0-07-012445-0

3. D. Patrnabis, “Principle of Industrial Instrumentation”, Tata Mcgraw Hill publishing company, 3rd Edition, 2010.

OUTCOMES:

At the end of the course, the student will be able

- To implement the concept of different measurement techniques and control systems in Iron and steel Industry.
- To implement the methods of computer control in Iron and steel industry.

GROUP 5

EIBX18 FAULT DETECTION AND DIAGNOSIS

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce fault detection and diagnosis based on process parameters.
- To provide knowledge on mathematical representation of fault and residual structure for fault isolation.
- To analyse faults using data driven methods and intelligent techniques.

MODULE I INTRODUCTION TO FAULT DETECTION AND DIAGNOSIS 8

Introduction to Fault Detection and Diagnosis: Scope of FDD: - Types of faults and different tasks of Fault Diagnosis and Implementation - Different approaches to FDD: Model free and Model based approaches. Classification of Fault and Disturbances- Different issues involved in FDD- Typical applications.

MODULE II ANALYTICAL REDUNDANCY CONCEPTS 7

Introduction- Mathematical representation of Fault and Disturbances: Additive and Multiplicative types – Residual Generation: Detection, Isolation, Computational and stability properties – Design of Residual generator – Residual specification and Implementation.

MODULE III DESIGN OF STRUCTURED RESIDUALS 8

Introduction- Residual structure of single fault Isolation: Structural and Canonical structures- Residual structure of multiple fault Isolation: Diagonal and Full Row canonical concepts – Introduction to parity equation implementation and alternative representation.

MODULE IV DESIGN OF DIRECTIONAL STRUCTURED RESIDUALS 8

Introduction – Directional Specifications: Directional specification with and without disturbances – Parity Equation Implementation – Linearly dependent column.

MODULE V DATA DRIVEN METHODS 6

Principal Component Analysis – Partial Least Squares - Canonical Variate Analysis – Knowledge Based Methods.

MODULE VI ADVANCED LEVEL ISSUES AND DESIGN INVOLVED IN FDD **8**

Introduction of Residual generation of parametric fault – Robustness Issues – Statistical Testing of Residual generators – Application of Neural and Fuzzy logic schemes in FDD – Case study.

Total Hours: 45

TEXT BOOK:

1. Janos J. Gertler “Fault Detection and Diagnosis in Engineering systems”, 2nd edition, Macel Dekker, 1998.

REFERENCES:

1. Sachin. C. Patwardhan, “Fault Detection and Diagnosis in Industrial Process”, Lecture Notes, IIT Bombay, 2005.
2. Rami S. Mangoubi, “Robust Estimation and Failure detection”, Springer-Verlag-London 1998. Springer London, Limited, 2012.

OUTCOMES:

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

- Categorize techniques for identifying dynamic systems.
- Formulate model and validate data sets containing dynamic relationships.
- Effectively use residual-based fault detection and diagnosis methods to identify and rectify the faults in industries.

EIBX19 MODERN CONTROL SYSTEM L T P C
3 1 0 4

OBJECTIVES:

- To provide the students a comprehension about the state space model and to understand the importance of the system state.
- To give the students a comprehension of the relation between continuous and digital controller design and to make the students able to apply nonlinear system analysis.
- To provide the knowledge about the design aspects to design state feedback controllers.
- To provide students an understanding of basic analysis and synthesis of control systems and to provide opportunities for students to gain practical experience in the use of computer design and analysis tools in Matlab and Simulink.

MODULE I STATE SPACE ANALYSIS OF SYSTEMS 10

Classical Vs modern control theory ,concept of state, state space and state variables, state model for typical linear systems, construction of state model from differential equations, block diagram representation of state models, state space model for electrical circuits, mechanical systems, electro-mechanical system-DC motors, state transition matrix from Cayleigh - Hamilton theorem. Simulation of state space model of DC motors using control system toolbox.

MODULE II TRANSFORMATION IN STATE SPACE MODEL 10

State space model from transfer functions, transfer from state space model, different cannonical models- phase variable form, observable canonical model, diagonal canonical model, Jordan canonical model. State variable description of discrete time systems.

