CVR COLLEGE OF ENGINEERING
Vastunagar, Mangalpalli (V), Ibrahimpatan (M), R.R. District
Ph. No.: 918414 - 252222 & 252369

DEPARTMENT OF EIE

Academic Curriculum for R18 Regulation

ACADEMIC REGULATIONS
COURSE STRUCTURE
&
SYLLABUS
R18 REGULATIONS
CHOICE BASED CREDIT SYSTEM (CBCS)

B.Tech. 1st year (from 2018-19)
All Branches

Applicable for the batches admitted in First year from 2018-19 onwards

CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution with NAAC 'A' Grade

(Approved by AICTE & Govt. of Telangana and Affiliated to JNT University Hyderabad)
Vastunagar, Mangalpalli (V), Ibrahimpatan (M)
R.R. Dist, Pin – 501 510

CVR COLLEGE OF ENGINEERING

VISION

- To be a state of the art institution of engineering in pursuit of excellence, in the service of society.

MISSION

- To excel in providing quality education at under graduate and graduate levels.
- To encourage research and innovation.
- To provide infrastructure and facilities to meet the latest technological needs.
- To establish Centres of Excellence through active interaction with industry.
- To nurture students towards holistic development with human values and ethics.

DEPARTMENT OF HUMANITIES AND SCIENCES

VISION:

- The vision of the Department is to develop into a teaching and research center in **APPLIED SCIENCES & MATHEMATICS.**

MISSION:

1. To provide necessary support for the Engineering Departments by offering courses in streams mentioned above to enable the students to

   - Understand the technical subjects & apply the concepts to solve Engineering Problems
   - Develop spoken and written communication skills in English Language.
   - Pursue higher studies in India and abroad without facing any difficulty with strong base in Mathematics, Physics, Chemistry etc.

2. To develop into Research Center in Applied Sciences & Mathematics.

3. To make the students adept in Managerial Skills and Accountancy which will be an asset to become an Entrepreneur and a good leader in Engineering Practice.

4. To create awareness about environment protection, ecology and industrial pollution.

5. To plan and introduce post-graduate courses in Physics, Chemistry, Mathematics and Management Science.

6. To initiate interdisciplinary research work in Science, Mathematics and Engineering Departments

CVR COLLEGE OF ENGINEERING

Vastunagar, Mangalpalli, Ibrahimpatan – 501 510

ACADEMIC REGULATIONS – 2018 (R18 Regulations)
B.Tech. PROGRAMMES

(Effective for the students admitted into I-year from the Academic Year 2018-19 onwards)

1.0 Under - Graduate Degree Programme in Engineering & Technology (B.Tech.: Under Graduate Programme (UGP) in Engineering & Technology (E&T))

CVR College of Engineering is an autonomous institution under the University Grants Commission, affiliated to Jawaharlal Nehru Technological University, Hyderabad. The College offers 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Programme, under R18 Regulations with **Choice Based Credit System (CBCS)** with effect from the Academic Year 2018-19 onwards, in the following Branches of Engineering:

Table-1

Sl. No.	Branch
I.	Civil Engineering
II.	Computer Science and Engineering
III.	Computer Science and Information Technology *
IV.	Electronics and Communication Engineering
V.	Electrical and Electronics Engineering
VI.	Electronics & Instrumentation Engineering
VII.	Information Technology
VIII.	Mechanical Engineering

*** From the Academic Year 2019-20 onwards**

2.0 Eligibility for Admissions

2.1 Category - A (70% of the sanctioned seats):

Admission to the UGP under Category – A are made by the Convener TS EAMCET on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test TS EAMCET conducted by Telangana State Government .

2.2 Category – B (30% of the sanctioned seats):

Admissions to the UGP under Category – B are made by the Management of the College and ratified by Telangana State Council of Higher Education (TSCHE) based on the merit rank of TS EAMCET / Marks in the Qualifying examination (Intermediate / Class XII) as prescribed in relevant G.Os. from time to time.

2.3 The medium of instruction for the entire UGP in E & T will be in **ENGLISH** only:

3.0 B.Tech. Programme (UGP) Structure

3.1 The B.Tech. Programmes of CVR College of Engineering are of Semester Pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/AICTE/JNTUH specified Definitions/Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are as listed below:

3.2.1 Semester Scheme

Each UGP is of 4 Academic Years (8 Semesters), with the year being divided into two Semesters of 22 weeks ($\geq$ 90 working days) each, each Semester having - 'Continuous Internal Evaluation (**CIE**)' and 'Semester End Examination (**SEE**)'. Choice Based Credit System (**CBCS**) and Credit Based Semester System (**CBSS**) as denoted by UGC, and Curriculum / Course Structure as suggested by the AICTE (Model Curriculum -2018) are followed.

3.2.2 Credit Courses

All Subjects / Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject / Course in a L:T:P:C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) Structure, based on the following general pattern:

1 Hour Lecture/Theory course per week (L)	1 credit
1 Hour Tutorial per week (T)	1 credit
1 Hour Practical/Laboratory course per week (P) 2 Hours Practical/ Laboratory course per week (P)	0.5 credit 1 credit

Other student activities like NCC, NSS, NSO, Study Tour, Guest Lecture etc., and identified Mandatory Courses will not carry Credits.

3.2.3 Subject/ Course Classification

All Subjects/ Courses offered for the UGP are broadly classified as:

(a) Foundation Courses (b) Core Courses and
(c) Elective Courses.

Foundation Courses are further categorized as:

(i) HS (Humanities and Social Sciences)
(ii) BS (Basic Sciences)
(iii) ES (Engineering Sciences)

Core Courses and Elective Courses are categorized as

(i) PC (Professional/ Departmental Core) Subjects
(ii) PE (Professional/ Departmental Electives)
(iii) OE (Open Electives)
(iv) Project Work (PC); Industry Oriented Mini-Project (PC)/Technical Seminar(PC)
(v) Minor Courses (1 or 2 Credit Courses, belonging to HS/BS/ES/PC as per relevance) such as Skill Development Courses of 1 Credit each
(vi) Mandatory Courses (MC - non-credit)

3.2.4 Course Nomenclature

The Curriculum Nomenclature or Course-Structure Grouping for each of the UGP E&T (B.Tech. Degree Programmes), is as listed below (along with AICTE specified % Range of Total Credits):

Table-2

S. No.	*Broad Course Classification*	*Course Group/ Category*	*Course Description*	*Range of Credits*
1	**Foundation Courses**	**BS – Basic Sciences**	Includes - Mathematics, Statistics, Physics and Chemistry Subjects	**10-15%**
2		**ES - Engineering Sciences**	Includes fundamental engineering subjects including Workshop, Drawing, basics of Electrical/Electronics/Computers, etc.	**15-20%**
3		**HS – Humanities and Social Sciences**	Includes subjects related to Humanities, Social Sciences and Management	**10-12%**
4	**Core Courses**	**PC – Professional Core Courses**	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engineering	**35-45%**
5	**Elective Courses**	**PE – Professional Electives**	Includes Elective subjects related to the Parent Discipline/ Department/ Branch of Engineering	**9-12%**
6		**OE – Open Electives**	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline / Department / Branch of Engineering	**6-12%**
7	**Core Courses**	**Project Work**	B.Tech. Project or UG Project or UG Major Project	**10%**
8		**Industry Oriented Mini-Project**	Mini-Project	
9		**Technical Seminar**	Technical Seminar based on core contents related to Parent Discipline / Department / Branch of Engineering	
10	**Minor Courses**	**Skill Development Courses/Value Added Courses**	1 or 2 Credit Courses (subset of HS)	**Included**
11	**Manda-tory Courses**	**MC Induction Programme (3 weeks' duration)@**	Non-credit	**-**
Total Credits for UGP (B. Tech.) Programme				**160 (100%)**

3.2.5 @Induction Programme (Mandatory)
An Induction Programme (3 weeks' duration) as per the guidelines given by the AICTE at the beginning of the first semester of first year, as presented in the Course Structure.

4.0 Course Work

4.1 A student, after securing admission, shall pursue the B.Tech. UGP in a minimum period of 4 Academic Years, and a maximum period of 8 Academic Years (starting from the Date of Commencement of I Year).

4.1.1 After eight academic years of course study, a candidate is permitted to write the end examinations for the immediately following **two** years.

4.2 Each student shall register for and secure the specified number of Credits required for the completion of the UGP and Award of the B.Tech. Degree in the respective Branch of Engineering.

4.3 Each Semester is structured to provide about 20 Credits totaling to **160** Credits for the entire B.Tech Programme.

4.4 Students who fail to fulfill all the academic requirements for the award of the degree within **ten** academic years from the year of their admission shall forfeit their seats in B. Tech course.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him about the UGP, its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

5.2 Academic Section of the College invites filled 'Registration Forms' from students apriori (before the beginning of the Semester), through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

5.3 A student can apply for ON-LINE Registration ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of the Department (a copy of the same being retained by the Head of the Department, Faculty Advisor and the Student).

5.4 A student may be permitted from III year I semester onwards to Register for Subjects/ Courses of CHOICE with a typical total of 20 Credits per Semester (Minimum being 17 C and Maximum being 23 C, permitted deviation being ± 14%), based on his /her PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses, in the Department Course Structure and Syllabus contents. However, a MINIMUM Credits assigned per Semester must be registered to ensure the 'STUDENTSHIP' in any Semester.

5.5 Choice for 'additional Subjects /Courses' to reach the Maximum Permissible Limit of 23 Credits (above the typical 20 Credit norm) must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/ Counselor.

5.6 If the student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject (s) /Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject / Course in that Category will be taken into consideration.

5.7 Subject / Course Options exercised through ON-LINE Registration are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices will not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within the **FIRST WEEK** from the commencement of Class-work for that Semester.

5.8 Dropping of Subjects / Courses may be permitted, ONLY AFTER obtaining prior approval from the Head of the Department(subject to retaining minimum Credits), 'within 15 Days of Time' from the beginning of the current Semester.

5.9 For Courses like NCC/NSS/NSO etc., a 'Satisfactory Participation Certificate' from the concerned authorities for the relevant Semester is essential. No Marks or Grades or Credits shall be awarded for these activities.

6.0 Subjects/ Courses to be offered

6.1 A typical Section (or Class) Strength for each Semester shall be 60.

6.2 A Subject/ Course may be offered to the students, ONLY IF a Minimum of 20 Students (1/3 of the Section Strength) opt for the same. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

6.3 More than ONE TEACHER may offer the SAME SUBJECT (Laboratory/ Practical classes may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection of students will be based on - 'FIRST COME FIRST SERVED Basis and CGPA Criterion'(ie., the first focus shall be on early ON-LINE ENTRY from the student for Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).

6.4 In cases of more Registration for a subject, the concerned Head of the Department shall decide whether to offer such a Subject / Course for TWO (or multiple) SECTIONS or NOT.

6.5 In case options are received from students of other Departments / Branches / Disciplines (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the 'Parent Department' first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the End Semester Examinations, if he acquires a minimum of 75% of attendance in aggregate of all the Subjects/ Courses (excluding Mandatory or Non-Credit Courses) of that Semester.

7.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each Semester may be granted by the College Academic Committee on genuine and valid grounds, based on the student's representation with supporting evidence.

7.3 A stipulated fees shall be payable towards condonation of shortage of attendance.

7.4 Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

7.5 Students whose shortage of attendance is not condoned in any Semester are not eligible to take their End Examinations of that Semester. They are detained and their registration for that Semester shall stand cancelled. They will not be promoted to the next Semester. They may seek re-registration for all those Subjects registered in that Semester in which they are detained, by seeking re-admission to that Semester as and when offered; in case there are any Professional Electives and/ or Open Electives, the same may also be re-registered if offered; however, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the SAME set of Elective Subjects offered under that category.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Item No.**7.**

8.1 A student is evaluated in each course for 100 marks (30 internal and 70 external; details in Item 9). A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 35% marks (25 out of 70 marks) in the End Semester Examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing **P** Grade or above in that Subject/ Course.

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to Industry Oriented Mini-Project/ Seminar, if he secures not less than 40% of the total marks (40 marks) to be awarded for each. The student would be treated as failed, if he (i) does not submit a report on his Industry Oriented Mini-Project, or does not make a presentation of the same before the Evaluation Committee as per schedule, or (ii) does not present the Seminar as required in the IV year I Semester, or (iii) secures less than 40% of marks (40 marks) in Industry Oriented Mini-Project / Seminar evaluations.
He may reappear for each of the above evaluations when they are scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the

same in the next subsequent Semester, as and when it is scheduled.

8.3 Promotion Rules:

Credits required for Promotion from I to II year

- A student will not be promoted from I year to II year unless he fulfills the academic requirement of securing 50% of total credits of I year from all the examinations and secures prescribed minimum attendance.

8.4 Credits required for Promotion from II to III year

- A student will not be promoted from II year to III year unless he fulfills the academic requirement of securing 60% of the credits up to II year I semester or 60% credits up to II year II semester, from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester, irrespective of number of credits registered.

8.5 Credits required for Promotion from III to IV year

- A student shall be promoted from III year to IV year only if he fulfills the academic requirement of securing 60 % of the credits up to III year I semester or credits upto III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester, irrespective of number of credits registered.

- A student shall register and put up minimum attendance in all **160** credits and earn all **160** credits.

- A Student who fails to earn **160** credits as indicated in the Course Structure within ten academic years (8 years of study + 2 years additionally for appearing for exams only) from the year of his admission, shall forfeit his seat in B.Tech. course and his admission stands cancelled.

NB: In case the total number of credits is a mixed number with decimals, the number of credits considered for promotion is rounded off to the nearest lower integer.

The above promotion rule is furnished below in tabulated form.

Promotion From To	Credits to be considered
1st year to 2nd year	50% of the credits of 1st year (1st and 2nd semester)
2nd year to 3rd year	a) 60% of the credits upto 2nd year 1st semester (1, 2 & 3 semesters) **or** b) 60% of the credits upto 2nd year 2nd semester (1, 2, 3 & 4 semesters) (Irrespective of number of credits registered)
3rd year to 4th year	a) 60% of the credits upto 3rd year 1st semester (1, 2, 3, 4 & 5 semesters) **or** b) 60% of the credits upto 3rd year 2nd semester (1, 2, 3, 4, 5 & 6 semesters) (Irrespective of number of credits registered)

8.6 A student shall register for all Subjects covering **160** Credits as specified and listed (with the relevant Course/Subject Classifications as mentioned) in the Course Structure, put up all the Attendance and Academic requirements for **160** Credits securing a minimum of **P** Grade (Pass Grade) or above in each Subject, and earn all **160** credits securing SGPA ≥ 5.0 (in each Semester), and CGPA (at the end of each successive Semester) ≥ 5.0, to successfully complete the B.Tech. Programme.

8.7 If a student registers for some more 'extra Subjects' (in the parent Department or other Departments/Branches of Engineering) other than those listed Subjects totaling to **160** Credits as specified in the Course Structure of the Department, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required **160** Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 7 and 8.1 – 8.6 above.

8.8 When a student is detained due to shortage of attendance in any Semester, he may be **re-admitted** into that Semester, as and when offered, with the Academic Regulations of the Batch into which he was first admitted. However if the batch of students of the class falls under the next Scheme of regulations, the student readmitted will be considered under the new scheme. However, no Grade Allotments or SGPA/ CGPA calculations will be done for that entire Semester in which he was detained.

8.9 When a Student is detained due to lack of Credits in any year, he may be readmitted in the next year, after fulfillment of the Academic Requirements, with the Academic Regulations of the Batch into which he was first admitted. However if the batch of students of the class falls under the next Scheme of regulations, the student readmitted will be considered under the new scheme.

8.10 A student eligible to appear in the End Semester Examination in any Subject/ Course, but absent at it or failed (thereby failing to secure **P** Grade or above), may reappear for that Subject/ Course in the supplementary examination (SEE) as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/Course will be carried over, and added to the Marks obtained in the SEE supplementary examination, for evaluating his performance in that Subject.

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory or Practicals or Seminar or Drawing/Design or Industry Oriented Mini-Project or Minor Course or Project Work or Skill Development/ Value Added Courses. These evaluations shall be based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination), and a Letter Grade corresponding to the % of marks obtained shall be awarded.

9.2 For all Subjects/Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE.

9.3 Distribution and Weightage of Credits

Type of Subject	Semester	
	Period/Week	Credits
Theory	**03**	**03**
Practicals	**02/03**	**1.0/1.5**
Drawing Subjects: **Engineering Drawing/Graphics** **Machine Drawing**	 **05 (2T+3P)** **04(1T+3P)**	 **3.5** **2.5**
Minor Theory	**02/03**	**01/1.5**
Minor Courses	**02**	**01**
Industry Oriented Mini Project	**--**	**02**
Technical Seminar	**02**	**01**
Project work	**20**	**10**

9.3.1. Theory Subjects

Theory subjects are allotted 2 or 3 credits. The distribution shall be 30 marks for internal evaluation and 70 marks for the end examination.

There shall be two midterm internal examinations. The syllabus for the mid examination will be the first 2.5 units for the first mid examination and the remaining 2.5 units for the second mid examination.

The midterm internal marks for theory subjects are to be scaled to a maximum of 20 marks. 8 marks are allotted for assignments and 2 marks for attendance of 75% or greater. There shall be one assignment to be submitted and evaluated before each mid exam. Total internal evaluation marks is therefore 30.

The first Mid-term examination Marks and first assignment marks shall make one set of CIE Marks and the second Mid-term examination marks and second assignment marks shall make second set of CIE marks. Average of these two sets of CIE marks will be taken as the final marks secured by each candidate.

The duration of mid examination is for theory subjects 2 hours.

The duration of end examination for theory subjects is 3 hours.

9.3.2. Substitution Test

- If any candidate is absent for any theory or minor theory subject in a mid examination or both mid examinations, a substitution test covering the entire syllabus of the subject will be conducted on payment of prescribed fees before the commencement of the end semester examinations. Prior permission is to be taken from the concerned Head of the Department for writing substitution tests.
- If a candidate has missed both the mid examinations, then the marks scored in the substitution test will be halved and accordingly recorded.

9.4 Practical Subjects

For practical subjects the distribution shall be 30 marks for internal evaluation and 70 marks for the end semester examination. Out of the 30 marks allotted for internal evaluation, day-to-day work in the laboratory shall be evaluated for 20 marks and internal practical / internal drawing examination for 10 marks. Internal examinations shall be conducted by the concerned teacher with the help of any other faculty member of the department.

The end examination for practical subjects shall be conducted with an external examiner and laboratory teacher specified by the Head of the Department concerned.

The duration of end examination for practical subjects is 3 hours.

External Examiner shall be appointed by the Controller of Examinations on the recommendation of the Chairman, Board of Studies of the concerned department. External examiner can be a teacher from outside the college or a teacher of the college who was not associated with the day-to-day class work of that laboratory.
The end examination in the subject of Drawing will be conducted along with the examinations of theory subjects.

9.5 Drawing Subjects

Drawing subjects are allotted marks as in theory subjects: 30 marks for internal evaluation and 70 marks for the end examination. Out of the 30 marks allotted for internal evaluation, day-to-day practice shall be evaluated for 20 marks, internal drawing examinations for 10 marks.

9.6 Electives

Departmental Electives include subjects related to the parent discipline, department or branch of engineering.

Interdisciplinary Electives include subjects offered by a department or branch of engineering to other departments or branches of engineering.

Open Electives are subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline or branch of engineering, that do not require a prerequisite course.

However, students **cannot opt** for an open elective subject offered by their own department, if it is already listed under core / elective subjects offered by that department, in any semester.

9.7 Skill Development Courses

Skill Development Courses are allotted 1 credit. The distribution of marks shall be 30 marks for internal evaluation and 70 marks for the end examination.

The end examination shall be conducted by examiners specified by the Head of the Department.

The end examination duration for Skill Development Courses is 3 hours.

9.8 Industry-Oriented Mini-Project

An industry-oriented mini-project in collaboration with an industry related to specialization of the department is to be taken up during the vacation following III year II semester examinations. The mini project work shall be submitted in report form to the Head of the Department concerned within the first two weeks of commencement of classes of IV year I semester. The marks allotted for Industry Oriented Mini Project is 100 (30 internal + 70 external). The Mini Project is to be presented in a seminar which will be evaluated by a committee for 30 marks. The committee consists of the Head of the Department, supervisor of the mini project and a senior faculty member of the department.

The external examination (viva-voce) for Mini Project shall be conducted by a committee consisting of an external examiner and an internal examiner nominated by the Head of the Department, for 70 marks. This examination is to be scheduled along with the laboratory exams of IV year I semester.

External examiner shall be appointed by the **Dean-Academics** on the recommendations of the Chairman, Board of Studies of the department. External examiner must be a teacher from outside the college.

9.9 Technical Seminar

A student shall present a technical seminar in IV year II semester. For the seminar, the student shall collect information on a specialized topic and present the same. The student will also have to submit a technical report to the department showing his / her understanding of the topic. The seminar presentation and the report shall be evaluated for 100 marks by a departmental committee consisting of the Head of the Department, seminar supervisor and a senior faculty member. There shall be **no external** examiner for technical seminar.

9.10 Project Work

Each Student shall start the Project Work during the IV Year I Semester, as per the instructions of the Project Guide/ Supervisor assigned by the Head of the Department. Out of a total of 100 marks allotted for the Project Work, 30 marks shall be for CIE (Continuous Internal Evaluation) and 70 marks for the SEE (Semester End Viva-Voce Examination). The Project Viva-Voce shall be conducted by a Committee comprising of an External Examiner, Head of the Department and Project Supervisor. Out of 30 marks allocated for CIE, 15 marks shall be awarded by the Project Supervisor (based on the continuous evaluation of student’s performance throughout the Project Work period), and the other 15 marks shall be awarded by a Departmental Committee consisting of Head of the Department and Project Supervisor, based on the work carried out and the presentation made by the student and internal Viva-Voce examination.

External examiner shall be appointed by the **Dean-Academics** on the recommendations of the Chairman, Board of Studies of the concerned department. External examiner must be a teacher from outside the college.

9.11 Laboratory examination marks / sessional marks awarded by the examiners are subject to scrutiny and scaling by the Results Committee wherever necessary. The committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the committee are final and binding.

9.12 For NCC / NSS / NSO type of Courses, and/or any other Mandatory Non-Credit Course offered in a Semester, a 'Satisfactory Participation Certificate' shall be issued to the student from the concerned authorities, only after securing ≥ 65% attendance in such a Course. No marks or Letter Grade shall be allotted for these activities.

10.0 Grading Procedure

10.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 9 above, and a corresponding Letter Grade shall be awarded as in Item **10.2**.

10.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed.

% of Marks Secured (Class Intervals)	***Letter Grade (UGC Guidelines)***	***Grade Points***
90% and above (≥ 90% , ≤ 100%)	S **(Outstanding)**	**10**
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ **(Excellent)**	**9**
Below 80% but not less than 70% (≥ 70% , < 80%)	A **(Very Good)**	**8**
Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ **(Good)**	**7**
Below 60% but not less than 50% (≥ 50% , < 60%)	B **(Average)**	**6**
Below 50% but not less than 40% (≥ 40% , < 50%)	P **(Pass)**	**5**
Below 40% (< 40%)	F **(FAIL)**	**0**
Absent for the Examination	**Ab (Absent)**	**0**

10.3 A student obtaining **F** Grade in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

10.4 A Letter Grade does not imply any specific % of Marks.

10.5 A student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, he has to repeat all the Subjects/ Courses pertaining to that Semester, when he is detained (as listed in Items 8.9 - 8.10).

10.6 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits for a Course

10.7 The student passes the Subject/ Course only when he gets GP $\geq$ 5 (**P** Grade or above).

10.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

SGPA = $\{ \sum_{i=1}^{N} C_i \, G_i \}$ / $\{ \sum_{i=1}^{N} C_i \}$ .... for each Semester,

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the number of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the ith Subject and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for the ith Subject.

10.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

CGPA = { $\sum_{j=1}^{M} C_j\ G_j$ } / { $\sum_{j=1}^{M} C_j$ } … for all S Semesters Registered (i.e., up to and inclusive of S Semesters, S$\geq$ 2),

where 'M' is the TOTAL number of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1^{st} Semester onwards up to and inclusive of the Semester S (obviously M>N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the number of Credits allotted to the jth-Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for the j^{th} Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

10.10 For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used.

10.11 For Calculations listed in Item 10.6 – 10.10, performance in failed Subjects / Courses (securing **F** Grade) will not be taken into account. Mandatory Courses with no credits will not be taken into consideration for calculation of SGPA/CGPA.