MODULE III STATE FEEDBACK AND OBSERVER DESIGN 10

State and output controllability of systems, criterion for controllability, observability of systems, ,state feedback controller design using pole placement method- Ackerman's formula, design of full state and reduced order observers. State feedback and observer design using control system toolbox

MODULE IV NONLINEAR CONTROL SYSTEMS **10**

Introduction to nonlinearities and non linear phenomenon, nonlinear system behavior. Methods of linearization, Phase Plane Analysis: Concepts of Phase Plane Analysis: Phase Portraits; Singular Points; Symmetry in Phase Plane Portraits, Methods of Constructing Phase Portraits: Analytical method, the method of Isoclines, limit cycles

MODULE V DESCRIBING FUNCTION METHOD **10**

Basic concepts, describing functions for common nonlinearities, stability analysis by describing function approach, jump resonance, lyapunov stability criterion, popov's stability criterion.

MODULE VI OPTIMAL CONTROL SYSTEM **10**

Introduction to optimal control problem, optimal regulator gain matrix determination- matrix riccati and LQR method. Optimal control of tracking systems, state regulator and output regulator design. Simulation of Optimal control of a process using control system tool box.

Total Hours : 60

REFERENCES:

1. Ogata, K., "Modern Control Engineering", Prentice Hall of India Ltd., 4th Edition, New Delhi, 2006.
2. Kuo, B.C., "Automatic Control Systems", Prentice Hall of India Ltd., New Delhi, 2003.
3. M. Gopal, "Control System Principle and Design", 4th edition, Tata Mc GrawHill, 2012.

OUTCOMES:

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

- Solve simple to moderately complex control systems using Lyapunov and Popov's theory.
- Apply concepts and methods from modern control theory to design state and output feedback controllers in industries and Research and Development.

EIBX20 ADAPTIVE CONTROL L T P C
3 0 0 3

OBJECTIVES:

- To provide knowledge on parametric and nonparametric identification of system.
- To impart knowledge on adaptive control techniques.
- To enhance knowledge on the implementation issues and practical consideration by investigating the adaptive schemes

MODULE I INTRODUCTION 7

Introduction to adaptive control - Effects of process variations – Adaptive control schemes – Adaptive control problem.

MODULE II NON-PARAMETRIC IDENTIFICATION 6

Non-parametric identification – Step response method – Impulse response method – Frequency response method.

MODULE III PARAMETRIC IDENTIFICATION 7

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.

MODULE IV SELF-TUNING REGULATOR 8

Deterministic in-direct self-tuning regulators – Deterministic direct self-tuning regulators – Introduction to stochastic self-tuning regulators – Stochastic indirect self-tuning regulator.

MODULE V MODEL REFERENCE ADAPTIVE CONTROLLER 8

The MIT rule – Lyapunov theory – Design of model reference adaptive controller using MIT rule and Lyapunov theory – Relation between model reference adaptive controller and self-tuning regulator.

MODULE VI TUNING OF CONTROLLERS AND CASE STUDIES 9

Design of gain scheduling controller - Auto-tuning of PID regulator – Stability analysis of adaptive controllers – Application of adaptive control in chemical reactor, distillation column and variable area tank system.

Total Hours: 45

TEXT BOOKS:

1. Karl J. Astrom & Bjorn Wittenmark, “Adaptive Control”, (Pearson Education, Singapore), Second Edition, 2003.
2. Landau, I.D., Lozano, R., M'Saad, M., Karimi, A., “Adaptive Control: Algorithms, Analysis and Applications”, Series: Communications and Control Engineering, 2nd edition. 2011.
3. Shankar Sastry, Marc Bodson, “Adaptive Control : Stability, Convergence and Robustness”, Prentice-Hall Advanced Reference Series (Engineering), 1994, Republished by Dover Publications in 2011 (ISBN-10: 0486482022)

REFERENCES:

1. T. C.H.A. Hsia, “System Identification”, Lexington books, 1974.
2. Stephanopoulis G. “Chemical Process Control”, Prentice Hall of India, New Delhi, 1990.
3. Ljung, L., “System Identification: Theory for the user”, Pretice Hall, Englewood cliffs, 1987.
4. Sastry S. and Bodson M., “Adaptive control – stability, Convergence ad Robustness”, Prentice Hall inc., New Jersey, 12989.