10.12 Passing Standards

10.12.1 A student shall be declared successful or 'passed' in a Semester, only when he gets a SGPA $\geq$ 5.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UGP, only when he gets a CGPA $\geq$ 5.00; subject to the condition that he secures a GP $\geq$ 5 (**P** Grade or above) in every registered Subject/ Course in each Semester (during the entire UGP) for the Degree Award, as required.

10.12.2 In spite of securing **P** Grade or above in some Subjects/Courses in any Semester, if a Student receives a SGPA<5.00 and/ or CGPA<5.00 at the end of such a Semester, then he 'may be allowed' to go into the next subsequent Semester (subject to fulfilling all other attendance and academic requirements as listed under Items 7-8).

10.12.3 A student shall be declared successful or 'passed' in any Non-Credit Subject / Course, if he secures a 'Satisfactory Participation Certificate' in that Mandatory Course.

10.13 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript)
shall be issued to all the Registered students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA and CGPA.

11.0 Declaration of Results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 10.6 – 10.11.

12.0 Award of Degree

12.1 A student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire UG E&T Programme (UGP), and secures the required number of **160** Credits (with CGPA $\geq$ 5.0), within 8 Academic Years from the Date of Commencement of the First Academic Year, shall be declared to have 'QUALIFIED' for the Award of the B.Tech. Degree in the chosen Branch of Engineering as selected at the time of Admission.

12.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of B.Tech degree he / she shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured
First Class with Distinction	≥ 7.75
First Class	$6.75 \leq$ CGPA < 7.75
Second Class	$5.75 \leq$ CGPA < 6.75
Pass Class	$5.0 \leq$ CGPA < 5.75

12.3 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used

% of Marks = (Final CGPA - 0.5) x 10

13.0 Withholding of Results

13.1 If the student has not paid fees to University/ College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

14.0 Transitory Regulations

14.1 Student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the Degree Programme, may be considered eligible for readmission to the same Subjects/Courses (or equivalent Subjects/Courses, as the case may be) and same Professional Electives/ Open Electives (or from set/category of Electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the Date of Commencement of his/her I-Year I-Semester). Further, the student will come under the current regulations on his re-admission but not the previous regulations under which he/she was first admitted.

14.2

a. A student seeking transfer to CVR College of Engineering from other Universities/ Institutions, after obtaining necessary permission from the State Government/ University has to pass all the subjects at the previous institution.

b. In case the student has failed in any subject, he has to take equivalent subject offered by this college and get a

Pass grade. He should also obtain a Pass grade in those subjects of this college which the student has not studied at the previous institution, up to that semester when transfer was effective.

c. For such of those transferred students with backlogs, the college will provide one chance to write the internal examinations in the failed subject and/or subject not studied in the curriculum of this college.

d. Equivalent subjects will be notified by the college, based on case to case basis as received from the University. However, in case of Professional Electives and Open Electives, student has to opt for a subject among the subjects listed under each of the electives, as the case may be.

e. For the completed semesters which the student studied previously at another institution/ under a different scheme, Grade Points will be awarded as per the College rules and CGPA calculated after clearing backlogs, if any.

15.0 Student Transfers

15.1 There shall be no Branch transfers after the completion of Admission Process.

16.0 Scope

i) Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her".
ii) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".
iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.
iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor / Principal is final.
v) The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all Students with effect from the dates notified by the College Authorities.

17. Disciplinary Action for Malpractices by students in Exams

Sl. No.	Nature of Malpractices / Improper Conduct	Punishment
1. a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculator, Cell Phone, pager, palm computer, blue-tooth equipment or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he/she is appearing but has not made use of it. Material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination.	Expulsion from the examination hall and cancellation of the performance in that subject only.
b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language method or communicates through cell phone or any other communication equipment with any candidate or persons inside or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case will be registered against him / her.
2.	Has copied in the examination hall from any paper, book, programmable calculator, palm computer or by dictation from wireless means any material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester / year. The Hall

		Ticket of the candidate will be cancelled.
3.	*Impersonates* any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from the examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case registered against him.
4.	*Smuggles* in the Answer book or additional sheet or takes out or arranges to send out the question paper or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year. The candidate is also debarred for two

		consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent / Assistant Chief Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer Incharge or any person on duty in or outside the examination hall, causes any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer Incharge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate (s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case will be registered against them.

	use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall *taking away answer script or intentionally* tears the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all end semester examinations. Continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. The candidate will be reported to the police.
9.	If a student of the college, who is not a candidate for the particular examination or any person not connected	Student of the college is expelled from the examination hall and cancellation of the

	with the college indulges in any malpractice or improper conduct mentioned in clauses 6 to 8.	performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a *drunken* condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester examinations.
12.	If any malpractice is detected which is not included in clauses 1 to 11, it shall be reported to the Dean-Academics for further action to award suitable punishment.	As decided by Dean-Academics

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B.Tech.
First Year B.Tech. - Electronics and Instrumentation Engineering
1st Semester Course Structure

Regulations: R18-CBCS **With effect from Academic Year 2018-19 Onwards**

Sl. No.	Subject Code	Subject	Category	Periods per Week		Credits	Scheme of Examination Maximum Marks			Page No.
				L	T/P /D		Internal	External	Total	
	-	Induction Programme	MC			No Credits	-	-	-	1
1	68102	Mathematics-I	BS	3	0	3	30	70	100	4
3	68103	Engineering Chemistry	BS	3	0	3	30	70	100	7
	65101	Problem Solving through 'C'	ES	3	0	3	30	70	100	16
	68105	Environmental Science	HS	3	0	3	30	70	100	19
5	63102	Engineering Drawing	ES	2	3	3.5	30	70	100	25
		Practicals								
6	68131	English Language and Communication Skills Lab- I	HS	0	2	1	30	70	100	28
7	68133	Engineering Chemistry Lab	BS	0	2	1	30	70	100	30
8	65131	Computer Programming Lab	ES	0	3	1.5	30	70	100	36
9	67131	IT Workshop Lab	ES	0	2	1	30	70	100	40
			Total	**14**	**12**	**20**	**270**	**630**	**900**	
			Total Hours	**26**						

First Year B.Tech. - Electronics and Instrumentation Engineering

2nd Semester Course Structure

Sl. No.	Subject Code	Subject	Category	Periods per Week		Credits	Scheme of Examination Maximum Marks			Page No.
				L	T/P /D		Internal	External	Total	
1	68151	English	HS	3	0	3	30	70	100	2
2	68152	Mathematics-II	BS	3	0	3	30	70	100	43
3	68153	Computational Mathematics	BS	2	0	2	30	70	100	45
4	68157	Applied Physics	BS	3	0	3	30	70	100	10
5	65151	Data Structures through 'C'	ES	3	0	3	30	70	100	49
		Practicals								
6	68181	English Language and Communication Skills Lab- II	HS	0	2	1	30	70	100	51
7	65181	Data Structures through 'C' Lab	ES	0	3	1.5	30	70	100	54
8	68187	Applied Physics Lab	BS	0	2	1	30	70	100	32
9	63181	Engineering Workshop	ES	0	2	1	30	70	100	39
10	68183	Computational Mathematics Lab	BS	0	3	1.5	30	70	100	52
			Total	**14**	**12**	**20**	**300**	**700**	**1000**	
			Total Hours	**26**						

Note: Lecture Hours (L), Tutorials (T), Practicals (P), Drawing (D) & Credits (C)

HS: Humanities & Sciences **BS: Basic Sciences** **ES: Engineering Sciences**

Induction Programme

Mandatory Course

Duration : 3 Weeks
Credits : No Credits

Objectives: To support the students to adjust to the new environment of the institution.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program as per the guidelines given by AICTE.

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
  (To overcome some critical lacunas that students might have for example, English, computer familiarity etc.)
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

  Any other relevant activity to enthuse, encourage and benefit the students.

68101/68151

ENGLISH

(Common to all Branches)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

The first year B.Tech English course helps students to enhance Listening, Speaking, Reading and Writing (LSRW) skills for communicating effectively to meet the following objectives:

1. Improving students' proficiency in English required for technical education.
2. Building up academic competence and confidence to use language effectively.
3. Developing life skills in them to tackle different mental and emotional challenges.
4. **Reading:**
   I. Students will develop understanding of key concepts related to language structures and language usage.
   II. Students will deploy and interpret textual features in ways such as composing and comprehending the prescribed text, and learning new vocabulary.
5. **Writing:**
   Students will be able to write grammatically correct, stylistically pleasing and diverse sentences, free from punctuation and spelling errors.

Text Book - *Fluency in English: A Course book for Engineering Students, published by Orient Black Swan Pvt. Ltd.*

Unit I

1. Presidential Address - A.P.J. Abdul Kalam.
2. Double Angels - David Scott.
3. **Vocabulary:** Prefixes, Suffixes and Collocations.
4. **Grammar:** Parts of speech and Punctuation.
5. **Reading & Writing:** Techniques for Effective Reading and Paragraph writing.

Unit II

1. Satya Nadella's E-mail to His Employees on His First Day as CEO of Microsoft - Satya Nadella.
2. The Road Not Taken - Robert Frost.

3. **Vocabulary**: Homonyms, Homophones, Homographs, Synonyms and Antonyms.
4. **Grammar:** Sentence structures and types of Verbs
5. **Reading & Writing:** Comprehension passages and E-mails.

Unit III

1. Technology with a Human Face - E.F. Schumacher.
2. **Vocabulary:** Commonly confused words and misspelled words
3. **Grammar:** Tenses: Types and uses & Question Tags.
4. **Reading & Writing:** Reading Practice and Official Letter Writing

Unit IV

1. Good Manners - J.C.Hill.
2. If - Rudyard Kipling.
3. **Vocabulary:** Idioms
4. **Grammar:** Subject Verb Agreement, Common Errors in Non-Pronoun Agreement, Articles, Prepositions and Redundancies and Clichés.
5. **Reading and Writing**: Reading Practice and Essay Writing

Unit V

1. Oh Father, Dear Father - Raj Kinger.
2. Basic Education - M.K. Gandhi.
3. **Vocabulary:** One word substitutes
4. **Grammar:** Degrees of Comparison, Active and Passive Voice and Reported Speech.
5. **Reading & Writing:** Reading Practice and Dialogue Writing

Course Outcomes: At the end of the semester, the students will be able to

CO 1: Write coherent, unified, and complete sentences.
CO 2: Identify word meaning and know the use of familiar lexical items.
CO 3: Understand explicit and implicit information and draw inferences for the given task.
CO 4: Communicate according to place, relation and medium.
CO 5: Know, emphasize, conceptualize, comprehend, apply, synthesize, and evaluate the given text, and other authentic texts such as magazines/newspaper articles.

References:

1. Remedial English Grammar, F.T. Wood, Macmillan.
2. Practical English Usage, Michael Swan, Oxford University Press.

68102

MATHEMATICS-I

(Common to All branches)

Instruction	:	3 Periods/week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the concept of rank of a matrix and application of rank to determine the Consistency of a linear system of equations.
2. To learn and evaluate eigen values, eigen vectors of a matrix and hence find the Modal matrix of the corresponding linear transformation that transforms to Spectral matrix.
3. To acquire knowledge of using definite integrals to evaluate surface areas and volumes of solids of revolution. To have an understanding of Mean value theorems and their applications.
4. To identify the nature of a series using the appropriate test for convergence.
5. To understand the concept of partial derivatives and total derivative and to use them in finding the extreme values of a multi-variate function with or without constraints.

Unit I - Matrices

Matrices: Types of real matrices; Determinants; rank of a matrix by Echelon form and Normal form; Inverse of a matrix by Gauss-Jordan method; System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method.

Unit II - Eigen values, Eigen vectors and Quadratic Forms

Linear Transformation and Orthogonal Transformation: Eigenvalues and eigenvectors and their properties: Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); finding inverse and power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and Nature of the Quadratic Forms; Reduction of Quadratic form to canonical forms by Orthogonal Transformation

Unit III - Uni-Variate Calculus

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's and Maclaurin's theorems with remainders.
Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Definition of Improper Integral: Beta and Gamma functions and their applications.

Unit IV - Sequences and Series

Sequence: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences.
Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert's ratio test; Raabe's test; Cauchy's Integral test; Cauchy's root test; logarithmic test. Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence.

Unit V - Multi-variable Calculus (Partial Differentiation and Applications)

Definitions of Limit and continuity; Partial Differentiation; Euler's Theorem; Total derivative; Jacobian; Functional dependence & independence, Maxima and minima of functions of two and three variables, Method of Lagrange multipliers.

Course Outcomes : At the end of the course, the student will be able to

CO 1	:	Find rank of a matrix and solve a linear system of equations.
CO 2	:	Evaluate eigen values, eigen vectors and find the Modal matrix under a linear transformation.
CO 3	:	Evaluate surface areas and volumes of solids of revolution, Apply Mean value theorems in relevant engineering domains.
CO 4	:	Determine the convergence/divergence of a given infinite series.
CO 5	:	Find the extremum of a multi-variate function with or without constraints.

Text Books :

1. Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Narosa Publishing House.
2. Higher Engineering Mathematics, B.V.Ramana, 11th Reprint, Tata McGraw- Hill, 2010.

References :

1. Calculus and Analytical Geometry, G.B.Thomas and R.L.Finney, Pearson Publishers.
2. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers.
3. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley Publishers.
4. Advanced Engineering Mathematics, Michael Greenberg, Pearson Publishers.

68103/68155

ENGINEERING CHEMISTRY

(Common to all Branches)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives: By studying this course

1. Students are exposed to central and fundamental concepts in periodic properties and intermolecular forces in chemistry relevant to the engineering.
2. Students get awareness in electrochemical changes, corrosion and treatment of water.
3. Students learn fundamental types of organic reactions and stereochemistry.
4. Students understand micro particle behavior and molecular orbitals.
5. Students get knowledge of industrial applications of engineering materials: polymers, lubricants and refractories.

Unit I - Periodic properties and Intermolecular forces

Electronic configurations, effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, co-ordination numbers and geometries, molecular geometries. Ionic, dipolar and van Der Waals interactions.

Unit II - Electrochemistry and water technology

EMF, Galvanic cells, cell notation, cell reaction, cell potentials, Nernst equation and applications. numerical problems. Saturated Calomel electrode, potentiometric acid-base titration.

Corrosion: Introduction, causes and its effects, dry corrosion and wet corrosion, cathodic protection.

Water technology: Hardness of water, boiler troubles: scales and sludges, boiler corrosion. Internal and external treatment of water: calgon conditioning, phosphate conditioning, Zeolite method, Ion exchange method Reverse osmosis.

Unit III - Stereochemistry, Reaction Mechanism and synthesis of drug molecules

Introduction to representation of 3-dimensional structures, Structural and stereoisomers, configurations, symmetry and chirality. Enantiomers, diastereomers, optical activity and Absolute configuration. Conformation analysis of n-butane.

Substitution reactions: Nucleophilic substitution reactions: Mechanism of S_N1, S_N2 reactions. Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions. Grignard additions on carbonyl compounds. Elimination reactions: Dehydro halogenation of alkylhalides. Saytzeff rule. Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and chromic acid. Reduction reactions: reduction of carbonyl compounds using $LiAlH_4$ and $NaBH_4$. Hydroboration of olefins.

Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

Unit IV - Atomic and molecular structure

Schrodinger equation. Particle in box solutions and their applications for conjugated molecules.

LCAO method, Molecular orbital theory. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Energy level diagrams of homo-nuclear and hetero-nuclear diatomic molecules: H_2, O_2, N_2, and CO. Band structure of solids and the role of doping on band structures.

Unit V - Engineering materials

Polymers: Addition polymers: preparation, properties and applications of PVC and Teflon, Condensation polymers: preparation, properties and applications of Nylon-6,6 and Terylene. Conducting polymers: poly acetylene and poly aniline and applications.

Lubricants: Criteria of a good lubricant, mechanism of lubrication, properties of lubricants: Viscosity, Cloud, pour point and flash, fire point and their Significance.

Refractories: Classification, Characteristics of a good refractory, refractoriness (pyrometric cone test and RUL test) and applications.

Course Outcomes: On completing the course the student

CO 1 : Rationalise periodic properties such as ionization potential, electron affinity, oxidation states and electronegativity.
CO 2 : Understanding the importance of EMF, corrosion and treatment of water.
CO 3 : List major chemical reactions that are used in the synthesis of molecules.
CO 4 : Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
CO 5 : Would develop ability to handle situations involving problems associated with chemical substances in engineering situations.

Text Books:

1. Engineering Chemistry, Prasantha Rath, B.Rama Devi, Ch. Venkata Ramana Reddy & Subhendu Chakraoborty, Cengage Learning India Pvt. Ltd., 2018.
2. Text Book of Engineering Chemistry, Shasi Chawla, 3rd Edition, Dhanpat Rai Publishing Company, 2015.

References:

1. Engineering Chemistry, P.C. Jain & Monica Jain, 16th Edition, Dhanpat Rai Publishing Company, 2015.
2. Engineering Chemistry, M. Thirumala Chary & E. Laxminarayana, 3rd Edition, SCITECH Publications (India) Pvt. Ltd, 2016.

68104/68157

APPLIED PHYSICS

(Common to EEE, ECE, CSE, EIE & IT Branches)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives: By studying this course a student would be exposed to

1. Basic concepts of lasers, construction and working of different types of lasers followed by the principles of fiber optics.
2. Basic concepts of quantum physics leading to the band theory of solids.
3. Semiconductor physics, Physics of pn junction and characteristics of different types of diodes.
4. Construction and working of bipolar transistor, JFET & MOSFET.
5. Fundamentals of nanomaterials, synthesis and their characterization.

Unit I - Lasers and Fiber optics

Characteristics of laser light, stimulated absorption, spontaneous and stimulated emission of radiation, meta-stable state, population inversion, evaluation of relation between Einstein coefficients, Ruby laser, He-Ne laser, Semiconductor laser: Homo junction and Hetero junction, Applications of lasers.

Structure of optical fiber, principle of propagation of light through optical fiber, acceptance angle, numerical aperture, types of optical fibers: step index and graded index. Losses in optical fibers, optical fiber communication and application of optical fibers.

Unit II - Quantum mechanics and Band theory of solids

The wave properties of matter, Schrodinger time independent wave equation, particle in 1-dimensional box, density of energy states, Fermi-Dirac distribution function and its variation with temperature.

The classical free electron theory, electrical conductivity of a metal: relaxation time, collision time and mean free path. Quantum theory of free electrons. Electron in a periodic potential, Bloch theorem, Kronig-Penny model, E-K curve, the effective mass of electron and hole (qualitative based on E-K curve), origin of energy bands, classification of solids into conductors, semiconductors and insulators.

Unit III - Conduction in semiconductors and Semiconductor diode characteristics

Introduction to semiconductors, carrier concentration in intrinsic and extrinsic semiconductors, Fermi level in a semiconductor and its variation with temperature and charge carrier concentration, drift and diffusion, conductivity of a semiconductor, carrier lifetime, the continuity equation, the Hall effect.

Formation of PN junction, open circuit PN junction, energy band diagram of PN diode, derivation of diode equation, I-V characteristics of PN junction diode and temperature dependence, diode resistance, Zener diode, LED and photo diode.

IV - Transistors

Bipolar junction transistor (BJT), transistor current components, the transistor as an amplifier, transistor construction, detailed study of the currents in a transistor, the transistor alpha, beta and gamma, the common-base configuration, the common-emitter configuration, the common-collector configuration.

The junction field-effect transistor (JFET), the JFET volt-ampere characteristics, the insulated-gate FET (MOSFET): The enhancement MOSFET, the depletion MOSFET, UJT construction and characteristics.

Unit V - Nanomaterials

Origin of nanotechnology, general definition of nanomaterials, surface to volume ratio, quantum confinement. Classification of nanomaterials: quantum dots (0-dimension), quantum wire (1-dimension) and quantum well (2-dimension). Density of states for 0, 1 and 2-dimensions (qualitative). Synthesis of nanomaterials: top down- Ball milling, Physical vapor deposition (thermal evaporation, PLD); Bottom up- Sol-gel method, Chemical vapor deposition. Characterization: XRD, optical microscope, SEM and TEM. Applications of nanomaterials.

Course Outcomes: On completing the course a student would be able to understand

CO 1 : The concepts involving the physics of lasers, lasing action, construction and working of He-Ne laser, semiconductor laser and propagation of light through optical fibers.

CO 2 : Schrodinger wave equation and its application, free electron models, formation of bands in solids and electron occupation in bands.

CO 3 : Estimation of charge carrier concentration in semiconductors and understand the formation of pn junction, construction and characteristics of different diodes like rectifying, Zener & Tunnel diodes.

CO 4 : Transistor current components, characteristics of CB, CE and CC configurations, also understand the construction, working and characteristics of JFET & MOSFET.

CO 5 : The principles of nanotechnology, types of nanomaterials, synthesis: Top-down and bottom-up methods, characterization: XRD, SEM & TEM.

Text Books:

1. Engineering Physics, Hitendra K Malik and A K Singh, McGraw-Hill Publications, 2017.
2. Electronic Devices and Circuits, Milliman and Halkias, 4^{th} Edition, McGraw-Hill Publications, 2015.

References:

1. Introduction to Solid State Physics, C. Kittel, 8^{th} Edition, Wiley India, 2012.
2. Semiconductor Physics and Devices, Donald A. Neamen, 4^{th} Edition, McGraw-Hill Publications, 2012.

68154

ENGINEERING PHYSICS

(Common to CE & ME Branches)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives: By studying this course a student would be exposed to

1. Understand the requirements of a hall/auditorium for good acoustics.
2. Develop an understanding of damped, un-damped, under damped, forced mechanical oscillators and learn to develop mathematical formulations for them.
3. Develop an understanding of vector operators.
4. Learn skills to apply vector analysis to the classical laws of physics.
5. Learn basics of semiconductor diodes. Understand the cause of magnetism in some materials.

Unit I - Acoustics

Classification of sound (Music and Noise), characteristics of musical sound: Pitch, quality, Loudness-Weber Fechner law and measurement of Loudness, Acoustics of buildings: Requirements of acoustically good hall, Reverberation, Reverberation time, Factors affecting the reverberation time in the halls and their remedies. Sabines formula for reverberation time, Absorption coefficient and experiment to determine the absorption coefficient by the reverberation time method.

Unit II - Oscillations

Simple harmonic motion, Damped harmonic oscillator (over damped, critically damped and lightly damped); Energy decay in damped harmonic oscillator, forced Simple harmonic oscillator, Steady state motion of forced damped harmonic oscillator and resonance.

Unit III - Vector Calculus

Review of vector algebra, Gradient of a scalar field, Line, surface and volume integrals, Divergence and curl of vector function and its physical significance, Classification of vector fields (four fields viz., lamellar, irrotational, rotational and solenoidal), Conservative and non-conservative forces with examples, Central forces, Conservation laws: Linear momentum, Angular momentum, Energy.

IV - Classical Mechanics

Transformation of scalars and vectors under Rotation transformation, Forces in Nature, Newton's laws and its completeness in describing particle motion, Form invariance of Newton's Second Law, Solving Newton's equations of motion in polar coordinates; Problems Including constraints and friction, Extension to cylindrical and spherical coordinates.

Unit V - Semiconductor devices & Magnetic properties

Intrinsic and extrinsic semiconductors, P-N Junction diode, Diode equation (Statement only), V-I Characteristics of P-N Diode, Construction and working of Zener diode, LED, Semiconductor laser, Photodiode.

Introduction to magnetic materials, Origin of magnetic moment-Bohr Magneton, Contribution due to spin of electron and nucleus, Classification of magnetic materials (Dia, Para, Ferro, Antiferro and Ferri magnetic materials), Domain theory of Ferromagnetism, Differences between Hard and soft magnetic materials, Applications of magnetic materials.

Course Outcomes: On completing the course a student would be able to understand

CO 1 : Address issues pertaining to acoustics of the hall / auditorium.
CO 2 : Formulate differential equations governing an oscillator under various conditions and solve the same.
CO 3 : Use vector operators in different physical situations.
CO 4 : Understand Newton's law of motion, in polar, cylindrical and spherical coordinates.
CO 5 : Understand the Domain theory of Ferromagnetism and applications of magnetic materials.

Text Books:

1. Engineering Physics, R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications, 2011.
2. Classical Mechanics , G. Aruldhas , Phi Publication, 2008.

References:

1. Engineering Physics, Hitendra K Malik and A. K. Singh, Tata McGraw-Hill Publications, 2016.
2. Mechanics, D. S. Mathur, S.Chand Publishing, 1981.
3. Classical Mechanics, J. C. Upadhyaya, Himalaya Publishing House, 2017.