OUTCOMES:

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

- Design of model based control of various processes through adaptive schemes.
- Apply concepts and methods from adaptive control theory to design controllers in industries and for Research and Development.

EIBX21 INTELLIGENT PROCESS AUTOMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide a basic understanding of PLC, DCS, SCADA for industrial application.
- To enhance knowledge on intelligent techniques applied to home automation.

MODULE I INTRODUCTION **8**

Introduction: Introduction to automation tools PLC, DCS, SCADA, Hybrid DCS/ PLC

MODULE II DCS PROJECT **8**

DCS Project: Development of User Requirement Specifications, Functional Design Specifications for automation tool, GAMP, FDA.

MODULE III PROGRAMMABLE LOGIC CONTROLLERS **8**

Programmable Logic Controllers: Introduction of Advanced PLC programming, Selection of processor, Input/output modules, Interfacing of Input/output devices, Operator Interface, OPC, study of SCADA software, Interfacing of PLC with SCADA software.

MODULE IV DCS **8**

DCS: Introduction to architecture of different makes, DCS Specifications, configuration of DCS blocks for different applications, Interfacing of protocol based sensors, actuators and PLC systems, Plant wide database management, Security and user access management, MES, ERP Interface.

MODULE V STUDY OF ADVANCE PROCESS CONTROL BLOCKS **8**

Study of Advance Process control blocks: Statistical Process Control, Model Predictive Control, Fuzzy Logic Based Control, Neural-Network Based Control, Higher Level Operations: Control & Instrumentation for process optimization Applications of the above techniques to the some standard MODULEs/ processes.

MODULE VI CASE STUDY **5**

Simulation of Boiler Purge control, starter of Boiler feed pump, logic involved in F.D FAN & I.D Fan.

Total Hours: 45

REFERENCES:

1. Webb & Reis, “Programmable logic Controllers”, (Prentice Hall of India)
2. Jose A. Romagnoli, Ahmet Palazoglu, “Introduction to process Control” (CRC Tylor and Francisgroup)
3. “Statistical Process Control” –ISA Handbook
4. B.G. Liptak, “Handbook of Instrumentation- Process Control”
5. Installation and user manuals of different DCS, PLC Vendors

OUTCOMES:

At the end of the course, the students will be able to

- Design the functional blocks of DCS
- Use PLC and DCS for control of industrial applications.
- Apply intelligent techniques in home automation.

GROUP 6

EIBX22 OPTIMAL CONTROL **L T P C**
3 0 0 3

(Prerequisites: Control Systems or equivalent course; knowledge of matrix analysis, linear algebra, and ordinary differential equations; familiarity with matlab)

OBJECTIVES:

- To describe how the dynamic programming principle works and apply it to optimal control problems over finite and infinite time horizons
- To provide knowledge on linear regulators and dynamic programming.
- To familiarize with minimization of functions and functional.
- To explain the principles behind the most standard algorithms for numerical solution of optimal control problems and use Matlab to solve fairly simple but realistic problems.

MODULE I INTRODUCTION **7**

The basic concepts of optimal control, formulation of optimal control problem, performance criteria.

MODULE II PARAMETER OPTIMIZATION **8**

Parameter optimization for servo systems (tracking problem), optimal control problem using transfer function approach for continuous and discrete time control system, output regulator problem.

MODULE III LINEAR REGULATORS **8**

Linear quadratic regulator problem, Derivation of Riccati equation for continuous and discrete time systems. State regulator, output regulator and tracking regulator problem for continuous and discrete time control system with examples.

MODULE IV DYNAMIC PROGRAMMING **7**

Principles of optimality, derivation of Hamilton. Jacobi - Bellman equation, Application of optimal control via dynamic programming for continuous and discrete time systems.