65101

PROBLEM SOLVING THROUGH 'C'

(Common to all branches)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To introduce student to the fundamental concepts of C programming, structured constructs and terse syntax.
2. To enable student to formulate simple algorithms for solving arithmetic and logical problems.
3. To enable student to translate algorithms into programs
4. To enable student to test and execute programs and correct syntax and logical errors.
5. To enable student to familiarize with modular programming in implementing solutions for complex problems.
6. To enable student to apply appropriate concepts like pointers, arrays, structures for a particular algorithm implementation.

Unit I – Introductory Concepts

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Types of Programming Languages.

Idea of Algorithm: Steps to solve logical and numerical problems.

Representation of Algorithm: Flowchart/Pseudo code with some conceptual examples and exercises.

From algorithms to programs Creating and Running Programs, Syntax and Logical Errors in compilation, object and executable code.

Introductory Concepts: Introduction to C, Simple C Programs, Desirable Program Characteristics.

C Fundamentals: The C Character Set, Identifiers and Keywords, Data Types, Constants, Variables and Arrays, Declarations, Expressions.

Operators and Expressions: Arithmetic Operators, Unary Operators, Relational and Logical Operators, Assignment Operators, The Conditional Operator, Library Functions.

Data Input and Output: Single Character I/O functions-getchar, putchar, I/O statements-scanf, printf, gets, puts functions**.**

Unit II – Programming Constructs

Control Statements: Selection Statements:2-way selection (if, nested if, if-else), multi-way selection (else-if ladder, switch-case), break, continue statements.

Iterative Statements: Pretest Loops (for, while), posttest loops (do-while)

Functions: Defining a function, accessing a Function, Function Prototypes, Passing arguments to a function, Example programs.

Program Structure: Storage Classes, Automatic variables, Extern (Global) variables, Static Variables, Register Variables.

Unit III – Recursion, Arrays

Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, GCD etc.
Preprocessor Directives: File Inclusion, Macros**.**
Arrays: Defining an array, processing an array, passing arrays to functions.
Sorting & Searching: linear search, Bubble Sort.

Unit IV – Pointers, Strings

Multidimensional Arrays: Example programs on matrix operations
Pointers: Pointer Declarations, Passing pointers to functions, Pointers and one-dimensional Arrays, Dynamic memory allocation, operations on pointers, pointers and multidimensional arrays, arrays of pointers.
Strings: String manipulation program using user defined functions and String library functions.

Unit V – Structures and Files

Structures and Unions: Defining a structure, Processing a structure, User-defined Data Types (typedef), Structures and Pointers, Passing Structures to functions, Self-referential Structures, Unions and Enumerated Data Types, Command Line Arguments.
Files: Opening and Closing a Data file, Creating a Data File, Processing a Data File, Unformatted Data Files.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Ability to understand programming concepts and analyze a problem, design a solution and develop an algorithm to solve it.

CO 2 : Ability to modularize a problem and implement the solution using basic programming concepts, control statements and functions.

CO 3 : Ability to evaluate the use of macros and implement solutions to complex problems using recursion and homogeneous data types.

CO 4 : Ability to implement pointers for problems of relevance and use different dynamic memory allocation methods.

CO 5 : Design and implement appropriate user defined structures to a given problem definition and apply various functions for processing files.

Text Books :

1. Programming with C (Schaum's Outlines Series), Byron S. Gottfried, 3rd Edition, McGraw-Hill, 2017.
2. Programming with C, Ajay Mittal, 9th Impression, Pearson Education Ltd, 2017.

References :

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd Edition, Prentice Hall of India.
2. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, 3rd Edition, Cengage Learning.

68105/68156

ENVIRONMENTAL SCIENCE

(Common to all branches)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives: By studying this course

1. To create awareness on significance of ecosystems and biodiversity.
2. To educate students about the importance of natural resources and their conservation.
3. To develop awareness in the students about the significance of environmental pollution.
4. To create the awareness regarding environmental management.
5. To understand the environmental legislation and sustainable development.

Unit I - Ecosystems and Biodiversity

Ecosystems: Definition of ecosystem, Structure and functions of ecosystem (Pond and Grassland ecosystems), Food chains (Grazing and Detritus), Food web and Ecological pyramids, Flow of energy, Biogeochemical cycles or Nutrient cycles: Carbon cycle and Nitrogen cycle, Biomagnification.

Biodiversity: Definition**,** Types of biodiversity (Species, Genetic and Ecosystem), Hotspots of biodiversity, Threats to biodiversity**,** Conservation of biodiversity: In-situ and Ex-situ conservation and wildlife conservation.

Unit II - Natural Resources

Renewable and Non-renewable resources, Water resources: Characteristic features of lake, Dams-Benefits and problems, Mineral resources: Mining and its environmental impacts, Renewable energy resources: Solar energy, Wind energy, Hydro energy, Tidal energy, Geothermal energy and Bioenergy, Non-renewable energy resources-Coal.

Unit III - Environmental Pollution and Control

Air pollution-Sources, effects and control measures, Greenhouse gases-Causes and consequences of Global warming, Kyoto protocol, Ozone layer depletion, Montreal protocol. Water pollution-Sources and effects, Waste water treatment methods: Effluent Treatment Plant (ETP),Sewage Treatment Plant (STP), Brief account of Soil pollution and Noise pollution.

Unit IV - Environmental Impact Assessment

Definition and Scope of EIA, Base line data acquisition, Impacts-Cultural, Social and Bio-Physical impacts, Impact assessment methodologies- Check list method, Ad-hoc method, Leopold matrix method and Map overlay methods. Environmental Impact Statement (EIS), Environmental Management Plan (EMP), Rain water harvesting, Role of IT in Environmental management (Remote Sensing and GIS).

Unit V - Environmental Legislation and Sustainable Development

Air (Prevention and Control of Pollution) Act-1981, Water (Prevention and Control of Pollution) Act-1974, Environment Protection Act-1986, Solid Waste Management - Municipal Solid Waste, Biomedical Waste, Concept of Bioremediation, Concept of Sustainable development.

Field Trip: Study of ecosystems-Pond, lake, river and forest, Visit to a rural/urban/industrial/agricultural site.

Course Outcomes: On completing the course a student

CO 1 : Define the concepts of ecosystem and emphasize the importance of biodiversity and its conservation.

CO 2 : Gain knowledge on natural resources and advantages and disadvantages on renewable energy sources and technologies.

CO 3 : Develop awareness on pollution control technologies and global atmospheric changes.

CO 4 : Emphasize the importance of Environmental impact assessment and green technologies.

CO 5 : Understand about Environmental legislation and the concept of Sustainable development.

Text Books:

1. Text Book of Environmental Science and Technology, M. Anji Reddy, B.S. Publications, 2013.
2. Text Book of Environmental Studies, Anubha Kaushik and C.P.Kaushik, 4th Edition, New Age International Pvt. Ltd., 2014.

References:

1. Environmental Science: Towards a Sustainable Future, Richard T. Wright and Dorothy F. Boorse, 11th Edition, PHI, Learning Pvt. Ltd., 2010.
2. Environmental Engineering and Science, Gilbert M. Masters and Wendell P. Ela, 3rd Edition, PHI Learning Pvt. Ltd., 2011.

63101

ENGINEERING GRAPHICS & Auto CAD

(Common to Mechanical & Civil)

Instruction	:	2 Periods / week	Sessional Marks	:	30
Practical	:	3 Periods / week	End Examination Marks	:	70
Credits	:	3.5	End Exam Duration	:	3 Hours

Course Objectives:

1. To understand Standards conventions and use AutoCAD commands for drawing various geometrical constructions and curves used in engineering practice.
2. To acquire skills to solve problems on orthographic projection of points and lines.
3. To understand orthographic projection of planes and solids.
4. To understand section of solids and development of surfaces.
5. To grasp the concept of converting isometric projection to orthographic projection and vice versa.

Unit I

Introduction to Engineering drawing: Principles of Engineering Graphics and their Significance– Size of drawing sheets, Types of lines, lettering, Dimensioning, Title block.
Introduction to Auto CAD: User Interface – Menu system – Different types of file formats – setting up a drawing space – coordinate systems – tool bars (draw, modify, annotations, layers etc.) – status bar (ortho, grid, snap, iso etc.) – display control commands (pan, zoom etc.) – printing setup.
Curves used in Engineering Practice: Conic Sections – Construction of Ellipse, Parabola and Hyperbola – General Method only. Special curves – Cycloid, Epicycloid, Hypo cycloid and Involute.
Introduction to Scales

Unit II

Principles of Orthographic Projections – Conventions – Fundamentals of First and Third Angle projections, Projections of Points, Projection of Lines inclined to one plane and inclined to both the planes.

Unit III

Projection of Planes: Projections of regular Planes – planes parallel to one and perpendicular to other plane, planes perpendicular to one and inclined to the other, planes inclined to both planes.

Projection of solids: Projections of Regular Solids - Cone, Cylinder, Prism, Pyramid and Tetrahedron - inclined to one and inclined to both the planes.

Unit IV

Sections of Right Regular Solids - Cone, Cylinder, Prism and Pyramid – Sectional plane parallel to one plane and perpendicular to the other plane - sectional planes inclined to H.P and V.P
Development of Surfaces of Right, Regular Solids – Cone, Cylinder, Prism and Pyramid – Sectional plane parallel to one plane and perpendicular to the other plane - sectional planes inclined to H.P and V.P.

Unit V

Principles of Isometric Projection – Isometric Scale – Isometric Views, Conventions, Isometric Projections and Views of simple Plane figures **–** Regular Polygons and circle. Isometric Projections and Views of simple solids – Prism, Pyramid, Cylinder, cone and sphere.
Conversion of Isometric Views to Orthographic Views – Drawing of Front, Top and Side views from isometric views of objects
Conversion of Orthographic views to Isometric Views.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Know the Standard conventions and Construction of various Engineering curves through Auto CAD.
CO 2	:	Apply fundamentals of theory of projections and draw orthographic projections of points and lines in any position through Auto CAD.
CO 3	:	Construct orthographic projections of simple planes and regular solids in any position through Auto CAD.
CO 4	:	Draw sectional views and developments of various basic 3D objects through Auto CAD.
CO 5	:	Construct isometric views and construct multi view drawings of simple and complex 3D objects through Auto CAD.

Text Books:

1. Engineering Drawing, N.D. Bhat, Charotar Publishers, 53rd Edition, 2016.
2. Engineering Graphics with AutoCAD, D. M. Kulkarni, A.P.Rastogi and A. K.Sarkar, PHI, 2009.

References:

1. Engineering Drawing and Graphics, Venugopal, New age Publishers, 2010.
2. Engineering Drawing, Dhananjay Johle, 1st Edition, Tata McGraw-Hill Publishers, 2007.
3. Engineering Graphics for Degree, K.C. John, PHI Learning Pvt. Ltd., 2009.
4. Engineering Drawing, K. L. Narayana and P. Kannaiah, 23rd Reprint, Scitech Publishers, 2010.

63102

ENGINEERING DRAWING

(Common to CSE, ECE, EEE, EIE & IT)

Instruction	:	2 Periods / week	Sessional Marks	:	30
Practical	:	3 Periods / week	End Examination Marks	:	70
Credits	:	3.5	End Exam Duration	:	3 Hours

Course Objectives:

1. To understand Standards conventions and curves used in engineering practice.
2. To acquire skills to solve problems on orthographic projection of points and lines.
3. To understand orthographic projection of planes and solids.
4. To understand section of solids and development of surfaces.
5. To grasp the concept of converting isometric projection to orthographic projection and vice versa.

Unit I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance– Drawing Instruments and their Use – Conventions in Drawing –BIS Conventions. Lettering, Dimensioning.

Geometrical Constructions; Perpendicular Bisection, Angular Bisection, Dividing line into equal parts, Construction of polygons – General Method of polygon construction and Angle Method only.

Curves used in Engineering Practice: Conic Sections – Construction of Ellipse, Parabola and Hyperbola – General Method only.
Scales: Different types of Scales- Plain, Diagonal and Vernier Scales.

Unit II

Principles of Orthographic Projections – Conventions – Fundamentals of First and Third Angle projections, Projections of Points, Projection of Lines inclined to one plane and inclined to both the planes.

Unit III

Projection of Planes: Projections of regular Planes – planes parallel to one and perpendicular to other plane, planes perpendicular to one and inclined to the other, planes inclined to both planes.

Projection of Solids: Projections of Regular Solids - Cone, Cylinder, Prism, Pyramid, Cube and Tetrahedron - inclined to one and inclined to both the planes.

Unit IV

Sections of Right Regular Solids - Cone, Cylinder, Prism and Pyramid – Sectional plane parallel to one plane and perpendicular to the other only.
Development of Surfaces of Right, Regular Solids – Cone, Cylinder, Prism and Pyramid - Sectional plane parallel to one plane and perpendicular to the other only.

Unit V

Principles of Isometric Projection – Isometric Scale – Isometric Views, Conventions, Isometric Projections and Views of simple Plane figures **–** Regular Polygons and circle. Isometric Projections and Views of simple solids – Prism, Pyramid, Cylinder, cone and sphere.

Conversion of Isometric Views to Orthographic Views – Drawing of Front, Top and Side views from isometric views of objects
Conversion of Orthographic views to Isometric Views.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Know the Standard conventions, design scale for drawing engineering components and draw geometrical constructions.
CO 2	:	Apply fundamentals of theory of projections, and draw orthographic projections of points and lines in any position.
CO 3	:	Construct orthographic projections of simple planes and regular solids in any position.
CO 4	:	Draw sectional views and developments of various basic 3D objects.
CO 5	:	Construct isometric views and construct multi view drawings of simple and complex 3D objects.

Text Books:

1. Engineering Drawing, N.D. Bhat, 53rd Edition, Charotar Publishers, 2016.
2. Engineering Drawing, Basant Agrawal, 2nd Edition, Tata McGraw-Hill Publishers, 2013.

References:

1. Engineering Drawing and Graphics, Venugopal, New age Publishers, 2010.
2. Engineering Drawing, Dhananjay Johle, 1st Edition, Tata McGraw-Hill Publishers, 2007.
3. Engineering Graphics for Degree, K.C. John, PHI Learning Pvt. Ltd., 2009.
4. Engineering Drawing, K.L. Narayana and P. Kannaiah, 23rd Reprint, Scitech Publishers, 2010.

68131

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB – I

(Common to all Branches)

Instruction	:	2 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	1	End Exam Duration	:	3 Hours

Course Objectives:

The main aim of introducing phonetics is to introduce the students to the basic concepts in phonetics and phonology, and enable them to apply these in practical work on English language.

1. **Listening**
   To train the listener in capturing accurately and actively the sounds of the speaker and in the process the listener uses prior knowledge of the rules of English phonetics.
2. **Speaking**
   I. To speak fluently and appropriately with comprehensible accent.
   II. To develop proficiency in speaking.
3. **Reading**
   To encourage the students to read extensively to develop a good writing style, adequate vocabulary, advanced grammar and proficiency in correct spelling.
4. **Writing**
   I. To write fluently in a variety of situations for a variety of purposes and employ the appropriate formats.
   II. To introduce the features of formal writing.
5. To empower the students to become proficient in LSRW Skills of English.

"K-VAN Solutions" and "English Grammar in Use" Softwares are used in practice sessions for the following topics:

Topics

Listening and Speaking

1. Introduction to sounds of English
   a) Vowels (monophthongs and diphthongs)
   b) Consonants (place of articulation, manner of articulation and voicing)
   c) Transcriptions

2. Spelling and Pronunciation (British and American)
3. Word Stress (Syllabic division, stress marking and word stress in a sentence)
4. Intonation (Falling and Rising tones)

Reading and Writing

5. Presentation skills (Oral, written and PPT)
6. Report writing (Components and types of Reports)
7. Practice sessions in usage of Grammar

Course Outcomes: At the end of the semester, the students will be able to:

CO 1 : Emerge as good speakers and listeners
CO 2 : Develop critical and analytical thinking.
CO 3 : Write effectively.
CO 4 : Develop effective presentation skills using the multimedia tools.
CO 5 : Neutralize mother tongue influence on their English and make them proficient speakers.

References:

1. A Text Book of English Phonetics for Indian students, T Balasubraminian, Macmillan India Ltd.
2. Test your English Vocabulary in Use, Stuart Redman & Ruth Gaims, Cambridge University Press.

68133/68185

ENGINEERING CHEMISTRY LAB

(Common to all Branches)

Practical	:	2 Periods / week	Sessional Marks	:	30
Credits	:	1	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives: It is aimed to train the students

1. In estimating the chemical substance by a set of procedures involving titrimetric analysis.
2. To expose the students to various instruments such as conductometer, potentiometer, colorimeter and viscometer.
3. In different techniques involved in qualitative and quantitative analysis of substances.
4. To learn preparation and identification techniques of a drug.
5. To make appropriate measurements, analyze the data and report the results.

List of Experiments (any 10 of the following)

1. Determination of surface tension by using Stalagmometer
2. Determination of viscosity by using Redwood/Ostwald viscometer.
3. Determination of hardness of water by complexometric method using EDTA.
4. Determination of the rate constant of hydrolysis of methyl acetate.
5. Thin layer chromatography calculation of R_f values of ortho, para-nitro phenol.
6. Determination of cell constant
7. Conductometric acid-base titration: Strong acid vs Strong base.
8. Potentiometric acid-base titration: Strong acid vs Strong base.
9. Synthesis of a drug aspirin/paracetamol.
10. Saponification /acid value of coconut oil.
11. Verification of Beer's law using $CuSO_4$ solution by Colorimetry.
12. Determination of the partition coefficient of acetic acid between n-butanol and water.
13. Adsorption of acetic acid by charcoal.

Course Outcomes: The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to

CO 1 : Estimate rate constants of reactions from concentration of reactants/products as a function of time.
CO 2 : Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, absorbance.
CO 3 : Understand the concepts of distribution and adsorption phenomena.
CO 4 : Synthesize a small drug molecule.
CO 5 : Develop analytical skills and learn how to analyze and present results of an experiment.

References:

1. Practical Engineering Chemistry, K. Mukkanti, et al., B.S. Publications, 2009.
2. Instrumental methods of Chemical Analysis, Gurdeep Chatwal & Sham Anand, Himalaya Publications, 2016.

68134/68187

APPLIED PHYSICS LAB

(Common to EEE, ECE, CSE, EIE & IT Branches)

Instruction	:	2 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	1	End Exam Duration	:	3 Hours

Course Objectives: By studying this course a student would be exposed to

1. Students perform experiments involving studies of thermal, elastic, optical, electrical and magnetic properties of certain materials.
2. Experiments based on certain laws are performed.
3. They are trained in handling and using instruments like spectrometer, vernier calipers, screw gauge, DMM (Digital Multi Meter), and function generator.
4. Students are trained to record the observations in a systematic manner, keeping the possible errors in the instruments in view.
5. Students are trained to graphically represent the observations and draw inferences.

List of experiments

1. Study of LCR series resonant circuit-Determination of resonant frequency, bandwidth and quality factor.
2. RC- Circuit- determination of time constant.
3. V-I Characteristics of P-N diode.
4. Stewart Gees method- Study of the variation of the magnetic field along the axis of a circular coil carrying current.
5. Determination of Dispersive power of material of prism.
6. Determination of Frequency of electrically vibrating tuning fork- Melde’s experiment.
7. Determination of Wavelength of laser beam- Semiconductor laser.
8. Determination of Energy gap of a semiconductor.
9. LED and Laser diode Characteristics.
10. Optical fibers - Determination of Numerical aperture, acceptance angle, bending loss and connector losses.
11. Hall effect: Determination of Hall coefficient and carrier concentration of a given semiconductor material.
12. Solar Cell.
13. Study of input and output characteristics of common emitter transistor.
14. Determination of Rigidity modulus of the material of a wire using Torsional Pendulum

Note: Every student should perform at least 10 experiments

Course Outcomes: On completing the course a student would be able to understand

CO 1: Get an understanding of errors and their estimation in determination of Physical quantities.
CO 2: Get an understanding of the laws of physics associated with the experiments.
CO 3: Would develop skills in handling various kinds of laboratory instruments.
CO 4: Get awareness of the magnitudes of the different physical parameters and learn how to Present the observations and results at the end of an experiment.
CO 5: Get an understanding of the physical concepts involved in the experiments.

References:

1. Practical Physics, P.R. Sasi Kumar, 1st Edition, Prentice-Hall of India Pvt. Ltd., September 2011.
2. Practical Physics, R.K. Shukla and Anchal Srivastava, New Age International Pvt. Ltd. Publishers, August 2006.

68184

ENGINEERING PHYSICS LAB

(Common to CE & ME Branches)

Instruction	:	2 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	1	End Exam Duration	:	3 Hours

Course Objectives: By studying this course a student would be exposed to

1. Students perform experiments involving studies of thermal, elastic, optical, electrical and magnetic properties of certain materials.
2. Experiments based on certain laws are performed.
3. They are trained in handling and using instruments like spectrometer, vernier calipers, screw gauge, DMM (Digital Multi Meter), and function generator.
4. Students are trained to record the observations in a systematic manner, keeping the possible errors in the instruments in view.
5. Students are trained to graphically represent the observations and draw inferences.

List of experiments: (Minimum 10 experiments are to be performed)

1. Study of Compound Pendulum- Determination of 'g' and 'K'.
2. Determination of Rigidity modulus of the material of a wire using Torsional Pendulum.
3. Determination of Frequency of electrically vibrating tuning fork-Melde's experiment.
4. Cantilever experiment- Determination of Young's modulus of elasticity by uniform and nonuniform bending.
5. Determination of Force constant of spring material using spring mass system.
6. Determination of dispersive power of material of prism.
7. Determination of Wavelength of laser beam-Semiconductor laser.

8. Coefficient of thermal conductivity of a bad conductor – Lee's Disc method.
9. V-I Characteristics of P-N diode.
10. LED and Laser diode Characteristics.
11. Stewart Gees method- Study of the variation of the magnetic field along the axis of a circular coil carrying current.
12. Study the frequency response of LCR series resonant circuit- Determination of resonant frequency, bandwidth and quality factor.
13. RC- Circuit- determination of time constant.
14. Solar Cell.

Course Outcomes: On completing the course a student would be able to understand

CO 1: Get an understanding of errors and their estimation in determination of Physical quantities.
CO 2: Get an understanding of the laws of physics associated with the experiments.
CO 3: Would develop skills in handling various kinds of laboratory instruments.
CO 4: Get awareness of the magnitudes of the different physical parameters and learn how to Present the observations and results at the end of an experiment.
CO 5: Get an understanding of the physical concepts involved in the experiments.

References:

1. Practical Physics, P.R. Sasi Kumar, 1st Edition, Prentice-Hall of India Pvt. Ltd., September 2011.
2. Practical Physics, R.K. Shukla and Anchal Srivastava, New Age International Pvt. Ltd. Publishers, August 2006.

65131

COMPUTER PROGRAMMING LAB

(Common to all Branches)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	1.5	End Exam Duration	:	3 Hours

Course Objectives:

1. To formulate problems and implement algorithms using C programming language.
2. To introduce role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
3. To impart role of functions involving the idea of modularity, usage of arrays, pointers, structures for developing solutions to complex problems.
4. To introduce programming using gcc compiler in Linux.

All the programs need to be implemented in GDB mode in a Linux Environment.

1. Write the algorithm and draw the flow chart to find the roots of a quadratic equation
2. Write the algorithm and draw the flow chart to find the sum of digits of a given n digit number
3. Write a C program to explore decimal, octal, hexadecimal, unsigned, unsigned long long formats of integers with printf and scanf functions.
4. Write a C program to convert the given temperature in Celsius into Fahrenheit.
5. Write a C Program to generate the following pattern.

```
    1
   123
  12345
 1234567
123456789
 1234567
  12345
   123
    1
```

6. Write a simple calculator program which reads operand1, operator and operand2 as input and displays the result
7. Write a C program to find the sum of individual digits of a positive integer.

8. Write the calculator program given in question no 6 to run the operations until user's choice is exit.
9. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
10. A number is said to be Armstrong if the number is equivalent to the sum of cubes of its digits. Write a C program to check whether a given number is Armstrong or not.
11. Write a C program to define the macros SUM (a, b), SQUARE (a) and SQUARE (SUM (a, b)) and print the results.
12. Write a C program to illustrate functions without parameters and without return type, without parameters and with return type, with parameters and without return type and with parameters and with return type.
13. Write a C function to calculate the sine series sum 1- x3/3! + X5//5!-…………… and call the function.
14. Write a C program in which a recursive and non-recursive functions are called to compute factorial values based on user's choice.
15. Write a C program in which a recursive and non-recursive functions are called to generate Fibonacci series based on user's choice.
16. Write a C program to illustrate command-line arguments.
17. Write a C program to find the sum of the elements of a given list (array).
18. Implement two separate functions which return the minimum and maximum values of a given array-list and call these functions.
19. Write a C program to find the transpose of a given input matrix (read the dimensions of matrix too as input).
20. Implement two separate functions for finding the sum and product of matrices and call these functions.
21. Implement a C function to exchange the values of given two variables and call the function (using pointers).
22. Implement two separate C functions to perform insertion of an element and deletion of an element operations on an array at a specified position (pass the array and its size as pointers).
23. Write a C program to create a dynamic list of real numbers where the size of the list is accepted as input, extend its size and release it (use dynamic memory allocation functions).
24. Write a C program to accept string as input and find its length using a user-defined string length function, reverse the string and check whether the string is palindrome or not.
25. Implement a C function to read a multi-word string and copy the input string to other string (the destination string must be a dynamically allocated string).

26. Write a C program to create a user defined data-type Complex and implement addition, subtraction and multiplication operations on complex numbers.
27. Create a user defined data-type Student containing the fields rollNo, name and dateOfBirth (by creating a user defined type Date). Implement C functions to read the details of a student and create an array of students.
28. Write a C program to illustrate the user-defined data type **union.**
29. Write a C program to read the content of a given text file and count the number of characters, words and lines in it (Read the file name as command line argument).
30. Write a C program to read the content of a given text file, convert all lower case letters into upper case and display it on the screen.
31. Write a C program to copy the contents of one file into another.
32. Write a C program to write the record list of Student type into a binary file student.dat. Re-open the file, read the records from the file and display on the screen.

Course Outcomes:

CO 1 : Familiarity of programming environment in Linux operating system and to translate given algorithms to a working and correct program.
CO 2 : Ability to interpret syntax errors as reported by the compilers and to be able to identify and correct logical errors encountered at run time using debuggers like GDB.
CO 3 : Ability to write iterative as well as recursive programs.
CO 4 : Ability to represent data in arrays, pointers, strings and structures and manipulate them through a program and use them in defining self-referential structures or structures or designing a user defined data type.
CO 5 : Ability to implement file processing functions and be able to store, retrieve and process data in text and binary formats.

References :

1. Schaum's Outline of Programming with C, Byron Gottfried, 2nd Edition, McGraw-Hill.
2. Programming with C, Ajay Mittal, 9th Impression, Pearson Education Ltd, 2017.
3. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd Edition, Prentice Hall of India.
4. C Programming & Data Structures, B.A.Forouzan & R.F. Gilberg, 3rd Edition, Cengage Learning.

63131/63181

ENGINEERING WORKSHOP

(Common to CE, CSE, ECE, EEE, EIE, IT & ME)

Practical	:	2 Periods / Week	Sessional Marks	:	30
Credits	:	1	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives:

1. To acquire skills in basic engineering practice.
2. To identify the hand tools and instruments.
3. To acquire measuring skills.
4. To acquire practical skills in the trades.
5. To understand safety practices.

1. TRADES FOR EXERCISES: (Any four trades of the following)

i. Carpentry
ii. Fitting
iii. Tin smithy
iv. House wiring
v. Foundry

2. TRADES FOR DEMONSTRATION & EXPOSURE:

a) Machine Shop (Lathe operations)
b) Power Tools
c) Welding

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Acquire skills of basic engineering trades like Carpentry, Tin smithy etc.
CO 2 : Demonstrate an understanding of and comply with workshop safety regulations.
CO 3 : Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
CO 4 : Apply the knowledge of the above trades in their day –to – day activities.
CO 5 : Select appropriate equipment and consumables for required applications.

References:

1. Workshop Manual, P.Kannaiah & K.L.Narayana, Scitech Publishers, 2004.
2. Workshop Manual, K. Venkat Reddy, BS Publications, 2008.

67131/67181

IT WORKSHOP LAB

(Common to All branches)

Instruction	:	2 Periods / week	Sessional Marks	:	30
Credits	:	1	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives:

1. The IT Workshop Lab includes training on PC Hardware, installation of system software, Productivity tools for Word Processing, Spread Sheet & Presentations and basic features of HTML.
2. Introduction of numerical computing programming language SCILAB and basic mathematical application development using it.

PART A: PC HARDWARE

TASK 1: Introduction to Computers and latest technologies.
TASK 2: Identifying the peripherals and Mother Board Components: A demo through Multimedia Lecture
TASK 3: Windows and Linux Installation on Virtual PC

PART B: PERSONAL PRODUCTIVITY TOOLS

WORD PROCESSING

TASK 4: Preparing News Paper Article/Advertisement
Features to be Covered:
1. Text Formatting 2. DROPCAP 3. IMAGE
4. SHAPES AND SYMBOLS
5. Paragraph Setting 6. Borders and shading
7. Inserting Special symbols & Equations

TASK 5: Creating and formatting Table and Mail Merge.

SPREAD SHEET & PRESENTATION:

TASK 6: Working with Student Marks Data and generate graphs.
Functions to be used
1. SUM 2. MIN 3. MAX 4. AVERAGE
5. STANDARD DEVIATION 6. RANK 7. COUNT 8. IF

TASK 7: Working with Sort, Filter and VLOOKUP Features

TASK 8: Working with Presentations
Features to be covered: PPT orientation, Slide Layout, Master Layout (slide, template and notes), Types of views (basics, presentation, slide sorter, notes etc.), Inserting – Background, textures, Design Templates, Hidden slides**.**

PART C: HTML (HYPER TEXT MARKUP LANGUAGE)

TASK 9: Working with Basic Elements like Fonts, Images, Lists, and Headings.
Creating Time Table Using <TABLE>
Features to be covered rowspan, colspan, cell spacing, table border, colors

TASK 10: Creating Web Forms (BIO-DATA FORM)
Elements to be included
Text Field, Check Box, Radio Button, Dropdown Menu, Text Area, etc.

PART D: SCILAB

TASK 11

a. Installation of SCILAB (Windows and Linux)
b. Evaluation of expressions.
c. Library functions.

TASK 12

a. Creating a vector.
b. Write a SCILAB program for Vector multiplication.
c. Write a SCILAB program for Vectorized sinus.
d. Write a SCILAB program for Vectorized function.

TASK 13 Write SCILAB Programs for performing various matrix operations.

TASK 14 (Programming using **if else** statement)

a. Write a SCILAB program to check whether the given input is an alphabet or not using if else statement.
b. Write a SCILAB program to print total number of days in a month using select statement.
c. Write a SCILAB program to find all roots of a quadratic equation using select statement

TASK 15 (File Operations)

a. Write a SCILAB program to read and write different file formats (.xls,.dat etc.,)

b. Write a SCILAB program to read an excel file with student marks and print the average of each student separately in command window

TASK 16 Write SCILAB programs for Plotting graphs.

Course Outcomes: At the end of the semester, the students will be able to:

CO 1 : Identify the peripherals of PC, assemble and disassemble PC components.
CO 2 : Install the System software MS Windows, Linux and required device drivers.
CO 3 : Work with productivity tools for Word Processing, Spread Sheet and Presentations along with Designing basic Web Pages.
CO 4 : Understand the main features of the SCILAB program development environment to enable their usage in higher learning.
CO 5 : Interpret and visualize simple mathematical functions and operations using plots or display.

Text Books:

1. IT Essentials PC Hardware and Software Companion guide, David Anfinson and Ken Quamme, Third Edition, CISCO Press, Pearson Education.
2. PC Hardware and A+ Handbook, Kate J. Chase, PHI (Microsoft).
3. **Libre Office Version 3.5 Getting Started,** Jean Hollis Weber, Martin Fox, Andrew Pitonyak, John A Smith, Jeremy Cartwright, Dan Lewis, Hazel Russman, Laurent Balland Poirier, Ron Faile Jr, David Michel, Peter Schofield, December 31,2012.
4. HTML Black Book, Steven Holzner, 2000.
5. SCILAB, Er. Hema Ramachandran and Dr. Achutsankar Nair, S. Chand Publishers, 2012.

68152

MATHEMATICS-II

(Common to All branches)

Instruction	:	3 Periods/week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives :

1. To study the first order Ordinary Differential Equations (O.D.E) and acquire the skill of finding analytical solutions of such equations.
2. To study the higher order O.D.E and acquire the skill of finding analytical solutions of such equations.
3. To evaluate double and triple integrals and study their applications.
4. To acquire the knowledge of differentiation and integration in scalar and vector fields and study their applications
5. To acquire the knowledge of the Partial Differential Equations (P.D.E) of first order and the skill of finding analytical solutions of such equations.

Unit I - First Order O.D.E

Exact, linear and Bernoulli's equations; Applications : Newton's law of cooling, Law of natural growth and decay; Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Unit II - Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type $\sin ax, \cos ax, e^{ax}$, polynomials in x, $e^{ax}V(x)$ and $x\,V(x)$; method of variation of parameters; Equations reducible to linear ODE with constant Coefficients: Legendre's equation, Cauchy-Euler equation.

Unit III - Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates); Change of order of integration (only Cartesian form); Change of variables (Cartesian to polar coordinates); Evaluation of Triple Integrals: Change of variables (Cartesian to Spherical and Cylindrical polar coordinates).
Applications: Areas and Volumes, Centre of Mass and Gravity (constant and variable densities); Applications involving cubes, sphere and rectangular parallelepipeds.

Unit IV - Vector Calculus

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational Vectors. Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

Unit V - Partial Differential Equations

Formation of partial differential equations by eliminating arbitrary constants or arbitrary functions. Solutions of first order linear (Lagrange) equations by Method of grouping and Multipliers. Solution of nonlinear first order equations (four standard types). Charpit's method .

Course Outcomes : At the end of the course, the student will be able to

CO 1 : Solve the first order O.D.E and appreciate their applications

CO 2 : Solve higher order O.D.E and appreciate their applications in engineering problems

CO 3 : Evaluate double and triple integrals and apply them in engineering problems

CO 4 : Evaluate the line, surface and volume integrals and converting them from one to another

CO 5 : Solve first order linear and non-linear P.D.E

Text Books :

1. Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Narosa Publishing House.
2. Higher Engineering Mathematics, B.V.Ramana, 11th Reprint, Tata McGraw-Hill New Delhi, 2010.

References :

1. Calculus and Analytical Geometry, G.B.Thomas and R.L.Finney, Pearson Publishers.
2. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers.
3. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley Publishers.
4. Advanced Engineering Mathematics, Michael Greenberg, Pearson Publishers.

68153

COMPUTATIONAL MATHEMATICS

(Common to All branches)

Instruction	:	2 Periods/week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	2	End Exam Duration	:	3 Hours

Course Objectives :

1. To understand the distinction between analytical and approximate solutions of certain problems. To find approximate solutions of Algebraic and Transcendental equations.
2. To obtain an approximating interpolating polynomial for a given set of data points of an unknown function .
3. To fit a suitable curve, to evaluate derivatives and integrals numerically for a given data.
4. To learn the numerical solutions of first order initial value problems in O.D.E.
5. To obtain finite difference solutions of certain P.D.E.

Unit I - Solutions of Algebraic and Transcendental Equations

Introduction - Bisection method, Method of false position, Iteration method and Newton-Raphson method.

Unit II - Interpolation

Finite differences – Forward, Backward differences- Newton's forward and backward difference formulas, Newton's Divided Differences, Lagrange interpolation for unevenly spaced data.

Unit III - Curve fitting, Numerical Differentiation and Numerical Integration

Curve fitting: Fitting a first degree (linear) and second degree (parabola), exponential, power curves for a data by the Method of least squares. Numerical differentiation, Numerical integration: Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules.

Unit IV - Numerical solutions of Initial Value Problems in O.D.E

Picard's method of successive approximation - Solution by Taylor series method - Euler method, Modified Euler method and Runge-Kutta methods of second and fourth orders.

Unit V - Numerical solutions to P.D.E

Classification of P.D.E- Finite difference solution to two-dimensional Laplace equation and Poisson equation; Implicit and Explicit methods for one-dimensional Heat equation(Bender-Schmidt and Crank-Nicholson methods).

Course Outcomes : At the end of the course, the student will be able to

CO 1 : Find the real roots of Algebraic and Transcendental equations.
CO 2 : Understand interpolation and obtain approximate solutions for evenly and unevenly spaced data.
CO 3 : Fit a given data to a linear/non-linear curve and appreciate the concepts of numerical differentiation and integration.
CO 4 : Develop the skill of finding approximate solutions to problems arising in first order initial value problems in differential equations.
CO 5 : Find finite difference solutions of certain P.D.E.

Text Books :

1. Numerical Methods in Engineering and Science (With Programs in Fortran 77, C and C++) B.S.Grewal, Khanna Publications.
2. Numerical methods, V.N.Vedamurthy and N.Ch.S.N. Iyengar, Vikas Publishing House Pvt. Ltd.

References :

1. Numerical Methods, P.Kandasamy, K.Thilagavathy & K.Gunavathi, S.Chand & Company.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley Publishers.
3. Advanced Engineering Mathematics, R.K.Jain and S.R.K.Iyengar, Narosa Publishing House.
4. Numerical methods, S.Arumugam, A.Thangapandi Isaac and A. Soma Sundaram, Scitech Publications (India) Pvt. Ltd.

63151

ENGINEERING MECHANICS

(For Mechanical & Civil Engineering)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Credits	:	3	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives:

1. To introduce the basic principles of engineering mechanics with emphasis on their analysis and application to practical engineering problems.
2. To give students practice in applying their knowledge of mathematics and science and to expand this knowledge for their area of engineering.
3. To comprehend the laws of friction.
4. To understand the principle of virtual work.
5. To prepare the students for higher level courses such as courses in Strength of Materials, Mechanical Design and Structural Analysis.

Unit I

Resultant of force systems: Introduction to Engineering Mechanics, System of forces, resultant force, equilibrant, triangle/polygon law of forces, moment of force and its applications, Varignon's theorem, couple and equivalent force systems.
Equilibrium of force systems: Free body diagrams, equations of equilibrium of coplanar system of forces, Lami's theorem, and concept of equilibrium applied to beams.

Unit II

Centroid: Centroid of plane areas (from basic principles) – Centroid of Composite areas.
Centre of Gravity: Centre of gravity of solid bodies (from basic principles), center of gravity of composite bodies, Pappus &Guldinus theorems.

Unit III

Area Moment of Inertia: Definition – Parallel and Perpendicular Axis Theorems – Moment of Inertia of Composite areas.
Mass Moment of Inertia: Moment of Inertia of solid bodies – Transfer Formula for Mass Moment of Inertia, Mass moment of inertia of composite bodies.

Unit IV

Friction: Introduction, Theory of friction – Static and kinetic friction – Angle of friction – Angle of repose – Cone of friction –Block Friction – Ladder friction – Wedge friction.
Principle of Virtual Work: Virtual Displacement, Virtual Work, Rigid Bodies – Problems on Beams.

Unit V

Kinematics of Particles: Rectilinear and Curvilinear motions – velocity and acceleration in terms of rectangular coordinate system, Normal and tangential component of acceleration –Projectile motion – Motion curves (a-t, v-t, s-t curves).
Kinetics of Particles: Introduction – D Alembert's Principle – Work Energy Principle – Impulse momentum Principle – Problems.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Solve for the resultants of any force system and determine equivalent force system.
CO 2	:	Determine centroid and center of gravity for different composite areas and composite solid bodies.
CO 3	:	Determine area and mass moment of inertia of composite areas and composite solid bodies.
CO 4	:	Solve the problems associated with frictional forces and simple problems using Principle of virtual work.
CO 5	:	Analyze the kinematics and kinetics of an object under translational motion.

Text Books:

1. Engineering Mechanics, S.S. Bhavikatti & K.G.Rajasekharappa, Newage International Private Limited publishers, 2014.
2. Engineering Mechanics, Timoshenko & Young, 5th Edition, McGraw-Hill publishers, 2013.

References:

1. Engineering Mechanics- Statics & Dynamics, R.C Hibbeler, 14th Edition, Prentice Hall publishers, 2015.
2. Engineering Mechanics, K L Kumar & Veenukumar, 4th Edition, Tata McGraw-Hill publishers, 2010.
3. Singer's Engineering Mechanics Statics and Dynamics, K.Vijay Kumar Reddy & J.Suresh Kumar, 3rd Edition, BS Publications, 2010.
4. Engineering Mechanics, A.K Tayal, 14th Edition, Umesh Publications, 2014.

65151

DATA STRUCTURES THROUGH 'C'

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To introduce and impart knowledge to the student on the concepts of Abstract data Type, data structure, performance measurement, time and space complexities of algorithms.
2. To enable understanding of the student, towards a real-world problem solving involving representation of data or physical entities in the program, processing them through a well-defined set of operations while giving persistence.
3. To enable the student apply appropriate data structures to solve a complex problem.
4. To enable the student analyze the solutions available for a problem, model, design and implement the best algorithm for an application development.

Unit I – User Defined Data types

Lists: Introduction to linear, non-linear data structures, What is a List, Operations on a List, List Implementation using Arrays and Linked Lists.
Searching: Linear Search, Binary Search
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort Algorithms.

Unit II – Stacks & Queues

Stacks: Stack ADT, Implementation of Stacks using Arrays and Linked lists. Applications of Stacks – infix to postfix, postfix evaluation of expressions implementation
Queues: Queue ADT, Implementation of Queues using Arrays and Linked Lists.

Unit III – Trees

Introduction to Trees:
Binary tree: Definition, Types of Binary Trees, Properties of Binary Trees, Binary Tree Traversals.
Binary search Tree (BST): Definition, Operations: Traversals, insertion, deletion, Search and their implementation on BST.

Unit IV – Graphs

Graphs: Definition, Applications of graphs, Graph Representation- Adjacency Matrix, Adjacency lists, Graph Traversals, Minimal Spanning Tree- Prim's Algorithm, and Kruskal's Algorithm.

Unit V – Hashing

Hashing: Introduction to Hashing, HashTable, hash function, Collision, Collision resolution techniques- Separate Chaining, Open addressing (linear probing, quadratic probing, double hashing), Rehashing and their implementation.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Understand basic concepts, Design and implement linear data structures such as linked lists, stacks, queues by using C as the programming language using static or dynamic implementations.
CO 2 : Able to understand and analyze, differentiate and implement elementary algorithms: sorting, searching and hashing and will also be able to compare and contrast algorithms with respect to time and space complexity.
CO 3 : Able to implement nonlinear data structures like trees and graphs and apply appropriate data structures to designing solutions to real world complex problems.
CO 4 : Demonstrate sound understanding of graph traversals and ability to implement various algorithms on graphs and interpret the results.
CO 5 : Ability to implement hashing techniques for storing and searching efficiently.

Text Books:

1. Data Structures: A Pseudocode Approach with C, Richard F. Gilberg, Behrouz A. Forouzan, 2nd Edition, Cengage Learning.
2. Fundamentals of Data structures in C, E. Horowitz, S. Sahni and Susan Anderson-Freed, 2nd Edition, Universities Press.

References:

1. Data Structures using C, R. Thareja, Oxford University Press.
2. Data Structures, Schaum's Outlines, S. Lipscutz, TMH.
3. Narasimha Karumanchi, Data Structures and Algorithms Made Easy, CareerMonk.

68181

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB – II

(Common to all Branches)

Instruction	:	2 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	1	End Exam Duration	:	3 Hours

Course Objectives: The students through the designed curriculum would acquire the following skills:

1. Speaking skills through oral communications.
2. Ability to think and speak through JAM sessions.
3. Encourage them to be more dynamic and empowered through Debates.
4. Fluency through vocabulary enrichment.
5. Discussion and Team building skills through mock GD's and group activities.

"K-VAN Solutions" Software is used in practice sessions for the following Activities:

ACTIVITIES

1. Group Discussion
2. Debate
3. Public Speaking & JAM
4. Situational Dialogues/Role play
5. Telephone skills
6. Asking and Giving directions
7. Information Transfer
8. Describing objects/situations/people

Course Outcomes: At the end of the semester, the students will be able to:

CO 1 : Evolve as effective communicators and will develop narrative skills

CO 2 : Emerge as decision makers and autonomous learners

CO 3 : Develop critical and analytical skills

CO 4 : Gather ideas and information, and organize them coherently.

CO 5 : Develop leadership and team building skills.

References:

1. Everyday Dialogues in English, Robert J Dixon, Prentice Hall India Pvt. Ltd.
2. Group Discussion, Karan Deo, Ramesh Publishing House.

68183

COMPUTATIONAL MATHEMATICS LAB

(Common to All branches)

Instruction	:	-	Sessional Marks	:	30
Practical	:	3 Periods / week	End Examination Marks	:	70
Credits	:	1.5	End Exam Duration	:	3 Hours

Course Objectives :

1. To find a real root of algebraic and transcendental equations using C.
2. To determine functional value at any given intermediate point of the given data for an unknown function by interpolation using C.
3. To find a best fit curve by Least Squares method for a given set of data points using C.
4. To write a C program for numerical integration.
5. To write a C program to solve a given first order initial value problem of O.D.E.and To write a C program to solve One-dimensional Heat equation and two-dimensional Laplace equation.

List of Programs

1. Write a C program to find a real root of a given Algebraic/Transcendental equation using Bisection method. (Write the program such that if the initial interval given to the system is not usable, then the program should prompt to give new interval).
2. Write a C program to find the root of a given equation using method of false position (Regula-Falsi position).
3. Write a C program to find the root of a given equation using Newton Raphson method.
4. Write a C program to determine y for a given x if a set of data points (x,y) are given using Newton's interpolation both forward and backward.
5. Write a C program to determine y for a given x if a set of data points (x,y) are given using Lagrange's interpolation.
6. Write a C program to find a line of best fit by the method of Least Squares for a given set of data points.
7. Write a C program to fit a curve of the form $y = Ae^{Bx}$ for the given set of data points.
8. Write a C program to evaluate definite integral using i) Trapezoidal rule, ii) Simpson's $1/3^{rd}$ rule and iii) Simpson's $3/8^{th}$ rule.

9. Write a C program to solve a given initial value problem in O.D.E using Taylor's series method.
10. Write a C program to solve a given initial value problem in O.D.E using Euler's and modified Euler's method.
11. Write a C program to solve a given initial value problem in O.D.E using Runge-Kutta method of 4^{th} order.
12. Write a C program to find the value of the solution of a two-dimensional Laplace equation.
13. Write a C program to find the value of the solution of a one-dimensional heat equation.

Course Outcomes : At the end of the course, the student will be able to

CO 1	:	Write a program to find real roots of Algebraic and Transcendental equations
CO 2	:	Write a program to determine functional value at any given intermediate point of the given data for an unknown function by interpolation
CO 3	:	Write a program for a best fit curve by Least Squares method for a given set of data points
CO 4	:	Write a program for numerical integration by Trapezoidal, Simpson's 1/3 and 3/8 rules
CO 5	:	Write a program to find the value of the solution of a given first order initial value problem of O.D.E
CO 6	:	Write a program to find the value of the solution One-dimensional Heat equation and two-dimensional Laplace equation

Text Books :

1. Numerical Methods in Engineering and Science, B S Grewal, Khanna Publications.
2. Numerical Methods, Sukhendu Dey and Shishir Gupta, McGraw-Hill Education (India) Pvt. Ltd.

References :

1. Advanced Engineering Mathematics, Alan Jeffery, Harcourt / Academic Press, 2002
2. Numerical methods for Engineers, Steven C.Chapra and Raymond P.Canale, McGraw-Hill Education (India).

65181

DATA STRUCTURES THROUGH 'C' LAB

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	-	End Examination Marks	:	70
Credits	:	1.5	End Exam Duration	:	3 Hours

Course Objectives :

1. To develop skills to design and analyze simple linear and non linear data structures and develop ADTs for stacks, queues, trees, graphs to perform their corresponding operations.
2. To introduce the students to identify and apply the suitable data structure for the given real world problem.
3. To impart practical understanding of how various information storage and retrieval techniques work.

All the programs need to be implemented in GDB mode in a Linux Environment

1. Write a C program to implement all the List operations using Arrays
2. Write a C program to implement all the List operations using Linked Lists.
3. Write a C program to implement Linear Search.
4. Write a C Program to implement Binary Search.
5. Write a C Program to implement Bubble Sort.
6. Write a C Program to implement Selection Sort.
7. Write a C Program to implement Insertion Sort.
8. Write a C Program to implement Quick Sort.
9. Write a C Program to implement Merge Sort.
10. Write a C Program to implement StackADT using Arrays
11. Write a C Program to implement StackADT using Linked Lists
12. Write a C Program to convert infix expression to postfix using stacks
13. Write a C Program to perform postfix evaluation of an expression.
14. Write a C Program to implement QueueADT using Arrays.
15. Write a C Program to implement QueueADT using Linked Lists.
16. Write a C program to implement the following operations on Binary Search Tree: Insertion, deletion, searching.
17. Write a C Program to perform traversals-preorder, inorder and postorder on a Binary Search Tree (BST).
18. Write a C Program to implement Breadth First Traversal of a Graph.