MODULE V CALCULUS OF VARIATION **8**

Minimization of functions, minimization of functionals, fixed end point and variable end point problems, formulation of variational calculus problem using Hamiltonian method.

MODULE VI CASE STUDIES **7**

Optimal control in selected applications-CSTR, distillation column, boiler and paper manufacturing plant. Simulation of case studies using MATLAB.

Total Hours : 45

TEXT BOOK:

1. M. Gopal,"Modern Control System Theory", Wiley Eastern, 2009.

REFERENCES:

1. R.C. Dorf, R.H. Bishop, "Modern Control Systems", 8th edition, Addison Wesley, 2009.
2. D. Kirk, "Optimal Control - An Introduction", Prentice Hall, Inc., Englewood Cliff, N. J, 1970.
3. Anderson B. D. O. and J. B. Moore, "Linear Optimal Control", Prentice Hall, Englewood Cliff, N. J., 1971.

OUTCOMES:

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

- Control the dynamical systems in the best possible way.
- Integrate the tools learnt during the course and apply them to more complex problems.
- Solve the variations of the problems of optimal control.

EIBX23	ROBUST CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide the relevant mathematical background needed for the subject robust control.
- To enhance knowledge on various uncertainties associated with physical systems.
- To impart methods of analysis of robust stability and robust performance analysis.
- To provide knowledge on the design of a robust optimal controller.

MODULE I INTRODUCTION TO ROBUST CONTROL 7

Review of vector norms and matrix norms – Singular value analysis – Norms for systems – Singular value decomposition – Basics of real, quasi and polytopic polynomials – Need for robust control.

MODULE II SYSTEM UNCERTAINTY 8

Sources of uncertainty – Parametric uncertainty – Non-parametric uncertainty – Additive and multiplicative type – Nominal stability, internal stability, nominal performance, uncertain linear dynamic plants and robust control problem. Review of sensitivity and complimentary sensitivity function.

MODULE III ROBUST STABILITY 7

Robust stability analysis – Kharitonov's theorem, edge theorem, mapping theorem, small gain theorem.

MODULE IV ROBUST PERFORMANCE 8

Robust performance analysis – Based on control sensitivity, input and output sensitivity minimization.

MODULE V H_2 AND H8∞ OPTIMAL CONTROL 7

Standard LQR problem – Extended LQR problem – H_2 problem – Stability margin of H_2 controller - H∞ control problem – Optimality and limiting behaviour – minimum entropy controller.

MODULE VI - CASE STUDY **8**

Modelling and design of robust controller for crane – Automatic steering of bus – Flight control – Comparison of conventional and robust control for the case studies.

Total Hours: 45

TEXT BOOKS:

1. Uwe Mackenroth, “Robust Control System: Theory and Case Studies”, Technology and Engineering, Springer, 2004
2. Geir E. Dullerud, Fernando Paganini, “A course in Robust Control Theory”, Springer, 2000
3. Andrzej Bartoszewics, “Robust Control, Theory and Applications”m InTech Publications, 2011, ISBN 978-953-307-229-6.
4. S.P. Bhattacharyya H. Chapellaf and L.H. Feel, “Robust Control (The parametric approach)”, Pearson Education, 1995.
5. J. Ackermann, “Robust Control Systems with Uncertain Physical Parameters”, Springer-Verlag, London, 1993.

REFERENCES:

1. Kemin Zhou, John C. Doyle, “Essentials of Robust Control”, Pearson Education, 1998.
2. P.C.Chandrasekharan, “Robust Control of Linear Dynamical Systems”, Academic Press, 1996.

OUTCOMES:

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

- Identify and tackle uncertainties associated with physical systems.
- Solve standard LQR problems in nonlinear processes.
- Design of a robust optimal controller for industrial applications.

EIBX24 ADVANCED CONTROL SYSTEM L T P C
3 0 0 3

OBJECTIVES:

- To provide a basic understanding of state space analysis of the system.
- To impart knowledge state space model for discrete systems.
- To provide knowledge about the nonlinear control systems.