19. Write a C Program to implement Depth First Traversal of a Graph.
20. Write a C Program to implement Prim's Algorithm.
21. Write a C Program to implement Kruskal's Algorithm.
22. Write a C Program to implement Hashing using linear Probing.
23. Write a C Program to implement Hashing using Quadratic probing.
24. Write a C Program to implement Hashing using separate chaining.

Course Outcomes:

CO 1 : Understand basic data structures such as arrays, linked lists, stacks and queues.
CO 2 : Ability to interpret syntax errors as reported by the compilers and to be able to identify and correct logical errors encountered at run time using debuggers like GDB.
CO 3 : Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
CO 4 : Solve problems involving graphs, trees and heaps.
CO 5 : Apply Hashing techniques for efficient storage and retrieval of data.

References:

1. C Programming and Data Structures, Behrouz A. Forouzan and Richard F. Gilberg, 3rd Edition, Cengage Learning.
2. Fundamentals of Data structures in C, E. Horowitz, S. Sahni and Susan Anderson-Freed, 2nd Edition, Universities Press.
3. Data Structures using C, R. Thareja, Oxford University Press.
4. Data Structures (Schaum's Outlines Series), S. Lipscutz, TMH.
5. Data Structures and Algorithms Made Easy, Narasimha Karumanchi, CareerMonk.

ACADEMIC REGULATIONS, COURSE STRUCTURE & SYLLABUS

R 18 REGULATIONS

CHOICE BASED CREDIT SYSTEM (CBCS)

B.Tech. 2nd Year

Electronics and Instrumentation Engineering

Applicable for the batches admitted in second year from 2019-20 onwards

CVR COLLEGE OF ENGINEERING
MANGALPALLI, R.R. DIST.
INSTITUTION IN PURSUIT OF EXCELLENCE

CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution with NAAC 'A' Grade

(Approved by AICTE & Govt. of Telangana and Affiliated to JNT University Hyderabad)
Vastunagar, Mangalpalli (V), Ibrahimpatan (M),
R.R. Dist, Pin - 501 510

CVR COLLEGE OF ENGINEERING

VISION

- To be a state of the art institution of engineering in pursuit of excellence, in the service of society

MISSION

- To excel in providing quality education at under graduate and graduate levels
- To encourage research and innovation
- To provide infrastructure and facilities to meet the latest technological needs
- To establish Centres of Excellence through active interaction with industry
- To nurture students towards holistic development with human values and ethics

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

VISION

- To turn out state of the art technologists in the area of Instrumentation engineering capable of meeting the challenging needs of industry in instrumentation and to create a 'Centre Of Excellence' in Instrumentation.

MISSION

- To provide the right blend of theory and practice thereby enabling students to become 'true professionals' with high ethical values.
- To provide high quality education which allows students to realize their aspiration and potential.
- To advance knowledge, create passion for learning, foster innovation and nurture talents towards serving the society and country.
- To pursue research and consultancy service and provide the necessary rubric for SME's (Small Medium Enterprise's) development.
- Holistic development of the students and staff – The first and foremost mission.

B.Tech. Electronics and Instrumentation Engineering

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

1. **Preparation:** The graduates of the four year B.Tech in Electronics & Instrumentation Engineering will be prepared for successful careers in technical field that meet the needs of Indian and International companies.
2. **Technical Competence**: The graduates of the programme will be trained to meet the technology by making them strong in engineering fundamentals and technical concepts of industrial approach.
3. **Knowledge Breadth:** The graduates of the programme will be developed to acquire knowledge, and analyze the reality, automate and create innovative projects to frame solutions for real life problems.
4. **Professional Capabilities:** The graduates of the programme will be inculcated with strong professional and ethical attitude so that they are enriched with good communication skills thereby making them multi dimensionally work.
5. **Learning Environment:** The graduates of the programme will be in a position to identify the professional issues related with instrumentation engineering and help them to work successfully in teams and creating an Industrial Learning Environment.

PROGRAM OUTCOMES (POs): Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or

processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Ability to analyze and design complex projects in the field of Electronics & Instrumentation.

PSO 2: To design and develop innovative prototypes related to product which meets real life problems.

PSO 3: Design high end Automation products using the knowledge and concepts of Electronics & Instrumentation

PSO 4: To pursue higher education and research in multi-disciplinary domain.

CVR COLLEGE OF ENGINEERING

Vastunagar, Mangalpalli, Ibrahimpatan – 501 510

ACADEMIC REGULATIONS – 2018 (R18 Regulations)
B.Tech. PROGRAMMES

(Effective for the students admitted into I-year from the Academic Year 2018-19 onwards)

1.0 Under - Graduate Degree Programme in Engineering & Technology (B.Tech.: Under Graduate Programme (UGP) in Engineering & Technology (E&T))

CVR College of Engineering is an autonomous institution under the University Grants Commission, affiliated to Jawaharlal Nehru Technological University, Hyderabad. The College offers 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Programme, under R18 Regulations with **Choice Based Credit System (CBCS**) with effect from the Academic Year 2018-19 onwards, in the following Branches of Engineering:

Table-1

Sl. No.	**Branch**
I.	Civil Engineering
II.	Computer Science and Engineering
III.	Computer Science and Information Technology *****
IV.	Electronics and Communication Engineering
V.	Electrical and Electronics Engineering
VI.	Electronics & Instrumentation Engineering
VII.	Information Technology
VIII.	Mechanical Engineering

*** From the Academic Year 2019-20 onwards**

2.0 Eligibility for Admissions

2.1 Category - A (70% of the sanctioned seats):
Admission to the UGP under Category – A are made by the Convener TS EAMCET on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test TS EAMCET conducted by Telangana State Government .

2.2 Category – B (30% of the sanctioned seats):
Admissions to the UGP under Category – B are made by the Management of the College and ratified by Telangana State Council of Higher Education (TSCHE) based on the merit rank of TS EAMCET / Marks in the Qualifying examination (Intermediate / Class XII) as prescribed in relevant G.Os. from time to time.

2.3 The medium of instruction for the entire UGP in E & T will be in **ENGLISH** only:

3.0 B.Tech. Programme (UGP) Structure

3.1 The B.Tech. Programmes of CVR College of Engineering are of Semester Pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/AICTE/JNTUH specified Definitions/Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are as listed below:

3.2.1 Semester Scheme

Each UGP is of 4 Academic Years (8 Semesters), with the year being divided into two Semesters of 22 weeks ($\geq$ 90 working days) each, each Semester having - 'Continuous Internal Evaluation (**CIE**)' and 'Semester End Examination (**SEE**)'. Choice Based Credit System (**CBCS**) and Credit Based Semester System (**CBSS**) as denoted by UGC, and Curriculum / Course Structure as suggested by the AICTE (Model Curriculum -2018) are followed.

3.2.2 Credit Courses

All Subjects / Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject / Course in a L:T:P:C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) Structure, based on the following general pattern:

1 Hour Lecture/Theory course per week (L)	1 credit
1 Hour Tutorial per week (T)	1 credit
1 Hour Practical/Laboratory course per week (P) 2 Hours Practical/ Laboratory course per week (P)	0.5 credit 1 credit

Other student activities like NCC, NSS, NSO, Study Tour, Guest Lecture etc., and identified Mandatory Courses will not carry Credits.

3.2.3 Subject/ Course Classification

All Subjects/ Courses offered for the UGP are broadly classified as:

(a) Foundation Courses (b) Core Courses and
(c) Elective Courses.

Foundation Courses are further categorized as:

(i) HS (Humanities and Social Sciences)
(ii) BS (Basic Sciences)
(iii) ES (Engineering Sciences)

Core Courses and Elective Courses are categorized as

(i) PC (Professional/ Departmental Core) Subjects
(ii) PE (Professional/ Departmental Electives)
(iii) OE (Open Electives)
(iv) Project Work (PC); Industry Oriented Mini-Project (PC)/Technical Seminar(PC)
(v) Minor Courses (1 or 2 Credit Courses, belonging to HS/BS/ES/PC as per relevance) such as Skill Development Courses of 1 Credit each
(vi) Mandatory Courses (MC - non-credit)

3.2.4 Course Nomenclature

The Curriculum Nomenclature or Course-Structure Grouping for each of the UGP E&T (B.Tech. Degree Programmes), is as listed below (along with AICTE specified % Range of Total Credits):

Table-2

S. No.	*Broad Course Classification*	*Course Group/ Category*	*Course Description*	*Range of Credits*
1	**Foundation Courses**	**BS – Basic Sciences**	Includes - Mathematics, Statistics, Physics and Chemistry Subjects	**10-15%**
2		**ES - Engineering Sciences**	Includes fundamental engineering subjects including Workshop, Drawing, basics of Electrical/Electronics/Computers, etc.	**15-20%**
3		**HS – Humanities and Social Sciences**	Includes subjects related to Humanities, Social Sciences and Management	**10-12%**
4	**Core Courses**	**PC – Professional Core Courses**	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engineering	**35-45%**
5	**Elective Courses**	**PE – Professional Electives**	Includes Elective subjects related to the Parent Discipline/ Department/ Branch of Engineering	**9-12%**
6		**OE – Open Electives**	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline / Department / Branch of Engineering	**6-12%**
7	**Core Courses**	**Project Work**	B.Tech. Project or UG Project or UG Major Project	**10%**
8		**Industry Oriented Mini-Project**	Mini-Project	
9		**Technical Seminar**	Technical Seminar based on core contents related to Parent Discipline / Department / Branch of Engineering	
10	**Minor Courses**	**Skill Development Courses/Value Added Courses**	1 or 2 Credit Courses (subset of HS)	**Included**
11	**Manda-tory Courses**	**MC Induction Programme (3 weeks' duration)@**	Non-credit	**-**
Total Credits for UGP (B. Tech.) Programme				**160 (100%)**

3.2.5 @Induction Programme (Mandatory)
An Induction Programme (3 weeks' duration) as per the guidelines given by the AICTE at the beginning of the first semester of first year, as presented in the Course Structure.

4.0 Course Work

4.1 A student, after securing admission, shall pursue the B.Tech. UGP in a minimum period of 4 Academic Years, and a maximum period of 8 Academic Years (starting from the Date of Commencement of I Year).

4.1.1 After eight academic years of course study, a candidate is permitted to write the end examinations for the immediately following **two** years.

4.2 Each student shall register for and secure the specified number of Credits required for the completion of the UGP and Award of the B.Tech. Degree in the respective Branch of Engineering.

4.3 Each Semester is structured to provide about 20 Credits totaling to **160** Credits for the entire B.Tech Programme.

4.4 Students who fail to fulfill all the academic requirements for the award of the degree within **ten** academic years from the year of their admission shall forfeit their seats in B. Tech course.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him about the UGP, its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

5.2 Academic Section of the College invites filled 'Registration Forms' from students apriori (before the beginning of the Semester), through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

5.3 A student can apply for ON-LINE Registration ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of the Department (a copy of the same being retained by the Head of the Department, Faculty Advisor and the Student).

5.4 A student may be permitted from III year I semester onwards to Register for Subjects/ Courses of CHOICE with a typical total of 20 Credits per Semester (Minimum being 17 C and Maximum being 23 C, permitted deviation being ± 14%), based on his /her PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses, in the Department Course Structure and Syllabus contents. However, a MINIMUM Credits assigned per Semester must be registered to ensure the 'STUDENTSHIP' in any Semester.

5.5 Choice for 'additional Subjects /Courses' to reach the Maximum Permissible Limit of 23 Credits (above the typical 20 Credit norm) must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/ Counselor.

5.6 If the student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject (s) /Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject / Course in that Category will be taken into consideration.

5.7 Subject / Course Options exercised through ON-LINE Registration are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices will not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within the **FIRST WEEK** from the commencement of Class-work for that Semester.

5.8 Dropping of Subjects / Courses may be permitted, ONLY AFTER obtaining prior approval from the Head of the Department(subject to retaining minimum Credits), 'within 15 Days of Time' from the beginning of the current Semester.

5.9 For Courses like NCC/NSS/NSO etc., a 'Satisfactory Participation Certificate' from the concerned authorities for the relevant Semester is essential. No Marks or Grades or Credits shall be awarded for these activities.

6.0 Subjects/ Courses to be offered

6.1 A typical Section (or Class) Strength for each Semester shall be 60.

6.2 A Subject/ Course may be offered to the students, ONLY IF a Minimum of 20 Students (1/3 of the Section Strength) opt for the same. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

6.3 More than ONE TEACHER may offer the SAME SUBJECT (Laboratory/ Practical classes may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection of students will be based on - 'FIRST COME FIRST SERVED Basis and CGPA Criterion'(ie., the first focus shall be on early ON-LINE ENTRY from the student for Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).

6.4 In cases of more Registration for a subject, the concerned Head of the Department shall decide whether to offer such a Subject / Course for TWO (or multiple) SECTIONS or NOT.

6.5 In case options are received from students of other Departments / Branches / Disciplines (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the 'Parent Department' first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the End Semester Examinations, if he acquires a minimum of 75% of attendance in aggregate of all the Subjects/ Courses (excluding Mandatory or Non-Credit Courses) of that Semester.

7.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each Semester may be granted by the College Academic Committee on genuine and valid grounds, based on the student's representation with supporting evidence.

7.3 A stipulated fees shall be payable towards condonation of shortage of attendance.

7.4 Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

7.5 Students whose shortage of attendance is not condoned in any Semester are not eligible to take their End Examinations of that Semester. They are detained and their registration for that Semester shall stand cancelled. They will not be promoted to the next Semester. They may seek re-registration for all those Subjects registered in that Semester in which they are detained, by seeking re-admission to that Semester as and when offered; in case there are any Professional Electives and/ or Open Electives, the same may also be re-registered if offered; however, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the SAME set of Elective Subjects offered under that category.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Item No.**7.**

8.1 A student is evaluated in each course for 100 marks (30 internal and 70 external; details in Item 9). A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 35% marks (25 out of 70 marks) in the End Semester Examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing **P** Grade or above in that Subject/ Course.

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to Industry Oriented Mini-Project/ Seminar, if he secures not less than 40% of the total marks (40 marks) to be awarded for each. The student would be treated as failed, if he (i) does not submit a report on his Industry Oriented Mini-Project, or does not make a presentation of the same before the Evaluation Committee as per schedule, or (ii) does not present the Seminar as required in the IV year I Semester, or (iii) secures less than 40% of marks (40 marks) in Industry Oriented Mini-Project / Seminar evaluations.
He may reappear for each of the above evaluations when they are scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the

same in the next subsequent Semester, as and when it is scheduled.

8.3 Promotion Rules:

Credits required for Promotion from I to II year

- A student will not be promoted from I year to II year unless he fulfills the academic requirement of securing 50% of total credits of I year from all the examinations and secures prescribed minimum attendance.

8.4 Credits required for Promotion from II to III year

- A student will not be promoted from II year to III year unless he fulfills the academic requirement of securing 60% of the credits up to II year I semester or 60% credits up to II year II semester, from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester, irrespective of number of credits registered.

8.5 Credits required for Promotion from III to IV year

- A student shall be promoted from III year to IV year only if he fulfills the academic requirement of securing 60 % of the credits up to III year I semester or credits upto III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester, irrespective of number of credits registered.

- A student shall register and put up minimum attendance in all **160** credits and earn all **160** credits.

- A Student who fails to earn **160** credits as indicated in the Course Structure within ten academic years (8 years of study + 2 years additionally for appearing for exams only) from the year of his admission, shall forfeit his seat in B.Tech. course and his admission stands cancelled.

NB: In case the total number of credits is a mixed number with decimals, the number of credits considered for promotion is rounded off to the nearest lower integer.

The above promotion rule is furnished below in tabulated form.

Promotion From To	Credits to be considered
1st year to 2nd year	50% of the credits of 1st year (1st and 2nd semester)
2nd year to 3rd year	a) 60% of the credits upto 2nd year 1st semester (1, 2 & 3 semesters) **or** b) 60% of the credits upto 2nd year 2nd semester (1, 2, 3 & 4 semesters) (Irrespective of number of credits registered)
3rd year to 4th year	a) 60% of the credits upto 3rd year 1st semester (1, 2, 3, 4 & 5 semesters) **or** b) 60% of the credits upto 3rd year 2nd semester (1, 2, 3, 4, 5 & 6 semesters) (Irrespective of number of credits registered)

8.6 A student shall register for all Subjects covering **160** Credits as specified and listed (with the relevant Course/Subject Classifications as mentioned) in the Course Structure, put up all the Attendance and Academic requirements for **160** Credits securing a minimum of **P** Grade (Pass Grade) or above in each Subject, and earn all **160** credits securing SGPA ≥ 5.0 (in each Semester), and CGPA (at the end of each successive Semester) ≥ 5.0, to successfully complete the B.Tech. Programme.

8.7 If a student registers for some more 'extra Subjects' (in the parent Department or other Departments/Branches of Engineering) other than those listed Subjects totaling to **160** Credits as specified in the Course Structure of the Department, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required **160** Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 7 and 8.1 – 8.6 above.

8.8 When a student is detained due to shortage of attendance in any Semester, he may be **re-admitted** into that Semester, as and when offered, with the Academic Regulations of the Batch into which he was first admitted. However if the batch of students of the class falls under the next Scheme of regulations, the student readmitted will be considered under the new scheme. However, no Grade Allotments or SGPA/ CGPA calculations will be done for that entire Semester in which he was detained.

8.9 When a Student is detained due to lack of Credits in any year, he may be readmitted in the next year, after fulfillment of the Academic Requirements, with the Academic Regulations of the Batch into which he was first admitted. However if the batch of students of the class falls under the next Scheme of regulations, the student readmitted will be considered under the new scheme.

8.10 A student eligible to appear in the End Semester Examination in any Subject/ Course, but absent at it or failed (thereby failing to secure **P** Grade or above), may reappear for that Subject/ Course in the supplementary examination (SEE) as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/Course will be carried over, and added to the Marks obtained in the SEE supplementary examination, for evaluating his performance in that Subject.

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory or Practicals or Seminar or Drawing/Design or Industry Oriented Mini-Project or Minor Course or Project Work or Skill Development/ Value Added Courses. These evaluations shall be based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination), and a Letter Grade corresponding to the % of marks obtained shall be awarded.

9.2 For all Subjects/Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE.

9.3 Distribution and Weightage of Credits

Type of Subject	Semester	
	Period/Week	Credits
Theory	03	03
Practicals	02/03	1.0/1.5
Drawing Subjects: Engineering Drawing/Graphics Machine Drawing	 05 (2T+3P) 04(1T+3P)	 3.5 2.5
Minor Theory	02/03	01/1.5
Minor Courses	02	01
Industry Oriented Mini Project	--	02
Technical Seminar	02	01
Project work	20	10

9.3.1. Theory Subjects

Theory subjects are allotted 2 or 3 credits. The distribution shall be 30 marks for internal evaluation and 70 marks for the end examination.

There shall be two midterm internal examinations. The syllabus for the mid examination will be the first 2.5 units for the first mid examination and the remaining 2.5 units for the second mid examination.

The midterm internal marks for theory subjects are to be scaled to a maximum of 20 marks. 8 marks are allotted for assignments and 2 marks for attendance of 75% or greater. There shall be one assignment to be submitted and evaluated before each mid exam. Total internal evaluation marks is therefore 30.

The first Mid-term examination Marks and first assignment marks shall make one set of CIE Marks and the second Mid-term examination marks and second assignment marks shall make second set of CIE marks. Average of these two sets of CIE marks will be taken as the final marks secured by each candidate.

The duration of mid examination is for theory subjects 2 hours.

The duration of end examination for theory subjects is 3 hours.

9.3.2. Substitution Test

- If any candidate is absent for any theory or minor theory subject in a mid examination or both mid examinations, a substitution test covering the entire syllabus of the subject will be conducted on payment of prescribed fees before the commencement of the end semester examinations. Prior permission is to be taken from the concerned Head of the Department for writing substitution tests.
- If a candidate has missed both the mid examinations, then the marks scored in the substitution test will be halved and accordingly recorded.

9.4 Practical Subjects

For practical subjects the distribution shall be 30 marks for internal evaluation and 70 marks for the end semester examination. Out of the 30 marks allotted for internal evaluation, day-to-day work in the laboratory shall be evaluated for 20 marks and internal practical / internal drawing examination for 10 marks. Internal examinations shall be conducted by the concerned teacher with the help of any other faculty member of the department.

The end examination for practical subjects shall be conducted with an external examiner and laboratory teacher specified by the Head of the Department concerned.

The duration of end examination for practical subjects is 3 hours.

External Examiner shall be appointed by Dean-Academics on the recommendation of the Chairman, Board of Studies of the concerned department. External examiner can be a teacher from outside the college or a teacher of the college who was not associated with the day-to-day class work of that laboratory.
The end examination in the subject of Drawing will be conducted along with the examinations of theory subjects.

9.5 Drawing Subjects

Drawing subjects are allotted marks as in theory subjects: 30 marks for internal evaluation and 70 marks for the end examination. Out of the 30 marks allotted for internal evaluation, day-to-day practice shall be evaluated for 20 marks, internal drawing examinations for 10 marks.

9.6 Electives

Departmental Electives include subjects related to the parent discipline, department or branch of engineering.

Interdisciplinary Electives include subjects offered by a department or branch of engineering to other departments or branches of engineering.

Open Electives are subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline or branch of engineering, that do not require a prerequisite course.

However, students **cannot opt** for an open elective subject offered by their own department, if it is already listed under core / elective subjects offered by that department, in any semester.

9.7 Skill Development Courses

Skill Development Courses are allotted 1 credit. The distribution of marks shall be 30 marks for internal evaluation and 70 marks for the end examination.

The end examination shall be conducted by examiners specified by the Head of the Department.

The end examination duration for Skill Development Courses is 3 hours.

9.8 Industry-Oriented Mini-Project

An industry-oriented mini-project in collaboration with an industry related to specialization of the department is to be taken up during the vacation following III year II semester examinations. The mini project work shall be submitted in report form to the Head of the Department concerned within the first two weeks of commencement of classes of IV year I semester. The marks allotted for Industry Oriented Mini Project is 100 (30 internal + 70 external). The Mini Project is to be presented in a seminar which will be evaluated by a committee for 30 marks. The committee consists of the Head of the Department, supervisor of the mini project and a senior faculty member of the department.

The external examination (viva-voce) for Mini Project shall be conducted by a committee consisting of an external examiner and an internal examiner nominated by the Head of the Department, for 70 marks. This examination is to be scheduled along with the laboratory exams of IV year I semester.

External examiner shall be appointed by the **Dean-Academics** on the recommendations of the Chairman, Board of Studies of the department. External examiner must be a teacher from outside the college.

9.9 Technical Seminar

A student shall present a technical seminar in IV year II semester. For the seminar, the student shall collect information on a specialized topic and present the same. The student will also have to submit a technical report to the department showing his / her understanding of the topic. The seminar presentation and the report shall be evaluated for 100 marks by a departmental committee consisting of the Head of the Department, seminar supervisor and a senior faculty member. There shall be **no external** examiner for technical seminar.

9.10 Project Work

Each Student shall start the Project Work during the IV Year I Semester, as per the instructions of the Project Guide/ Supervisor assigned by the Head of the Department. Out of a total of 100 marks allotted for the Project Work, 30 marks shall be for CIE (Continuous Internal Evaluation) and 70 marks for the SEE (Semester End Viva-Voce Examination). The Project Viva-Voce shall be conducted by a Committee comprising of an External Examiner, Head of the Department and Project Supervisor. Out of 30 marks allocated for CIE, 15 marks shall be awarded by the Project Supervisor (based on the continuous evaluation of student's performance throughout the Project Work period), and the other 15 marks shall be awarded by a Departmental Committee consisting of Head of the Department and Project Supervisor, based on the work carried out and the presentation made by the student and internal Viva-Voce examination.

External examiner shall be appointed by the **Dean-Academics** on the recommendations of the Chairman, Board of Studies of the concerned department. External examiner must be a teacher from outside the college.

9.11 Laboratory examination marks / sessional marks awarded by the examiners are subject to scrutiny and scaling by the Results Committee wherever necessary. The committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the committee are final and binding.