MODULE I STATE SPACE ANALYSIS OF SYSTEMS 7

Classical Vs modern control theory ,concept of state, state space and state variables, state model for typical linear sytems,construction of state model using differential equations, state variable diagram and block diagram representation of state models, state space model for electrical circuits, mechanical systems, electro-mechanical system-DC motors, solution of time invariant state equation, state transition matrix from cayleigh-hamilton theorem, solution of linear time varying state equation. Simulation of state space model of electrical circuits, mechanical systems, electro-mechanical system-DC motors using control system toolbox.

MODULE II TRANSFORMATION IN STATE SPACE MODEL 7

State space model from transfer functions, decomposition methods, state model for a multi input muti output system from block diagrams, similarity transformation, non uniqueness of state space model, transfer from state space model, different canonical models like phase variable form ,observable canonical model, diagonal canonical model, Jordan canonical model, state variable description of discrete time systems.

MODULE III STATE FEEDBACK AND OBSERVER DESIGN 8

State and output controllability of systems, criterion for controllability of continuous and discrete time systems, observability of systems, criterion for observabilty of a system, significance of controllability and observability ,state feedback controller design using pole placement for plant represented in phase variable form, determination of feedback gain using ackerman's formula, design of full state and reduced order observers. State feedback and observer design using control system toolbox

MODULE IV STATE SPACE ANALYSIS OF DISCRETE TIME CONTROL SYSTEM 7

Discrete time systems - analogies with continuous-time systems, Z-transforms (review), mathematical models for LTI discrete-time systems. State model of

linear discrete-time systems, state models from linear difference equations/ system functions, derivation of system function from state model, solution of state equations- state transition matrix, controllability and observability conditions.

MODULE V NONLINEAR CONTROL SYSTEMS 8

Introduction to nonlinearities and non linear phenomenon, nonlinear system behavior. Methods of linearization, Phase Plane Analysis: Concepts of Phase Plane Analysis: Phase Portraits; Singular Points; Symmetry in Phase Plane Portraits, Methods of Constructing Phase Portraits: Analytical method, the method of Isoclines, Determining time form Phase Portraits, Phase Plane Analysis of linear systems, Phase Plane Analysis of nonlinear systems, limit cycles and existence of limit cycle

MODULE VI DESCRIBING FUNCTION METHOD 8

Describing function fundamentals: An example of describing functions; Computing describing functions, Derivations of describing functions of common nonlinearities, Describing function analysis of nonlinear systems.

Total Hours: 45

TEXT BOOKS:

1. Benjamin C. Kuo, “Digital Control Systems”, Oxford University Press, 2002.
2. George J. Thaler, “Automatic Control Systems”, Jaico Publishers, 2004.

REFERENCES:

1. I.J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
2. Raymond T. Stefani & Co., “Design of Feed back Control systems”, Oxford University, 2002.
3. William L. Luyben and Michael L. Luyben, “Essentials of Process Control”, McGraw Hill International Editions, Chemical Engineering Series, 1997.

OUTCOMES:

At the end of the course, the students will be able to,

- Derive mathematical models in terms of state space of the system.
- Design and analyse discrete systems using state space techniques
- Apply describing functions for nonlinear systems

EIBX25 MODELING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide a basic understanding of mathematical models of the system.
- To impart knowledge about the lumped systems for steady state and unsteady state conditions.
- To provide knowledge about the distributed systems for steady state and unsteady state conditions.

MODULE I INTRODUCTION **3**

Introduction to modeling and simulation, classification of mathematical models, conservation equations and auxiliary relations.

MODULE II STEADY STATE LUMPED SYSTEMS **9**

Degree of freedom analysis, single and network of process MODULEs, systems yielding linear and non-linear algebraic equations, flow sheeting – sequential modular and equation oriented approach, tearing, partitioning and precedence ordering, solution of linear and non-linear algebraic equations.

MODULE III UNSTEADY STATE LUMPED SYSTEMS **9**

Analysis of liquid level tank, gravity flow tank, jacketed stirred tank heater, reactors, flash and distillation column, solution of ODE initial value problems, matrix differential equations, simulation of closed loop systems.