9.12 For NCC / NSS / NSO type of Courses, and/or any other Mandatory Non-Credit Course offered in a Semester, a 'Satisfactory Participation Certificate' shall be issued to the student from the concerned authorities, only after securing ≥ 65% attendance in such a Course. No marks or Letter Grade shall be allotted for these activities.

10.0 Grading Procedure

10.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 9 above, and a corresponding Letter Grade shall be awarded as in Item **10.2**.

10.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed.

% of Marks Secured (Class Intervals)	***Letter Grade (UGC Guidelines)***	***Grade Points***
90% and above (≥ 90% , ≤ 100%)	S **(Outstanding)**	**10**
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ **(Excellent)**	**9**
Below 80% but not less than 70% (≥ 70% , < 80%)	A **(Very Good)**	**8**
Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ **(Good)**	**7**
Below 60% but not less than 50% (≥ 50% , < 60%)	B **(Average)**	**6**
Below 50% but not less than 40% (≥ 40% , < 50%)	P **(Pass)**	**5**
Below 40% (< 40%)	F **(FAIL)**	**0**
Absent for the Examination	**Ab (Absent)**	**0**

10.3 A student obtaining **F** Grade in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

10.4 A Letter Grade does not imply any specific % of Marks.

10.5 A student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, he has to repeat all the Subjects/ Courses pertaining to that Semester, when he is detained (as listed in Items 8.9 - 8.10).

10.6 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits for a Course

10.7 The student passes the Subject/ Course only when he gets GP $\geq$ 5 (**P** Grade or above).

10.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

SGPA = { $\sum_{i=1}^{N} C_i \; G_i$ } / { $\sum_{i=1}^{N} C_i$ } .... for each Semester,

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the number of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the ith Subject and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for the ith Subject.

10.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

CGPA = { $\sum_{j=1}^{M} C_j \; G_j$ } / { $\sum_{j=1}^{M} C_j$ } … for all S Semesters Registered (i.e., up to and inclusive of S Semesters, S$\geq$ 2),

where 'M' is the TOTAL number of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards up to and inclusive of the Semester S (obviously M>N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the number of Credits allotted to the jth-Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for the j^{th} Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

10.10 For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used.

10.11 For Calculations listed in Item 10.6 – 10.10, performance in failed Subjects / Courses (securing **F** Grade) will not be taken into account. Mandatory Courses with no credits will not be taken into consideration for calculation of SGPA/CGPA.

10.12 Passing Standards

10.12.1 A student shall be declared successful or 'passed' in a Semester, only when he gets a SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UGP, only when he gets a CGPA ≥ 5.00; subject to the condition that he secures a GP ≥ 5 (**P** Grade or above) in every registered Subject/ Course in each Semester (during the entire UGP) for the Degree Award, as required.

10.12.2 In spite of securing **P** Grade or above in some Subjects/Courses in any Semester, if a Student receives a SGPA<5.00 and/ or CGPA<5.00 at the end of such a Semester, then he 'may be allowed' to go into the next subsequent Semester (subject to fulfilling all other attendance and academic requirements as listed under Items 7-8).

10.12.3 A student shall be declared successful or 'passed' in any Non-Credit Subject / Course, if he secures a 'Satisfactory Participation Certificate' in that Mandatory Course.

10.13 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript)
shall be issued to all the Registered students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA and CGPA.

11.0 Declaration of Results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 10.6 – 10.11.

12.0 Award of Degree

12.1 A student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire UG E&T Programme (UGP), and secures the required number of **160** Credits (with CGPA $\geq$ 5.0), within 8 Academic Years from the Date of Commencement of the First Academic Year, shall be declared to have 'QUALIFIED' for the Award of the B.Tech. Degree in the chosen Branch of Engineering as selected at the time of Admission.

12.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of B.Tech degree he / she shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured
First Class with Distinction	≥ 7.75
First Class	$6.75 \leq CGPA < 7.75$
Second Class	$5.75 \leq CGPA < 6.75$
Pass Class	$5.0 \leq CGPA < 5.75$

12.3 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used

% of Marks = (Final CGPA - 0.5) x 10

13.0 Withholding of Results

13.1 If the student has not paid fees to University/ College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

14.0 Transitory Regulations

14.1 Student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the Degree Programme, may be considered eligible for readmission to the same Subjects/Courses (or equivalent Subjects/Courses, as the case may be) and same Professional Electives/ Open Electives (or from set/category of Electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the Date of Commencement of his/her I-Year I-Semester). Further, the student will come under the current regulations on his re-admission but not the previous regulations under which he/she was first admitted.

14.2

a. A student seeking transfer to CVR College of Engineering from other Universities/ Institutions, after obtaining necessary permission from the State Government/ University has to pass all the subjects at the previous institution.

b. In case the student has failed in any subject, he has to take equivalent subject offered by this college and get a

Pass grade. He should also obtain a Pass grade in those subjects of this college which the student has not studied at the previous institution, up to that semester when transfer was effective.

c. For such of those transferred students with backlogs, the college will provide one chance to write the internal examinations in the failed subject and/or subject not studied in the curriculum of this college.

d. Equivalent subjects will be notified by the college, based on case to case basis as received from the University. However, in case of Professional Electives and Open Electives, student has to opt for a subject among the subjects listed under each of the electives, as the case may be.

e. For the completed semesters which the student studied previously at another institution/ under a different scheme, Grade Points will be awarded as per the College rules and CGPA calculated after clearing backlogs, if any.

15.0 Student Transfers

15.1 There shall be no Branch transfers after the completion of Admission Process.

16.0 Scope

i) Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her".
ii) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".
iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.
iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor / Principal is final.
v) The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all Students with effect from the dates notified by the College Authorities.

17. Disciplinary Action for Malpractices by students in Exams

Sl. No.	Nature of Malpractices / Improper Conduct	Punishment
1. a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculator, Cell Phone, pager, palm computer, blue-tooth equipment or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he/she is appearing but has not made use of it. Material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination.	Expulsion from the examination hall and cancellation of the performance in that subject only.
b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language method or communicates through cell phone or any other communication equipment with any candidate or persons inside or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case will be registered against him / her.
2.	Has copied in the examination hall from any paper, book, programmable calculator, palm computer or by dictation from wireless means any material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester / year. The Hall

		Ticket of the candidate will be cancelled.
3.	*Impersonates* any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from the examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case registered against him.
4.	*Smuggles* in the Answer book or additional sheet or takes out or arranges to send out the question paper or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year. The candidate is also debarred for two

		consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent / Assistant Chief Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer Incharge or any person on duty in or outside the examination hall, causes any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer Incharge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate (s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case will be registered against them.

	use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall *taking away answer script or intentionally* tears the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all end semester examinations. Continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. The candidate will be reported to the police.
9.	If a student of the college, who is not a candidate for the particular examination or any person not connected	Student of the college is expelled from the examination hall and cancellation of the

	with the college indulges in any malpractice or improper conduct mentioned in clauses 6 to 8.	performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a *drunken* condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester examinations.
12.	If any malpractice is detected which is not included in clauses 1 to 11, it shall be reported to the Dean-Academics for further action to award suitable punishment.	As decided by Dean-Academics

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B.Tech.

Second Year B.Tech. Electronics and Instrumentation Engineering (CBCS)

1st Semester Course Structure

Regulations: R18-CBCS Admission to I-Year: 2018-19 With effect from Academic Year 2019-20

Sl. No.	Subject Code	Subject	Category	Periods per Week		Credits	Scheme of Examination Maximum Marks			Page No.
				L	T/P/D		Internal	External	Total	
1	64201	Electronic Circuits - I	PC	3	0	3	30	70	100	1
2	64202	Signals and Systems	PC	3	0	3	30	70	100	3
3	66201	Transduction of Physical Variables	PC	3	0	3	30	70	100	6
4	68202	Mathematics-III	BS	3	0	3	30	70	100	8
5	62205	Fundamentals of Electrical Engineering	ES	3	0	3	30	70	100	11
Practicals										
6	64231	Electronic Circuits - I Lab	PC	0	3	1.5	30	70	100	13
7	62234	Electrical Engineering Lab	ES	0	3	1.5	30	70	100	14
8	66231	Transducers and Instrumentation Lab - I	PC	0	2	1	30	70	100	15
9	68231	Reasoning and Data Interpretation Lab	BS	0	2	1	30	70	100	17
			Total	**15**	**10**	**20**	**270**	**630**	**900**	
			Total Periods	**25**						

Second Year B.Tech. Electronics and Instrumentation Engineering(CBCS)

2nd Semester Course Structure

Sl. No.	Subject Code	Subject	Category	Periods per Week		Credits	Scheme of Examination Maximum Marks			Page No.
				L	T/P/D		Internal	External	Total	
1	66251	Analog Circuits and IC Applications	PC	3	0	3	30	70	100	19
2	66252	Digital Circuits and ICApplications	PC	3	0	3	30	70	100	22
3	66253	Transducers and Applications	PC	3	0	3	30	70	100	24
4	64256	Principles of Communications	ES	3	0	3	30	70	100	26
5	66254	Control Systems Engineering	ES	3	0	3	30	70	100	28
Practicals										
6	66281	Analog Circuits and IC Applications Lab	PC	0	3	1.5	30	70	100	30
7	66282	Digital Circuits and IC Applications Lab	PC	0	2	1	30	70	100	32
8	66283	Transducers and Instrumentation Lab - II	PC	0	3	1.5	30	70	100	34
9	68281	Verbal Ability Lab	HS	0	2	1	30	70	100	35
			Total	**15**	**10**	**20**	**270**	**630**	**900**	
			Total Periods	**25**						
10	68282	Gender Sensitization	MC	1	0	0	100	-	-	37

1. HS: Humanities & Sciences **2. ES: Engineering Sciences** **3. PC: Professional Core**
4. BS : Basic Sciences **5. MC: Mandatory Course**

64201

ELECTRONIC CIRCUITS-I

(Common to ECE & EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Credits	:	3	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives:

1. To realize the rectifier circuits
2. To realize clippers, clampers, RC circuits and comparators
3. To analyze the single stage and multistage amplifiers

Unit I – Diode Applications

Review of PN Junction Diode and Zener Diode. **Rectifiers:** Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier. **Filters:** Inductor Filter, Capacitor Filter, L-section, Π-section Filter, Comparison of various Filter Circuits, Critical Inductance, Bleeder Resistor, Zener Diode as a Voltage Regulator.

Unit II– Wave Shaping- Linear and Non-linear

Diode Clippers, Clipping at two Independent Levels, Transfer Characteristics of Clippers, Comparators and their Applications, Clamping Operation, Clamping Circuits, High Pass and Low Pass RC Circuits and their Response for Sinusoidal, Step, Pulse, Square Wave, Ramp and Exponential Inputs, RC Network as a Differentiator and Integrator.

Unit III –Biasing BJT and FET

Review of BJT and FET, Transistor as a switch. **BJT Biasing:** Need for Biasing, Operating point, Bias Stability, The DC load line, Fixed Bias, Collector to Base Bias, Voltage Divider Bias, Stabilization Factors, Bias Compensation, Thermal Runaway, Thermal Stability. **FET Biasing:** Source Self-bias and Self-bias with Fixed Bias.

Unit IV–Low Frequency Analysis of BJT Amplifiers

Two Port Network, Transistor Hybrid Model, Analysis of BJT amplifiers using Exact h-parameter Model, Analysis of CB, CE and CC Amplifiers using Approximate h-parameter Model, Frequency Response, Effect of Coupling and Bypass Capacitors on frequency response.

Unit V– HF Analysis of BJT and Analysis of JFET Amplifiers

HF Analysis of BJT: Hybrid -∏ Common Emitter Transistor Model, Hybrid- ∏ Conductance, Hybrid -∏Capacitances, Current Gain with Resistive Load, CE Short Circuit Gain.

JFET Amplifiers: JFET Small Signal Model, CS, CD JFET Amplifiers.

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Analyze different rectifier circuits with and without filters.
CO 2	:	Analyze clippers, clampers, RC circuits and comparator circuits.
CO 3	:	Analyze different biasing circuits for BJTs and FETs.
CO 4	:	Analyze different small signal BJT amplifiers at low frequencies.
CO 5	:	Analyze different small signal BJT amplifiers at high frequencies and analyze different single stage JFET amplifiers.

Text Books:

1. Electronic Devices and Circuits, J. Millman and C.C. Halkias, Tata McGraw-Hill, 2007.
2. Micro Electronic Circuits, Sedra A.S. and K.C. Smith, 5th Edition, Oxford University Press, 2014.

References:

1. Integrated Electronics, J.Millman, ChristosHalkias, 2nd Edition, Tata McGraw-Hill, 2010.
2. Pulse, Digital and Switching Waveforms, Jacob Milliman and Herbert Taub, Tata McGraw-Hill, 2000.
3. Electronic Devices and Circuits, R.L.Boylestad and Louis Nashelsky, 9th Edition, Pearson/Prentice Hall, 2006.

64202

SIGNALS AND SYSTEMS

(Common to ECE & EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Credits	:	3	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives:

- To learn the concept and methods that are necessary for analysis of continuous time signals and systems.
- To analyze signals and systems in terms of both the time and transform domains.
- To develop the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Unit I – Signal and System Analysis

Signal and its Properties, Basic Continuous Time Signals, Classification of Signals, Basic Operations on Signals, System and its Classification, Linear Time Invariant System, Impulse Response, Response of a Linear Time Invariant (LTI) system, Concept of Convolution, Graphical Interpretation of Convolution, Analogy between Vectors and Signals, Orthogonal Signal Space, Signal Approximation using Orthogonal Functions, Mean Square Error, Closed or Complete Set of Orthogonal Functions, Orthogonality in Complex Functions.

Unit II – Fourier Series and Fourier Transforms

Fourier series: Dirichlet Conditions, Representation of Fourier series, Trigonometric and Exponential Fourier series, Complex Fourier series and Spectrum, Parseval's Theorem.
Fourier Transforms: Fourier Transform from Fourier Series, Inverse Fourier Transform, Fourier Transform of Arbitrary Signal, Fourier Transform of Different Signals, Properties of Fourier Transforms, Fourier Transform of Periodic Signals.

Unit III – Signal Transmission through Linear Systems & Sampling

Signal Transmission through Linear Systems: Transfer Function of a LTI System, Inter Connection of LTI Systems, Filter Characteristics of Linear Systems, Distortion Less Transmission through a System, Signal Bandwidth, System Bandwidth, Ideal Filter Characteristics, Causality and Paley-Wiener Criterion for Physical

Realization, Correlation of Signals, Properties of Correlation, Relation between Convolution and Correlation, Detection of Periodic Signals in the Presence of Noise by Correlation, Extraction of Signal from Noise by Filtering. **Sampling:** Sampling Theorem – Graphical and Analytical Proof for Band Limited Signals, Impulse Sampling, Natural and Flat Top Sampling, Reconstruction of Signal from its Samples, Aliasing Effect.

Unit IV – Laplace Transforms

Concept of Laplace Transforms, Concept of Region of Convergence (ROC) for Laplace Transforms, Constraints on ROC for various Classes of Signals, Laplace Transform of Different Signals, Properties of Laplace Transforms, Inverse Laplace Transform, The Unilateral Laplace Transform, The System Function, Stability and Causality, Solution of Differential Equations using Laplace Transforms.

Unit V – Z-Transforms

Concept of Z-Transform of a Discrete Sequence, Region of Convergence in Z-Transform, Constraints on ROC for Various Classes of Signals, Z-Transform of Different Signals, Properties of Z-Transforms, Inverse Z-Transform using Partial Fraction and Long Division Method, Unilateral Z-Transforms, Applications of Z-Transforms, System Function of Discrete-Time LTI Systems, Stability and Causality, Solution of Difference Equations using Z-Transforms.

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Characterize and analyze the properties of continuous and discrete time signals and systems. To apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
CO 2	:	Represent continuous signals and systems in the Frequency domain using Fourier Series and Fourier transform.
CO 3	:	Understand the filter characteristics of LTI systems, correlation and the concept of sampling and reconstruction of analog signals.
CO 4	:	Apply the Laplace transforms to analyze continuous-time signals and systems.
CO 5	:	Apply Z- transforms to analyze discrete-time signals and systems.

Text Books:

1. Signals, Systems & Communications, B.P.Lathi, BS Publications, 2003.
2. Signals and Systems, A.V. Oppenheim, A.S.Willsky and S.H. Nawab, 2^{nd} Edition, PHI, 2010.

References:

1. Schaum's Outlines of Signals and Systems, H. P. HSU, Tata McGraw-Hill, 2004.
2. Fundamentals of Signals and Systems, Michel J.Robert, MGH International Edition, 2008.
3. Signals & Systems, Simon Haykin and Van Veen, 2^{nd} Edition, John Wiley & Sons, Inc., 2005.

66201

TRANSDUCTION OF PHYSICAL VARIABLES

(EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course objectives:

1. To understand the functional elements of measurement system and calibration of instruments.
2. To design different types of instruments for measuring different physical parameters.
3. To learn the basic working principle of different types of mechanical and electronic instruments.

Unit I - Introduction to measurement systems

General concepts and terminology, functional elements of measurement system with examples, Recorders- Introduction, PMMC Recorders, Sensor classification, general input-output configuration, calibration, methods of correction. Characteristics of Instruments:
Static characteristics: accuracy, linearity, resolution, precision, and sensitivity etc, estimation of errors. Dynamic characteristics: Transfer function, dynamic characteristics of measurement systems, zero order, first order systems and response.

Unit II - Standards

Definitions of standard units, International standards, Primary standards, Secondary standards, Working standards, Voltage standard, Resistance standard, Current standard, Capacitance standard, Time and frequency standards.

Unit III - Measuring Devices-1

Temperature: Thermal expansion methods, thermoelectric, electric resistance and semiconductor sensors, Radiation methods-thermal and photon detectors based thermometers.
Strain: Strain Gauge- Introduction, types, Bounded type, Unbounded type, Gauge Factor.

Unit IV - Measuring Devices-2

Methods of pressure measurements: Dead weight gauges and manometers, Elastic transducers, vibrating cylinders and other resonant transducers, High pressure measurement, Diaphragm, McLeod, Knudsen, thermal conductivity and ionization gauges, dual gauge techniques and sound measurement. Flapper and Nozzle arrangement.

Unit V - Bridges

DC bridges: Wheatstone bridge, Kelvin bridge, Megger.
AC bridges: Measurement of inductance - Maxwell's bridge, Anderson bridge, Measurement of capacitance - Schering Bridge, DeSauty's bridge. Measurement of frequency - Wein bridge, Q-meter.

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Understand the basics and its characteristics of Instrumentation.
CO 2	:	Gain knowledge in analyzing different standards
CO 3	:	Understand the different temperature and strain transducers.
CO 4	:	Identify the various methods of pressure and sound measurements.
CO 5	:	Understand the principle and operation of AC & DC bridges.

Text Books:

1. A Course in Mechanical Measurements & Instrumentation Control, Sawhney AK and Puneet Sawhney.
2. Transducers and Instrumentation, Murthy D.V.S, Second edition, PHI.

References:

1. Sensors Technology Handbook-Jon Wilson, Newne2004.
2. Introduction to Measurements and Instrumentation, Arun Ghoshl, 2ed. PHI, 2007.
3. Sensors and Transducers, D. Patranbis, TMH, 2003.

68202

Mathematics-III

(Transform Calculus and Complex Variables)
(Common to ECE, EEE, EIE branches)

Instruction	:	3 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives: To learn the

- Evaluation of Laplace Transform of a given function
- Evaluation of Fourier Transform of a given function
- Analyticity and Integration of Complex valued functions.
- Evaluation of integrals using Cauchy's integral formulae.
- Taylor's series and Laurent's series expansions of complex functions.
- Evaluation of integrals using residue theorem.

Unit I - Laplace Transforms

Laplace transform of standard functions - inverse Laplace transform - First shifting theorem, Transform of derivatives and integrals - Unit step function - Second shifting theorem- Differentiation and integration of transforms - Dirac's delta function. Convolution theorem - Periodic function - Application of Laplace transforms to ordinary differential equations

Unit II - Fourier Transforms

Definition -Shifting theorem- Frequency Shifting-Modulation theorem-Fourier transform of Derivatives- Fourier transform of Integral-Convolution. Fourier transform of Dirac-Delta function. Fourier Cosine and Sine transforms- Fourier Cosine and Sine transforms of derivatives- Finite Fourier transform- Applications of Fourier transforms to solve P.D.E.

Unit III - Analytic Functions

Functions of a Complex variable - Concepts of limit, continuity, differentiability and analyticity-Cauchy-Riemann equations-Harmonic functions- Construction of an analytic function if
real / imaginary part is given – Elementary functions.

Unit IV - Integration of Complex Functions

Integration of complex functions: Line integrals-Evaluation along a path and indefinite integration-Cauchy's Integral theorem (without proof)-Independence of path-Cauchy's Integral formula – Cauchy's Integral formula for derivatives.

Unit V - Power Series and Residues

Power series- Radius of Convergence - Taylor's series-Laurent series-zeros and singularities of complex functions-Residues-Cauchy's Residue theorem (without proof) - Evaluation of contour integrals using Residue Theorem.

Course Outcomes: After undergoing course, the student will be able to:

CO1 : Develop the skill of evaluating Laplace and Inverse Laplace transform of functions which are required to solve linear systems under initial conditions.

CO2 : Develop the skill of evaluating Fourier transform of functions which are required to solve Partial Differential equations under given conditions.

CO3 : Understand the concepts of analyticity and integration of complex functions, construction of analytic functions if a part of it is known.

CO4 : Evaluate integrals using Cauchy's Integral formulae around a simple closed contour.

CO5 : Find the Taylor's and Laurent's series expansion of complex functions and to evaluate contour integrals using Residue theorem.

Text Books:

1. Advanced Engineering Mathematics by R. K. Jain and S.R. K. Iyengar, Narosa Publishing House.
2. Complex Variables and Applications by R. V. Churchill and Brown, McGraw-Hill publishers.

References:

1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons (10th Edition).
2. Mathematics for Engineers and Scientists by Alan Jeffrey, Elsevier.
3. Complex Variables- Schaum's Outline series.
4. Complex Analysis by T.W.Gamelin, Springer Series publications.

62205

FUNDAMENTALS OF ELECTRICAL ENGINEERING

(Common to ECE & EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Credits	:	3	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives:

1. To familiarize with the basic laws, theorems and the methods of analyzing electrical circuits.
2. To explain the concept of AC circuits and resonance.
3. To acquire knowledge about various network theorems.
4. To analyze the transient and steady state response of circuits with dc input and two port network parameters.

Unit I– Introduction to Electrical Circuits

Current, voltage, power, electrical energy, types of elements, types of sources, R-L-C parameters, Ohms law, Kirchhoff's laws, source transformation, V-I relationship for passive elements (for input signals like square, ramp, saw tooth and triangular). Series, parallel, series-parallel, star-to-delta transformation and vice versa, nodal analysis, mesh analysis, super node and super mesh analysis.

Unit II – Single phase ac circuits

R.M.S. and Average values and form factor of different periodic waveforms, Steady state analysis of R, L and C (series, parallel and series-parallel combinations) with Sinusoidal Excitation, Concept of Reactance, Impedance, Susceptance and Admittance, Phase and Phase difference- Concept of Power Factor, Real and Reactive powers, rectangular and polar forms, J-notation, Complex and Polar forms of representation, Complex power for R-L-C circuits.

Unit III – Resonance and Network Theorems

Resonance of Series, Parallel Circuits, properties of Series and Parallel Resonance, Concept of Bandwidth lower and upper half power frequency, Q factor and numerical problems. **Network theorems**: Thevenin's theorem, Norton's Theorem, Superposition Theorem, Maximum Power transfer theorem, Compensation theorem, Millman's and Tellegen's theorems.

Unit IV – Transients and Network Parameters

Transient response of RL, RC and RLC series circuits (with DC excitation) using differential equation approach and Laplace transformation approach. **Network Parameters**: Z, Y, ABCD and h parameters, Interconnection of two port networks.

Unit V– Electrical Machines

Construction and working principle of DC machines, single phase transformer and three phase induction motors.

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.
CO 2	:	Solve the complex AC and DC electric circuits by applying the suitable principles.
CO 3	:	Understand the concept and applications of Resonance and able to solve the problems using various network theorems.
CO 4	:	Apply the concepts of two port network parameters and transient response of electrical circuits in the real time applications.
CO 5	:	Acquire sufficient knowledge about the basic principles of various Electrical Machines.

Text Books:

1. Engineering Circuit Analysis, W.H. Hayt, J. E. Kemmerly and S.M. Durbin, 6th Edition, Tata McGraw-Hill, 2008.
2. Principles of Electrical Engineering and Electronics, V.K. Mehta, S. Chand & Co, 3rd Edition, 2014.

References:

1. Network Analysis, M.E. Vanvalkenburg, 3rd Edition, PHI, 2006
2. Electric Circuits, A. Chakrabarthy, Dhanpat, 6th Edition, Rai & Son, 2011.
3. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, Pearson Education India, 2nd Edition, 2017.

64231

ELECTRONIC CIRCUITS - I LAB

(Common to ECE & EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Credits	:	1.5	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives:

1. To realize the rectifier circuits
2. To realize the clippers, clampers and comparator
3. To design and analyze the single stage and multistage amplifiers

(For Laboratory Examination-Minimum of 12 Experiments)

Design and Analysis* of the following Circuits

1. pn Junction and Zener Diode Characteristics
2. Zener Diode as a Voltage Regulator
3. Half Wave Rectifier with & without filters
4. Full Wave Rectifier with & without filters
5. Non-Linear Wave Shaping – Clippers
6. Non-Linear Wave Shaping – Clampers
7. Linear Wave Shaping- Design of Low Pass Filter, Integrator
8. Linear Wave Shaping- Design of High Pass Filter, Differentiator.
9. Common Emitter (CE) characteristics- measurement of h-parameters.
10. Transistor as a Switch
11. Measurement of zero signal voltages and currents for a CE amplifier, finding the β value.
12. Frequency Response of Common Emitter Amplifier
13. Frequency Response of Common Collector Amplifier
14. Frequency Response of Common Source Amplifier

*For Rectifiers- Ripple factor, % of regulation
*For Amplifiers- Maximum gain, Bandwidth

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Design and analyze different rectifier circuits with and without filters.
CO 2	:	Design and analyze clippers, clampers and RC circuits.
CO 3	:	Design biasing circuits for BJTs.
CO 4	:	Design and analyze different small signal BJT, JFET amplifiers at low frequencies.
CO 5	:	Use diode and transistor for different applications.

62234/62284

ELECTRICAL ENGINEERING LAB

(Common to EIE & ECE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Credits	:	1.5	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives: To acquaint the students with the basic concepts and properties of electrical circuits

1. To verify various network theorems practically
2. To learn the basic concepts of electrical machines

List of Experiments

1. Verification of Kirchhoff's laws
2. Verification of Thevenin's and Norton's theorems
3. Verification of Superposition and Maximum power transfer theorems.
4. Verification of Compensation theorem
5. Determination and verification of ABCD and h-parameters
6. Determination and verification of Z and Y parameters
7. Resonance in series and parallel circuits
8. OC and SC test on single phase transformer
9. Magnetization characteristics of DC shunt generator
10. Swinburne's test on DC shunt motor

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Verify the network theorems practically and can apply wherever is necessary in the circuit analysis.
CO 2	:	Understand about phenomenon of resonance and study the response of series and parallel resonant circuits.
CO 3	:	Verify the two port network parameters practically.
CO 4	:	Determine the efficiency of a transformer.
CO 5	:	Analyze the magnetization characteristics of dc shunt generator.

66231

TRANSDUCERS AND INSTRUMENTATION LAB - I

(EIE)

Instruction	:	2 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	1	End Exam Duration	:	3 Hours

Course Objectives: The aim of this course is to familiarize the students practically:

1. To learn how to measure pressure using primary transducers.
2. To learn the skill of measuring Sound and Strain.
3. To study how to measure the Resistance and capacitance using Wheatstone bridge, Kelvin's bridge, Schering Bridge.
4. To learn the skill of measuring temperature using several primary and secondary transducers.

List of Experiments

1. Study of strain gauges using any one application.
2. Measurement of temperature using resistance temperature detector (RTD).
3. Linearization of Thermistor.
4. Bourdon tube for pressure measurement.
5. Measurement of temperature using Thermocouple
6. Characteristics of Opto-electric transducers (photo-transistor, photodiode, LDR).
7. Measurement of sound level intensity
8. Calibration of Pressure gauge using Deadweight Tester
9. Measurement of resistance using Wheatstone bridge.
10. Measurement of resistance using Kelvin's bridge.
11. Measurement of capacitance using Schering bridge.
12. Measurement of inductance using Maxwell's Bridge

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Acquire confidence using bridge circuits to measure several parameters.
CO 2	:	Analyze the effect of temperature on resistance using different transducers.
CO 3	:	Analyze the effect of pressure using different transducers.
CO 4	:	Gain knowledge on calibrating devices.
CO 5	:	Acquire knowledge on sound measurement.

68231

REASONING AND DATA INTERPRETATION LAB

Instruction	:	2 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	1	End Exam Duration	:	3 Hours

Course Objectives:

1. To train the students to face the questions that require reasoning and interpretation of data with greater facility and help them face requirement tests and entrance examinations for all courses of higher education successfully.
2. To develop the use of analytical, reasoning and logical skills in formal and informal situations.
3. To introduce Graphs, Charts, problem solving with Data, Puzzles and Logical Questions.
4. To train the students towards preparation for placement, Competitive examinations like GATE, CAT, GRE etc.

CONTENTS:

Exercises/Experiments on the following topics will be done during the course with necessary illustrations.

1. Classification of data
2. Coding and Decoding
    a. Letter coding
    b. Number coding
    c. Split by Half coding
    d. Coded Inequality
3. Series
    a. Number
    b. Letter
    c. Alpha Numeric
    d. Alphabet Test
4. Direction Sense
    a. Fictious Symbol
    b. Direction Test
5. Cubes
6. Blood Relations
7. Ratios, Percentages and Averages
8. Syllogism
9. Data Sufficiency
    a. Analytical Decision Making

   b. Input-Output
10. Data Visualization / Interpretation
   a. Bar Charts
   b. Line Graphs
   c. X-Y Charts
   d. Pie charts
   e. Tables
11. Analogy
   a. Number
   b. Letter
   c. Word
12. Puzzles
   a. Simple Table & Comparisons Problems
   b. Circle sitting & Row/Column sitting Problems

Course Outcomes: At the end of the course, student should be able to

CO 1	:	Understand the concepts of Statement-Argument, Assumption and Course of Action and use reasoning as a tool to match statements with arguments etc.
CO 2	:	Look at data and find links and patterns, link data with conclusions and study data logically.
CO 3	:	Study problem situations and use reasoning as a tool to find solutions.
CO 4	:	Nurture the ability to use reasoning as a skill in real time problems solving.
CO 5	:	Analyze and infer the data with respect to trend and case based.

Text Books:

1. How to prepare for Data Interpretation for CAT, Arun Sharma, McGraw-Hill.
2. A Modern Approach to Verbal and Nonverbal Reasoning, R.S. Aggarwal, S. Chand.

References:

1. Quantitative Aptitude, R.S Aggarwal, S. Chand.
2. A Modern Approach to Logical Reasoning, R.S. Aggarwal, S. Chand.
3. Reasoning & Aptitude for GATE & ESE, MADE EASY Publications.

66251

ANALOG CIRCUITS AND IC APLICATIONS

(EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To identify the type of feedback present in the given circuit and analyzing to calculate the parameters of amplifiers.
2. The concept of oscillators and power amplifiers and the calculation of the distortion in amplifiers.
3. To introduce the basic building blocks of linear ICs
4. To teach the linear and non-linear applications of operational amplifiers.
5. To teach the theory and construction of ADC and DAC.

Unit I - Amplifiers and Oscillators

MULTISTAGE AMPLIFIERS: Methods of Inter Stage Coupling, Analysis of n-Stage Cascaded Amplifier, Multistage BJT Amplifiers, Miller's Theorem. FEEDBACK AMPLIFIERS: Concepts of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations. OSCILLATORS: Classification of Oscillators, Condition for oscillations, RC Phase shift Oscillator, Wein Bridge oscillator. Generalized analysis of LC-oscillator, Hartley and Colpitts Oscillators.

Unit II - Power Amplifiers

Classification, Series Fed Class A Power amplifiers, Transformer Coupled Class A amplifier, Efficiency, Class B amplifier, Efficiency of class B Amplifier, class B Push pull Amplifier, Complementary Symmetry Class B Push Pull Amplifier, Distortion of Power Amplifiers, second Harmonic distortion, Heat sinks, Class C Power amplifier.

Unit III - Operational Amplifier

Basic information of Op-amp, Ideal and practical characteristics of Op-amp, internal block diagram of Op-amp, Op-amp DC and AC characteristics, modes of operation-inverting, non-inverting, differential amplifiers. Applications of Op-amp: Adder, subtractor, Differentiator and Integrator, Instrumentation amplifier.

Unit IV - OP-AMP Applications

Active Filters using Op-amp: 1st order LPF, HPF filters. Band pass, Band reject and all pass filters. Oscillators using Op-amp: RC and Wien bridge oscillators, Comparators and its Applications, Schmitt trigger, Multivibrators using Op-Amp.

UNIT V - Converters and Timers

Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC. Timers & Phase Locked Loops: Introduction to 555 timer, functional diagram, Monostable and Astable operations. PLL - block schematic and description of individual blocks.

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

CO 1	:	Identification and design feedback amplifiers of different topologies andDesign RC and LC oscillators using transistors.
CO 2	:	Analyze and design different types of power amplifiers.
CO 3	:	Construct op-amp basic applications.
CO 4	:	Acquire confidence in designing active filters using Op-Amp.
CO 5	:	Analyze and design A/D and D/A convertors using Op-Amp and Develop different applications of 555 timer.

Text Books:

1. Integrated Electronics – by J. Millman and C.C. Halkias, McGraw-Hill, 1972.
2. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.

References:

1. Micro Electronic Circuits – by Serda A.S. and K.C. Smith, Oxford University Press, 5th Edition.
2. Electronic Devices and Circuits – by S. Salivahanan, N. Sunil Kumar, A.Vallavaraj, 2ed., 2009, TMH.
3. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 1987.
4. Electronic Circuit Analysis - by U.A.Bhakshi, A.P.Godse, Technical Publications.
5. Electronic Devices and Circuits – by K. Lal Kishore, BS Publ.

66252

DIGITAL CIRCUITS AND IC APPLICATIONS

(EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To imbibe the knowledge of number systems and logic gates.
2. To familiarize the analysis and design of Combinational and Sequential circuits.
3. To investigate the static and dynamic characteristics of popular MOS and bipolar logic families, with emphasis on CMOS and TTL technologies.
4. To design different applications using Digital ICs.

Unit I - Number Systems and Codes

Number systems: Decimal, Binary, Octal, Hexadecimal and number base conversions, compliments, binary Arithmetic: addition, subtraction and multiplication, Binary codes: BCD, Excess-3, gray code, code converters.

Unit II - Combinational Circuits

Fundamentals of Boolean algebra: Basic theorems and Properties, Canonical and Standard forms, Algebraic simplification, Digital Logic Gates, minimization of logic functions using SOP , POS and K-Map method, Single bit adders and subtractors, Multiplexers, decoders, Code Converters.

Unit III - Sequential Circuits

Latches and Flip-Flops and their excitation tables, Binary counters: Synchronous and Asynchronous counters, Mod-N counters, Ring and Johnson counters, Shift registers. Finite State Model(FSM) – Basic Definitions of Mealy and Moore FSM.

Unit IV - Integrated Circuits

Introduction, Basics of digital integrated circuits, Basic operational characteristics and parameters, CMOS circuits: CMOS NAND, NOR gates, open drain and tri-state outputs, CMOS transmission gate, TTL circuits: standard TTL inverter, TTL NAND Gate- Analysis& characteristics, TTL open collector O/Ps, Tristate TTL, Comparison of CMOS and TTL performance, interfacing between TTL and CMOS.

Unit V - Digital ICS

Design using TTL-74XX & CMOS 40XX series, Digital arithmetic circuits-parallel binary adder/Subtractor circuits. Digital comparator circuits, Decoders, De-multiplexers, and their applications, Encoder, priority Encoder, multiplexers & their applications, Sequential Circuits**:** Flip-flops, Design of synchronous and asynchronous counters. Decade counter, shift registers & applications.

Course Outcomes: At the end of the course, the student will be able to

CO 1	:	Understand how to convert the one code format to other code format.
CO 2	:	Ooptimize Boolean functions and design various combinational logic circuits.
CO 3	:	Analyze and design various synchronous sequential logic circuits.
CO 4	:	Gain the knowledge to design basic digital gates using CMOS and TTL logic families.
CO 5	:	Design combinational and sequential circuits using digital IC's.

Text Books:

1. Digital Design – Morris Mano, 3rd ed., 2006, PHI.
2. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005.

References:

1. Digital Design Principles & Practices, John F.Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005.
2. Switching & Finite Automata theory – Zvi Kohavi, 2 ed., TMH.
3. Switching Theory and Logic Design – A. Anand Kumar, 2008, PHI.

66253

TRANSDUCERS AND APPLICATIONS

(EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the basic characteristics of transducers.
2. To select a suitable transducer for specific variable measurement.
3. To learn the skill of measuring velocity and acceleration.
4. To apply various transducer principles for force and torque.
5. To study the basic applications of medical transducers.

Unit I – Introduction to Transducers

Classification of transducers and selection of transducer, Displacement Measurement: Resistive potentiometers, Inductive displacement transducer, capacitive displacement transducer, Ultrasonic methods.

Unit II – Measuring Devices-1:

Velocity and Acceleration Measurement: Differentiation and Integration methods, laser based and stroboscopic methods, Electromagnetic methods. Seismic displacement, velocity and acceleration pickup (Accelerometers). Gyroscopic angular displacement and velocity sensors. Force and Torque Measurement: Methods of force measurement and characteristics, differential transformers, variable reluctance, piezoelectric transducer types, torque measuring on rotating shafts.

Unit III – Measuring Devices-2:

Local Flow & Gross Volume Flow:
Flow visualization from pitot - static tube, yaw tube, pivoted vane and served sphere, wind vector indicator, anemometers, velocity sensor, Obstruction meters, pitot tubes, Rota meters, turbine and positive displacement meters, electromagnetic, drag force, vortex shedding, ultrasonic flow meters.

Unit IV – Measuring Devices-3:

Humidity measurement: Capacitive impedance and piezoelectric Hygrometers. **Density measurement**: differential pressure, U-tube and ultrasonic Densitometers.

Unit V - Medical Applications:

Flow transducers - Electromagnetic and ultrasonic type, Pressure transducers - Piezo electric and Strain Gauge Type and Temperature transducers - Thermistor and RTD type.

Course Outcomes: At the end of the course, the student will be able to

CO 1	:	Improve skills in selecting a suitable transducer for a given application.
CO 2	:	Confidence in applying various transducer principles for many domestic requirements.
CO 3	:	Measure velocity and Acceleration using appropriate transducers.
CO 4	:	Measure force and torque using appropriate transducers.
CO 5	:	Understand applications of medical transducers.

Text Books:

1. Electronic Instrumentation – HS Kalsi, Tata McGraw-Hill, 2004.
2. Transducers and Instrumentation, Murthy D.V.S, Second edition, PHI.
3. Modern Electronic Instrumentation and Measurement Techniques – Albert D Helfrick, William, PHI, 1990.

References:

1. A Course in Electrical and Electronic Measurements and Instrumentation – Shawney A.K, Dhanpath Rai & Co., 2011.
2. Electronic Instrumentation and measurements – David A. Bell, 2nd Edition, PHI, 2003.
3. Measuring Systems: Application and Design – E.O. Doebelin, 5th Edition, McGraw-Hill.

64256

PRINCIPLES OF COMMUNICATIONS

(EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Credits	:	3	End Examination Marks	:	70
			End Exam Duration	:	3 Hours

Course Objectives:

1. To introduce the basic communication and modulation concepts.
2. To understand the different generation and detection techniques of analog communication.
3. To understand the different generation and detection techniques of Digital communication.
4. To get the knowledge of error correction and detection.

Unit I – Amplitude Modulation:

Block Diagram of Basic Communication System, Need for Modulation, Modulation Property, Types of Communications, Types of Amplitude Modulation, Generation of AM, DSBSC, SSB, Demodulation of AM, DSBSC and SSB.

Unit II – Angle Modulation :

Frequency and Phase Modulation, Advantages of FM over AM, Narrow Band and Wide Band FM, Comparison of FM and PM, Generation and Detection of FM and PM.

Unit III – Pulse Modulation :

Introduction of Sampling, Sampling Theorem for Band Limited Signals, Generation and Detection of PAM, PWM and PPM, Time Division Multiplexing, Frequency Division Multiplexing, Asynchronous Multiplexing.

Unit IV – Digital Communication:

Advantages, Block diagram of PCM, Quantization, Quantization Error, Base Band Digital Signal, DM ADM, DPCM and Comparison.
Digital Modulation**:** ASK FSK, PSK, DPSK, QPSK Coherent and Incoherent Reception Modems.

Unit V – Information Theory

Concept of Information, Rate of Information and Entropy, Source Coding for Optimum Rate of Information, Coding Efficiency, Shanon-Fano and Huffman Coding.

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Understand the use different amplitude modulation and demodulation techniques used in analog communication.
CO 2	:	Understand the concepts of frequency and phase Modulation and their demodulation techniques.
CO 3	:	Understand the different pulse modulation and demodulation techniques and signal multiplexing for various applications.
CO 4	:	Design simple systems for generating and demodulating digital modulated signals.
CO 5	:	Evaluate the performance of communication systems using coding techniques.

Text Books:

1. Communication Systems Analog and Digital, R.P.Singh, SD Sapre, 20th reprint, Tata McGraw-Hill, 2004.
2. Principle of Communications, H.Taub & D.Schilling, Tata McGraw-Hill, 2003.

References:

1. Electronic Communication Systems, Kennedy & Davis, 4thEdition, Tata McGraw-Hill, 2004.
2. Communication Systems Engineering, John. G. Proakis and Masoud Sahehi, 2nd Edition, PHI, 2004.
3. Modern Digital and Analog Communication Systems, B. P. Lathi and Zhi Ding, Oxford University Press, 2018.

66254

CONTROL SYSTEMS ENGINEERING

(EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the analysis of systems response in time and frequency domain.
2. To analyze the stability in frequency response.
3. To understand the state space analysis of the systems.

Unit I - Concepts of Control Systems

Open Loop and closed control systems and their differences – Different examples of control systems – Classification of control systems, Feed-Back Characteristics, Effects of feedback, Mathematical models – Differential equations, Impulse Response and transfer functions – Translational and Rotational mechanical systems.

Transfer Function Representation

Block diagram representation of systems considering electrical systems are examples – Block diagram Reduction – Representation by Signal flow graph – Reduction using Mason's gain formula.

Unit II - Time Response Analysis

Standard test signals – Time response of First Order Systems – Characteristic Equations of Feedback control systems, Transient response of second order systems – Time domain specifications – Steady state response – Steady state errors and error constants.

Stability Analysis in S-Domain

The concept of stability – Routh stability criterion – Qualitative stability and conditional stability, The root locus concept – construction of root loci – effects of adding poles and zeros to G(s)H(s) on the root loci.

Unit III - Frequency Response Analysis

Introduction, Frequency domain specifications – Bode diagrams – Determination of Frequency domain specifications and transfer function from the Bode – Diagram – Phase margin and Gain margin – Stability Analysis from Bode Plots.

Stability Analysis in Frequency Domain
Polar Plots, Nyquist Plots and Application of Nyquist criterion to find the stability.

Unit IV - Classical Control Design Techniques

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain.

Unit V - State Space Analysis of Continuous Systems
Concepts of state, state variables and state model, Derivation of state models from block diagrams, Diagonalization – Solving the Time invariant state Equations – State Transition Matrix and its Properties.

Course Outcomes: At the end of the course, the student will be able to

CO 1	:	Understand the basic concepts and transfer function representation of control system.
CO 2	:	Understand the stability concept and their time domain analysis.
CO 3	:	Understand the frequency response analysis in frequency domain.
CO 4	:	Understand the compensating techniques of controllers.
CO 5	:	Design state models.

Text Books:

1. Control Systems Engineering – by I.J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.
2. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

References:

1. Control Systems by N.K. Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998.
2. Automatic Control Systems 8th edition – by B.C. Kuo 2003 – John Wiley and son's.
3. Control Systems Engineering, NISE 3rd Edition – John Wiley
4. Modeling & Control of Dynamic Systems, Narciso F. Macia George J. Thaler, Thomson Publishers.

66281

ANALOG CIRCUITS AND IC APPLICATIONS LAB

(EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	1.5	End Exam Duration	:	3 Hours

Course Objectives: The aim of this course is to familiarize the students practically:

1. To identify the type of feedback present in the given circuit and analyzing to calculate the parameters of amplifiers.
2. The concept of oscillators and power amplifiers and the calculation of the distortion in amplifiers.
3. To acquire the design concepts of basic op-amp applications
4. To understand the design and operation of multi-vibrators using 555 timer.

List of Experiments
(Minimum 6 experiments have to be performed from each part)

Part A: Analog Circuits using Simulation Software

1. Frequency response of two stage RC coupled amplifier
2. Voltage Shunt Feedback Amplifier
3. Current Series Feedback Amplifier
4. RC Phase shift and Wein Bridge Oscillators using BJT
5. Hartley and Colpitts Oscillators,
6. Class A Power amplifier
7. Class B Power amplifier

Part B: Analog IC Applications using Hardware

8. Voltage Shunt Feedback Amplifier
9. RC Phase shift Oscillators using BJT
10. OP AMP Applications –Adder, Subtractor, Comparator circuits.
11. Integrator and Differentiator Circuits using IC 741.
12. Active Filter Applications –LPF, HPF (first order)

13. IC 741 Oscillator Circuits-Phase Shift and Wien Bridge Oscillators
14. IC 555 timer – Monostable Operation Circuit.

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

CO 1	:	Implement the feedback amplifiers of different topologies
CO 2	:	Design and implement RC and LC oscillators using transistors.
CO 3	:	Analyze and implement the different types of power amplifiers.
CO 4	:	Design practical op-amp applications and Acquire confidence in designing all filters.
CO 5	:	Develop different applications of 555 timers practically.

66282

DIGITAL CIRCUITS AND IC APPLICATIONS LAB

(EIE)

Instruction	:	2 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	1	End Exam Duration	:	3 Hours

Course Objectives:

1. To imbibe the knowledge of number systems and logic gates and applications.
2. To familiarize the analysis and design of Combinational and Sequential circuits.
3. To learn the special type of digital ICs and their applications.
4. To understand the operation of digital ICs.

List of Experiments

(Minimum 6 experiments have to be performed from each part)

Part A: Digital Circuits

1. Realization of Logic functions using gates
2. Realization of Adders and Subtractors
3. Realization of Logic functions using Multiplexers
4. Design of 2 to 4 decoder and full adder circuit using 3 to 8 Decoder
5. Design and Verify the functionality of all Flip-Flops
6. Realization of 4-bit binary and Decade counters.
7. Realization of Shift registers.

Part B: Digital IC Applications

8. Verify the function of D and JK Flip-flops 7474,7483.
9. Design a Decade Counter using FFs and verify the IC 7490.
10. Verify the Universal shift registers 74194/195
11. Design 3-8 decoder using logic gates and verify the function of 74138.
12. Design 4- bit Comparator and verify the function of IC 7485.

13. Design 4x1 multiplexer using gates and implement 8x1 multiplexer using ICs.
14. Verify the 8X1 Multiplexer IC74151 and 2X4 De-multiplexer IC74155.

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Design and Verify the Boolean functions and various combinational logic circuits.
CO 2	:	Design and implement the various synchronous sequential logic circuits.
CO 3	:	Design and verify the Asynchronous circuits of any size and shift registers of specific length using Digital ICs.
CO 4	:	Analyze and design combinational circuits using Digital ICs.
CO 5	:	Design sequential circuits using Digital ICs.

66283

TRANSDUCERS AND INSTRUMENTATION LAB-II

(EIE)

Instruction	:	3 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	1.5	End Exam Duration	:	3 Hours

Course Objectives:

1. To identify different transducers to measure physical and electrical Parameters.

2. To understand the control operation in the industry.

3. To measure the different physical and electrical parameters in a plant.

List of experiments:

1. Measurement of linear displacement using LVDT.
2. Study of capacitive transducers.
3. Acceleration transducer-characteristics
4. Piezo electric transducers-characteristics.
5. Displacement measurement using inductive pickup
6. Displacement measurement using capacitive pickup
7. Water Level measurement using capacitive transducer
8. Speed (RPM) measurement using stroboscope
9. Conversion of Current(I) to Pressure (P) and Pressure (P) to Current(I) using P to I and I to P converters.
10. Humidity measurement
11. Flow Measurement using flow meter
12. RLC and Q measurement using Q-meter

Course Outcomes: At the end of the course, student will be able to

CO 1	:	Gain knowledge in identifying the various instruments used to measure physical Parameters.
CO 2	:	Acquire confidence using capacitive and inductive transducers for displacement measurement.
CO 3	:	Perform piezoelectric method of force and acceleration measurement.
CO 4	:	Understand the control operation in the industry.
CO 5	:	Measure the different Physical and electrical parameters in a plant.