MODULE IV STEADY STATE DISTRIBUTED SYSTEM **7**

Analysis of compressible flow, heat exchanger, packed columns, plug flow reactor, solution of ODE boundary value problems.

MODULE V UNSTEADY STATE DISTRIBUTED SYSTEM **11**

Analysis laminar flow in pipe, sedimentation, boundary layer flow, conduction, heat exchanger, heat transfer in packed bed, diffusion, packed bed adsorption, plug flow reactor, hierarchy in model development, classification and solution of partial differential equations.

MODULE VI OTHER MODELLING APPROACHES 6

Empirical modeling, parameter estimation, population balance and stochastic modeling.

Total Hours: 45

TEXT BOOKS:

1 Gopal, M., "Control Systems, Principles and Design", 2nd Edition, Tata McGraw-Hill Pub. Co., New Delhi, 2012.

2 Nagrath, I.J. and Gopal, M., "Control System Engineering", New-age International (P), 4th Edition Ltd., New Delhi, 2006.

REFERENCES:

1 Ogata, K., "Modern Control Engineering", Prentice Hall of India Ltd., 4th Edition, New Delhi, 2006.

2 Kuo, B.C., "Automatic Control Systems", Prentice Hall of India Ltd., New Delhi, 2003.

OUTCOMES:

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

- Simulate mathematical models of the system.
- Solve problems using lumped systems for steady state and unsteady state conditions.
- Apply for Research and Development.

GENERAL ELECTIVES

GEBX01 DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management.

MODULE I ENVIRONMENTAL HAZARDS **7**

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS **7**

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS **7**

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion.

MODULE IV DISASTER MANAGEMENT **8**

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT **8**

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards.

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA 8

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

Total Hours: 45

REFERENCES:

1. Satender, "Disaster Management in Hills", Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), "Environmental Geography", Heritage Publishers, New Delhi,1990.
3. Savinder Singh, "Environmental Geography", Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., "The Environment as Hazards", Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), "Disaster Management", University Press, India, 2003.
6. Singh, R.B.,"Space Technology for Disaster Mitigation in India (INCED)", University of Tokyo, 1994.
7. Bhandani, R.K., "An overview on Natural & Manmade Disaster & their Reduction", IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., "Manuals on Natural Disaster management in India", National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GEBX02 NANO TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force

microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

Total Hours: 45

TEXTBOOKS:

1. Hari Singh Nalwa, "Handbook of Nanostructured Materials and Nanotechnology", Academic Press, 2000.
2. Guozhong Cao, "Nanostructures and Nano materials-Synthesis, Properties and Applications", Imperial College Press (2011).
3. Zhong Lin Wang, "Handbook of Nanophase and Nanomaterials (Vol 1 and II)", Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, "Nanotechnology: Basic Science and Emerging Technologies", Overseas press, 2005.

REFERENCES:

1. A. Nabok, "Organic and Inorganic Nanostructures", Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: "Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, "Nano Technology – Basic Science and Emerging Technologies", 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, "Nanoscience and Nanotechnology: Fundamentals to Frontiers", Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GEBX03	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION 8

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN 8

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

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN 7

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY 8

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.

MODULE V COMPENSATOR DESIGN 8

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

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS 6

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC Tacho generator - DC Tacho generator - Typical applications of control system in industry.

Total Hours : 45

REFERENCES:

1. K. Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
3. C.J.Chesmond, "Basic Control System Technology", Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, "Control System Engineering", Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, "Modern Control Systems", Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GEBX04 GREEN DESIGN AND SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT **7**

Objectives of Sustainable Development - Need for sustainable development- Environment and development linkages - Globalisation and environment- Population, poverty and pollution- global, regional and local environment issues- Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS **8**

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY **7**

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS **8**

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY **7**

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation- Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN **8**

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

Total Hours: 45

TEXT BOOK:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCE:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- explain the relationship between sustainability and emergence of green building practices.
- address the economic, environmental, and social concerns.

GEBX05 KNOWLEDGE MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification - Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery - Content management tools - Knowledge sharing and dissemination tools - Group ware and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels - Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method - Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

Total Hours:45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- critically evaluate current trends in knowledge management and apply it for e-learning

GEBX06 APPROPRIATE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 9

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 9

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 9

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 9

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 9

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 9

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

Total Hours: 45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.

2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.

2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOME:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GEBX07 SYSTEM ANALYSIS AND DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic principles of systems engineering
- To understand the systems engineering methodology
- To provide a systems viewpoint

MODULE I INTERDICTION TO SYSTEMS ENGINEERING 8

Concept of Systems Engineering – Origin – Systems Approach – Advantages of systems approach – Examples.

The building blocks of modern systems – Systems and environment – Interfaces – Complexity of Modern Systems.

MODULE II SYSTEM DEVELOPMENT PROCESS AND MANAGEMENT 8

System life cycle – the systems engineering method – Role of Testing – Management of system development – Risk Management – Organisation.

MODULE III CONCEPT DEVELOPMENT 8

Need Analysis – Concept Exploration – Performance requirement and validation - Concept selection and validation – systems architecture – Decision making.

MODULE IV ESTABLISHING ENGINEERING SYSTEMS 8

Risk Analysis – Risk Mitigation –System performance Analysis – Simulation Techniques in System Analysis – Validation Methods..

MODULE V DECISION SUPPORT TOOLS IN SYSTEMS ENGINEERING 7

Analytical decision support – Statistical influences on system design – System performance analysis – System Reliability, Availability and Maintainability (RAM) – Analysis of Alternatives.

MODULE VI CASE STUDIES 6

Case studies in Software Systems Engineering – Systems for Product Design - Manufacturing Systems.

Total Hours: 45

REFERENCES:

1. Charles S. Wasson, “System Analysis, Design, and Development: Concepts, Principles, and Practices”, Wiley Series in Systems Engineering and Management, 2006.

2. Kossiakoff Alexander and William N. Sweet A, “Systems Engineering: Principles And Practice”, Wiley Student Edition, 2009.

OUTCOMES:

At the end of the course the student will have the

- ability to have systems of view of problems and issues at hand.
- ability to comprehend systems in their totality and specific.
- ability to design, build and evaluate simple systems for industrial requirement.
- ability to analyze systems and strengthen them for performance enhancement.

GEBX08 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS **8**

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS **6**

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES **8**

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES **9**

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

Total Hours: 45

TEXTBOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOME:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GEBX09 OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- Introduce methods of optimization to engineering students, including linear programming, network flow algorithms, integer programming, interior point methods, quadratic programming, nonlinear programming, and heuristic methods.
- The goal is to maintain a balance between theory, numerical computation, problem setup for solution by optimization techniques, and applications to engineering systems.

MODULE I INTRODUCTION **7**

Overview of Optimization techniques for Civil Engineering Problems - Introduction to methods of optimization - Classification of Optimization problems - optimality and convexity - General optimization algorithm - necessary and sufficient conditions for optimality.

MODULE II LINEAR PROGRAMMING **8**

Introduction to linear programming - a geometric perspective - Standard form in linear programming; basic solutions; fundamental theorem of linear programming - Simplex Algorithm for Solving Linear Programs - Duality; complementary slackness; economic interpretation of the dual;

MODULE III DYNAMIC PROGRAMMING **8**

Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality; Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP); Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP.

MODULE IV APPLICATIONS **8**

Regression modeling in engineering; industrial blending problems; dynamic optimal control of engineering systems; optimal estimation in environmental engineering - Water resources; production planning in industrial engineering; transportation problem - Heuristic optimization methods: genetic algorithms;

ecological engineering application; Minimum cost network flow algorithms; out-of-kilter method; primal-dual methods; Dynamic Programming Applications - Water allocation as a sequential process - Capacity expansion and Reservoir operation.

MODULE V INTEGER PROGRAMMING 8

Integer programming - applications in optimal irrigation scheduling in agricultural engineering - Interior point optimization methods - affine scaling method.

MODULE VI NON-LINEAR PROGRAMMING 6

Non-linear programming - Kuhn-Tucker conditions for constrained nonlinear programming problems; necessary and sufficient conditions; quadratic programming; applications.

Total Hours: 45

REFERENCES:

1. Taha, H.A., “Operations Research - An Introduction", 9th Edition, Pearson Prentice Hall, 2011.
2. Winston.W.L. “Operations Research”, 4th Edition, Thomson – Brooks/Cole, 2003.
3. Kreyszig .E., “Advanced Engineering Mathematics“,10th Edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.

OUTCOMES:

At the end of the course, the students will be able to understand

- basic theoretical principles in optimization.
- formulation of optimization models.
- solution methods in optimization.
- methods of sensitivity analysis and post processing of results.
- applications to a wide range of engineering problems.

GEBX10	ENGINEERING SYSTEM MODELLING AND SIMULATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION **6**

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES **7**

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS **7**

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS **9**

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES **10**

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES **6**

Total Hours: 45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GEBX11	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 9

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 9

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 9

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV SOURCING AND TRANSPORTATION 9

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE V INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 9

Information technology in a supply chain – CRM, ISCM, SRM in supply chain - Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

Total Hours: 45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 4th Indian Reprint, 2010.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GEBX12 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality

Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS **7**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

Total Hours: 45

TEXT BOOK:

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, "The Management and Control of Quality", 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S., "Total Quality Management", Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., "Quality Management – Concepts and Tasks", New Age International, 1996.
5. Zeiri, "Total Quality Management for Engineers", Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GEBX13 ENERGY STUDIES L T P C
3 0 0 3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipments. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENRGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

Total Hours: 45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GEBX14 ROBOTICS L T P C
3 0 0 3

OBJECTIVE:

- To learn about the robots, various components, of Robots, programming and their applications.

MODULE I INTRODUCTION 8

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL 8

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS 8

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES 7

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS 7

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity

of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

Total Hours: 45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer –Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GEBX15 CYBER SECURITY L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Laws.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 8

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II TYPES OF THREATS AND SECURITY MEASURES 8

Security Programs – Non-malicious program Errors – Virus and other Malicious Code – Targeted Malicious Code – Control against program threats – Web Attacks – DOS – Online Security Resources.

MODULE III APPLICATION SECURITY 8

Introduction to Databases - Database Security Requirements – Reliability & Integrity – Multilevel Databases - E-Mail and Internet Security – SQL Injection – Cross Site Scripting – Local File Inclusion – Intrusion Detection Software"s.

MODULE IV PHYSICAL SECURITY AND FORENSICS 7

Firewalls – Benefits and Limitations – Firewall Types - Components – Server Room Design and Temperature Maintenance – Cyber Terrorism and Military Operation Attacks- Introduction to Forensics – Finding evidence on PC and Evidence on System Logs – Windows and Linux logs.

MODULE V CYBER STALKING & FRAUD 7

Introduction – Internet Frauds – Auction Frauds – Identity theft – Phishing – Pharming- Cyber Stalking – Laws about Internet Fraud – Protecting against Cyber Crime – Secure Browser settings – Industry Espionage.

MODULE VI CYBER SECURITY STANDARDS AND POLICIES 7

Introduction– ISO 27001– ISO 27002 - PCI DSS – Compliance - IT ACT – Copyright ACT, Patents. Definition of Policy – Types- User Policies- Administrative Policies – Access control – Developmental Policies.

Total Hours: 45

TEXT BOOK:

1. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, attendees should be able to satisfy the critical need for ensuring Cyber Security in Organizations.

- The students attending this course will be able to analyse the attacks and threats.
- They can also provide solutions with Intrusion Detection systems and Softwares.
- They will have knowledge about Cyber Frauds and Cyber Laws.

GEBX16 USABILITY ENGINEERING

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OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION **6**

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES **8**

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN **8**

Process of Interaction Design - Establishing Requirements – Design, Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING **8**

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS **8**

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual

Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards

MODULE VI USER INTERFACES **7**

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

Total Hours : 45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human - Computer Interaction", John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, "Usability Engineering", Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface: Strategies for Effective Human Interaction", Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, "Usability Engineering: Process, Products, and Examples", Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GEBX17	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

Total Hours: 45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.