68281

VERBAL ABILITY LAB

(Common to all)

Instruction	:	2 Periods / week	Sessional Marks	:	30
			End Examination	:	70 Marks
Credits	:	1	End Exam Duration	:	3 Hours

Course Objectives:

1. Students will be trained to become proficient in word formation, spellings, and vocabulary.
2. Students will develop linguistic competence through appropriate use of Idioms and Phrasal verbs.
3. Students will develop verbal reasoning through Verbal Analogy.
4. Students will be trained to identify the common errors in English and write grammatically correct sentences.
5. Students will develop professional writing skills through business letters.

The students will be given exercises covering the following topics:

1. Word Formation
2. Spelling
3. Synonyms and Antonyms
4. Homonyms, Homophones and Homographs
5. Collocations
6. One word substitutes
7. Idiomatic expressions
8. Phrasal Verbs
9. Verbal Analogy
10. Sentences
    a. Rearranging jumbled words to make meaningful sentences
    b. Identifying errors in sentences
    c. Correction of sentences
    d. Improvement of sentences
11. Writing Skills
    a. Paragraph writing (different kinds of paragraph writing)
    b. Essay writing
    c. Business Letter writing

The students will be tested on the use and application of all the topics mentioned in the syllabus in addition to their basic conceptual understanding.

Course Outcomes:

CO 1	:	Students will be empowered in English language skills and meet the demands of the global work environment.
CO 2	:	Students will have enriched vocabulary.
CO 3	:	Students will be proficient in answering reasoning based questions.
CO 4	:	Students will develop the ability to write grammatically correct sentences.
CO 5	:	Students will enhance their professional writing skills through business letters.

References:

1. Objective English, Edgar Thorpe & Showick Thorpe, S.Chand & Co., 2011.
2. A Modern Approach to Verbal Reasoning, R. S. Aggarwal, S.Chand & Co., 2011.
3. Barron's Essential Words for GRE, Philip Geer, Barron's Educational Series, 2011.
4. How to prepare for Verbal Ability and Reading Comprehension for the CAT, Arun Sharma and Meenakshi Upadhyay, Tata McGraw-Hill, 2011.
5. Word Power Made Easy, Norman Lewis, Goyal publishers & Distributors, 2011.
6. English Vocabulary in Use Advanced, Michael McCarthy, Cambridge University Press, 2008.

68282

GENDER SENSITIZATION

(Common to All Branches)

Instruction	:	1 Periods/week	Sessional Marks	:	100
Credits	:	0			

Course Objectives:

1. To develop student's sensibility with regard to issue of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.
6. To expose students to more egalitarian interactions between men and women.

Unit I – Understanding Gender:

Gender: Why Should We Study It? **(Towards a World of Equals: Unit -1)**
Socialization: Making Women, Making Men **(Towards a World of Equals: Unit -2)**
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.
Just Relationships: Being Together as Equals **(Towards a World of Equals: Unit-12)**
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters.
Mothers and Fathers. Further Reading: Rosa Parks- The Brave Heart.

Unit II - Gender and Biology:

Mission Women: Sex Selection and Its Consequences **(Towards a World of Equals: Unit-4)**
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary **(Towards a World of Equals: Unit-10)**
Two or Many? Struggles with Discrimination.
Additional Reading: Our Bodies, Our Health **(Towards a World of Equals: Unit-13)**

Unit III - Gender and Labour:
Housework: the Invisible Labour**(Towards a World of Equals: Unit-3)**
"My Mother doesn't Work." "Share the Load".
Women's Work: Its Politics and Economics **(Towards a World of Equals: Unit-7)**
Fact and Fiction. Unrecognized and Unaccounted work. Further Reading: Wages and Conditions of Work.

Unit IV - Issues of Violence:

Sexual Harassment: Say No! **(Towards a World of Equals: Unit-6**)
Sexual Harassment, not Eve-teasing-Coping with Everyday Harassment-Further Reading: " Chupulu"
Domestic Violence: SpeakingOut (Towards a World of Equals: Unit-8)
Is Home a Safe Place? When Women Unite (Film). Rebuilding Lives. Further Reading: New Forums for justice.
Thinking about Sexual Violence (Towards a World of Equals: Unit-11)
Blaming the Victim – "Fought for my life…"-Further Reading: The Caste Face of Violence.

Unit V - Gender Studies:

Knowledge: Through the Lens of Gender (Towards a World of Equals: Unit-5)
Point of View. Gender and the Structure of Knowledge. Further Reading: Unacknowledged Women Artists of Telangana.
Whose History? Questions for Historians and Others (Towards a World of Equals: Unit-9)
Reclaiming a Past. Writing other Histories. Further Reading: Missing Pages from Modern Telangana History.

Essential Reading: All the Units in the Textbook, "Towards a World of Equals: A Bilingual Textbook on Gender" written by A.Suneetha, Uma Bhrugubanada, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, GoguShyamala, Deepa Sreenivas and Susie Tharu.

Note: Since it is interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field.

Course Outcomes: At the end of the Course student will be able to:

CO 1: Students will have developed a better understanding of important issues related to gender in contemporary India.
CO 2: Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
CO 3: Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
CO 4: Students will acquire insight into the gendered division of labour and its relation to politics and economics.
CO 5: Men and women students and professionals will be better equipped to work and live together as equals.
CO 6: Students will develop a sense of appreciation of women in all walks of life
CO 7: Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Text Books:

1. Sen, Amartya. "More than One Million Women are Missing. "New York Review of Books 37.20 (20 December 1990). Print "We Were Making History……." Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women, 1989
2. TriptiLahiri. "By the Numbers: Where Indian Women Work." Women's Studies Journal (14 November 2012) Available online at: http://blogs.wsj.com/India real time/2012/11/14by-thenumbers- where-Indian-women-work
3. K. Satyanarayana and Susie Tharu (Ed.) Steel Nibs Are Sprouting: New Dalit Writing From South India, Dossier 2: Telugu and Kannada http://harpercollins.co.in/ BookDetail.asp?Book Code=3732 4. Vimala. "Vantillu (The Kitchen)". Women Writing in India: 600 BC to the Present. Volume II: The 20th Century. Ed. Susie Tharu and K. Lalitha. Delhi: Oxford University Press, 1995. 599- 601.
4. Shatrughna, Veena et al. Women's Work and its Impact on Child Helath and Nutrition, Hyderabad, National Institute of Nutrition, Indian Council of Medical Research. 1993.
5. Stree Shakti Sanghatana. "We Were Making Histroy…", Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women, 1989.

6. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
7. Jayaprabha, A. "Chupulu (stares)". Women Writing in India: 600 BC to the Present. Volume II: The 20th Century Ed. Susie Tharu and K. Lalitha. Delhi: Oxford University Press, 1995. 596-597.
8. Javeed, Shayan and Anupam Manuhaar. "Women and Wage Discrimination in India: A Critical Analysis." International Journal of Humanities and Social Science Invention 2.4 (2013)
9. Gautam, Liela and Gita Ramaswamy. "A'conversation' between a Daughter and a Mother." Broadsheet on Contemporary Politics. Special Issue on Sexuality and Harassment: Gender Politics on Campus Today. Ed.Madhumeeta Sinha and Asma Rasheed. Hyderabad: Anveshi Research Center for Women's Studies, 2014.
10. Abdulali Sohaila. "I Fought For My Life… and Won." Available online at: http://www.thealternative.in/lifestyle/i-fought-formy-lifeand-wonsohaila-abhulal/
11. Jeganathan Pradeep, Partha Chatterjee (Ed). "Community, Gender and Violence Subaltern Studies XI". Permanent Black and Ravi Dayal Publishers, New Delhi, 2000.
12. K. Kapadia. The Violence of Development: The Politics of Identity, Gender and Social Inequalities in India. London: Zed Books, 2002.
13. S. Benhabib. Situating the Self: Gender, Community, and Postmodernism in Contemporary Ethics, London: Rout ledge, 1992.
14. Virginia Woolf. A Room of One's Own. Oxford: Black Swan. 1992.
15. T. Banuri and M. Mahmood, Just Development: Beyond Adjustment with a Human Face, Karachi: Oxford University Press, 1997.

ACADEMIC REGULATIONS
COURSE STRUCTURE
&
SYLLABUS

R18 REGULATIONS
CHOICE BASED CREDIT SYSTEM (CBCS)

B.Tech. 3rd year (from 2020-21)

B.Tech. 4th year (from 2021-22)

ELECTRONICS AND INSTRUMENTATION ENGINEERING

Applicable for the batches admitted in First year from 2018-19 onwards

CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution with NAAC 'A' Grade

(Approved by AICTE & Govt. of Telangana and
Affiliated to JNT University Hyderabad)
Vastunagar, Mangalpalli (V), Ibrahimpatan (M)
R.R. Dist, Pin – 501 510

CVR COLLEGE OF ENGINEERING

VISION

- To be a state of the art institution of engineering in pursuit of excellence, in the service of society

MISSION

- To excel in providing quality education at under graduate and graduate levels
- To encourage research and innovation
- To provide infrastructure and facilities to meet the latest technological needs
- To establish Centres of Excellence through active interaction with industry
- To nurture students towards holistic development with human values and ethics

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

VISION

- To turn out state of the art technologists in the area of Instrumentation engineering capable of meeting the challenging the needs of industry in instrumentation and to create a ‘centre of excellence’ in Virtual Instrumentation.

MISSION

- To provide the right blend of theory and practice thereby enabling students to become ‘true professionals’ with high ethical values.
- To provide high quality education which allows students to realize their aspiration and potential.
- To advance knowledge, create passion for learning, foster innovation and nurture talents towards serving the society and country.
- To pursue research and consultancy service and provide the necessary rubric for SME’s (Small Medium Enterprise’s) development.
- Holistic development of the students and staff – The first and foremost mission.

B. Tech ELECTRONICS AND INSTRUMENTATION ENGINEERING

Program Educational Objectives (PEO's)

PEO's are broad statements for the Electronics and Instrumentation Engineering Department that describe the Career and Professional accomplishments that the program is preparing graduates to achieve.

- PEO1: Preparation: The graduates of the four year B.Tech in Electronics & Instrumentation Engineering will be prepared for successful careers in technical field that meet the needs of Indian and International companies.
- PEO2: Technical Competence: The graduates of the programme will be trained to meet the technology by making them strong in engineering fundamentals and technical concepts of industrial approach.
- PEO3: Knowledge Breadth: The graduates of the programme will be developed to acquire knowledge, and analyze the reality, automate and create innovative projects to frame solutions for real life problems.
- PEO4: Professional Capabilities: The graduates of the programme will be inculcated with strong professional and ethical attitude so that they are enriched with good communication skills thereby making them multi dimensionally work effective.
- PEO5: Learning Environment: The graduates of the programme will be in a position to identify the professional issues related with instrumentation engineering and help them to work successfully in teams and creating an Industrial Learning Environment.

Program Outcomes: On completion of the four year B.Tech programme in EIE, the Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

- PSO 1: Ability to analyze and design complex projects in the field of Electronics & Instrumentation.
- PSO 2: To design and develop innovative prototypes related to product which meets real life problems.
- PSO 3: Design high end Automation products using the knowledge and concepts of Electronics & Instrumentation.
- PSO 4: To pursue higher education and research in multi-disciplinary domain.

CVR COLLEGE OF ENGINEERING

Vastunagar, Mangalpalli, Ibrahimpatan – 501 510

ACADEMIC REGULATIONS – 2018 (R18 Regulations)
B.Tech. PROGRAMMES
(Effective for the students admitted into I-year from the Academic Year 2018-19 onwards)

1.0 Under - Graduate Degree Programme in Engineering & Technology (B.Tech: Under Graduate Programme (UGP) in Engineering & Technology (E&T))

CVR College of Engineering is an autonomous institution under the University Grants Commission, affiliated to Jawaharlal Nehru Technological University, Hyderabad. The College offers 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Programme, under R18 Regulations with **Choice Based Credit System (CBCS**) with effect from the Academic Year 2018-19 onwards, in the following Branches of Engineering:

Table-1

Sl. No.	Branch
I.	Civil Engineering
II.	Computer Science and Engineering
III.	Computer Science and Information Technology *
IV.	Electronics and Communication Engineering
V.	Electrical and Electronics Engineering
VI.	Electronics & Instrumentation Engineering
VII.	Information Technology
VIII.	Mechanical Engineering

*** From the Academic Year 2019-20 onwards**

2.0 Eligibility for Admissions

2.1 Category - A (70% of the sanctioned seats):

Admission to the UGP under Category – A are made by the Convener TS EAMCET on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test TS EAMCET conducted by Telangana State Government.

2.2 Category – B (30% of the sanctioned seats):

Admissions to the UGP under Category – B are made by the Management of the College and ratified by Telangana State Council of Higher Education (TSCHE) based on the merit rank of TS EAMCET / Marks in the Qualifying examination (Intermediate / Class XII) as prescribed in relevant G.Os. from time to time.

2.3 The medium of instruction for the entire UGP in E & T will be in **ENGLISH** only:

3.0 B.Tech. Programme (UGP) Structure

3.1 The B.Tech. Programmes of CVR College of Engineering are of Semester Pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/AICTE/JNTUH specified Definitions/Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are as listed below:

3.2.1 Semester Scheme

Each UGP is of 4 Academic Years (8 Semesters), with the year being divided into two Semesters of 22 weeks ($\geq$ 90 working days) each, each Semester having - 'Continuous Internal Evaluation (**CIE**)' and 'Semester End Examination (**SEE**)'. Choice Based Credit System (**CBCS**) and Credit Based Semester System (**CBSS**) as denoted by UGC, and Curriculum / Course Structure as suggested by the AICTE (Model Curriculum -2018) are followed.

3.2.2 Credit Courses

All Subjects / Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject / Course in a L:T:P:C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) Structure, based on the following general pattern:

1 Hour Lecture/Theory course per week (L)	1 credit
1 Hour Tutorial per week (T)	1 credit
1 Hour Practical/Laboratory course per week (P) 2 Hours Practical/ Laboratory course per week (P)	0.5 credit 1 credit

Other student activities like NCC, NSS, NSO, Study Tour, Guest Lecture etc., and identified Mandatory Courses will not carry Credits.

3.2.3 Subject/ Course Classification

All Subjects/ Courses offered for the UGP are broadly classified as:

(a) Foundation Courses (b) Core Courses and

(c) Elective Courses.

Foundation Courses are further categorized as:

(i) HS (Humanities and Social Sciences)
(ii) BS (Basic Sciences)
(iii) ES (Engineering Sciences)

Core Courses and Elective Courses are categorized as

(i) PC (Professional/ Departmental Core) Subjects
(ii) PE (Professional/ Departmental Electives)

(iii) OE (Open Electives)

(iv) Project Work (PC); Industry Oriented Mini-Project (PC)/Technical Seminar (PC)

(v) Minor Courses (1 or 2 Credit Courses, belonging to HS/BS/ES/PC as per relevance) such as Skill Development Courses of 1 Credit each

(vi) Mandatory Courses (MC - non-credit)

3.2.4 Course Nomenclature

The Curriculum Nomenclature or Course-Structure Grouping for each of the UGP E&T (B.Tech. Degree Programmes), is as listed below (along with AICTE specified % Range of Total Credits):

Table-2

S. No.	***Broad Course Classification***	***Course Group/ Category***	***Course Description***	***Range of Credits***
1	**Foundation Courses**	**BS – Basic Sciences**	Includes - Mathematics, Statistics, Physics and Chemistry Subjects	**10-15%**
2		**ES - Engineering Sciences**	Includes fundamental engineering subjects including Workshop, Drawing, basics of Electrical/ Electronics/Computers, etc.	**15-20%**
3		**HS – Humanities and Social Sciences**	Includes subjects related to Humanities, Social Sciences and Management	**10-12%**
4	**Core Courses**	**PC – Professional Core Courses**	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engineering	**35-45%**
5	**Elective Courses**	**PE – Professional Electives**	Includes Elective subjects related to the Parent Discipline/ Department/ Branch of Engineering	**9-12%**
6		**OE – Open Electives**	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline / Department / Branch of Engineering	**6-12%**
7	**Core Courses**	**Project Work**	B.Tech. Project or UG Project or UG Major Project	**10%**
8		**Industry Oriented Mini-Project**	Mini-Project	
9		**Technical Seminar**	Technical Seminar based on core contents related to Parent Discipline / Department / Branch of Engineering	
10	**Minor Courses**	**Skill Development Courses/Value Added Courses**	1 or 2 Credit Courses (subset of HS)	**Included**
11	**Mandatory Courses**	**MC** **Induction Programme (3 weeks' duration)@**	Non-credit	**-**
Total Credits for UGP (B. Tech.) Programme				**160 (100%)**

3.2.5 [@]Induction Programme (Mandatory)

An Induction Programme (3 weeks' duration) as per the guidelines given by the AICTE at the beginning of the first semester of first year, as presented in the Course Structure.

4.0 Course Work

4.1 A student, after securing admission, shall pursue the B.Tech. UGP in a minimum period of 4 Academic Years, and a maximum period of 8 Academic Years (starting from the Date of Commencement of I Year).

4.1.1 After eight academic years of course study, a candidate is permitted to write the end examinations for the immediately following **two** years.

4.2 Each student shall register for and secure the specified number of Credits required for the completion of the UGP and Award of the B.Tech. Degree in the respective Branch of Engineering.

4.3 Each Semester is structured to provide about 20 Credits totaling to **160** Credits for the entire B.Tech Programme.

4.4 Students who fail to fulfill all the academic requirements for the award of the degree within **ten** academic years from the year of their admission shall forfeit their seats in B. Tech course.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him about the UGP, its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

5.2 Academic Section of the College invites filled 'Registration Forms' from students apriori (before the beginning of the Semester), through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

5.3 A student can apply for ON-LINE Registration ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of the Department (a copy of the same being retained by the Head of the Department, Faculty Advisor and the Student).

5.4 A student may be permitted from III year I semester onwards to Register for Subjects/ Courses of CHOICE with a typical total of 20 Credits per Semester (Minimum being 17 C and Maximum being 23 C, permitted deviation being ± 14%), based on his /her PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses, in the Department Course Structure and Syllabus contents. However, a MINIMUM Credits assigned per Semester must be registered to ensure the 'STUDENTSHIP' in any Semester.

5.5 Choice for 'additional Subjects /Courses' to reach the Maximum Permissible Limit of 23 Credits (above the typical 20 Credit norm) must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/ Counselor.

5.6 If the student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject (s) /Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject / Course in that Category will be taken into consideration.

5.7 Subject / Course Options exercised through ON-LINE Registration are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices will not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within the **FIRST WEEK** from the commencement of Class-work for that Semester.

5.8 Dropping of Subjects / Courses may be permitted, ONLY AFTER obtaining prior approval from the Head of the Department(subject to retaining minimum Credits), 'within 15 Days of Time' from the beginning of the current Semester.

5.9 For Courses like NCC/NSS/NSO etc., a 'Satisfactory Participation Certificate' from the concerned authorities for the relevant Semester is essential. No Marks or Grades or Credits shall be awarded for these activities.

6.0 Subjects/ Courses to be offered

6.1 A typical Section (or Class) Strength for each Semester shall be 60.

6.2 A Subject/ Course may be offered to the students, ONLY IF a Minimum of 20 Students (1/3 of the Section Strength) opt for the same. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

6.3 More than ONE TEACHER may offer the SAME SUBJECT (Laboratory/ Practical classes may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection of students will be based on - 'FIRST COME FIRST SERVED Basis and CGPA Criterion'(i.e., the first focus shall be on early ON-LINE ENTRY from the student for Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).

6.4 In cases of more Registration for a subject, the concerned Head of the Department shall decide whether to offer such a Subject / Course for TWO (or multiple) SECTIONS or NOT.

6.5 In case options are received from students of other Departments / Branches / Disciplines (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the 'Parent Department' first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the Semester End Examinations, if he acquires a minimum of 75% of attendance in aggregate of all the Subjects/ Courses (excluding Mandatory or Non-Credit Courses) of that Semester.

7.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each Semester may be granted by the College Academic Committee on genuine and valid grounds, based on the student's representation with supporting evidence.

7.3 A stipulated fees shall be payable towards condonation of shortage of attendance.

7.4 Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

7.5 Students whose shortage of attendance is not condoned in any Semester are not eligible to take their End Examinations of that Semester. They are detained and their registration for that Semester shall stand cancelled. They will not be promoted to the next Semester. They may seek re-registration for all those Subjects registered in that Semester in which they are detained, by seeking re-admission to that Semester as and when offered; in case there are any Professional Electives and/ or Open Electives, the same may also be re-registered if offered; however, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the SAME set of Elective Subjects offered under that category.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Item No.**7.**

8.1 A student is evaluated in each course for 100 marks (30 internal and 70 external; details in Item 9). A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 35% marks (25 out of 70 marks) in the Semester End Examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing **P** Grade or above in that Subject/ Course.

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to Industry Oriented Mini-Project/ Seminar, if he secures not less than 40% of the total marks (40 marks) to be awarded for each. The student would be treated as failed, if he (i) does not submit a report on his Industry Oriented Mini-Project, or does not make a presentation of the same before the Evaluation Committee as per schedule, or (ii) does not present the Seminar as required in the IV year I Semester, or (iii) secures less than 40% of marks (40 marks) in Industry Oriented Mini-Project / Seminar evaluations.
He may reappear for each of the above evaluations when they are scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent Semester, as and when it is scheduled.

8.3 Promotion Rules:

Credits required for Promotion from I to II year

- A student will not be promoted from I year to II year unless he fulfills the academic requirement of securing 50% of total credits of I year from all the examinations and secures prescribed minimum attendance.

8.4 Credits required for Promotion from II to III year

- A student will not be promoted from II year to III year unless he fulfills the academic requirement of securing 60% of the credits up to II year I semester or 60% credits up to II year II semester, from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester, irrespective of number of credits registered.

8.5 Credits required for Promotion from III to IV year

- A student shall be promoted from III year to IV year only if he fulfills the academic requirement of securing 60 % of the credits up to III year I semester or credits upto III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester, irrespective of number of credits registered.

- A student shall register and put up minimum attendance in all **160** credits and earn all **160** credits.

- A Student who fails to earn **160** credits as indicated in the Course Structure within ten academic years (8 years of study + 2 years additionally for appearing for exams only) from the year of his admission, shall forfeit his seat in B.Tech. course and his admission stands cancelled.

NB: In case the total number of credits is a mixed number with decimals, the number of credits considered for promotion is rounded off to the nearest lower integer.

The above promotion rule is furnished below in tabulated form.

Promotion **From** **To**	**Credits to be considered**
1st year to 2nd year	50% of the credits of 1st year (1st and 2nd semester)
2nd year to 3rd year	a) 60% of the credits upto 2nd year 1st semester (1, 2 & 3 semesters) **or** b) 60% of the credits upto 2nd year 2nd semester (1, 2, 3 & 4 semesters) (Irrespective of number of credits registered)
3rd year to 4th year	a) 60% of the credits upto 3rd year 1st semester (1, 2, 3, 4 & 5 semesters) **or** b) 60% of the credits upto 3rd year 2nd semester (1, 2, 3, 4, 5 & 6 semesters) (Irrespective of number of credits registered)

8.6 A student shall register for all Subjects covering **160** Credits as specified and listed (with the relevant Course/Subject Classifications as mentioned) in the Course Structure, put up all the Attendance and Academic requirements for **160** Credits securing a minimum of **P** Grade (Pass Grade) or above in each Subject, and earn all **160** credits securing SGPA $\geq$ 5.0 (in each Semester), and CGPA (at the end of each successive Semester) $\geq$ 5.0, to successfully complete the B.Tech. Programme.

8.7 If a student registers for some more 'extra Subjects' (in the parent Department or other Departments/Branches of Engineering) other than those listed Subjects totaling to **160** Credits as specified in the Course Structure of the Department, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required **160** Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 7 and 8.1 – 8.6 above.

8.8 When a student is detained due to shortage of attendance in any Semester, he may be **re-admitted** into that Semester, as and when offered, with the Academic Regulations of the Batch into which he was first admitted. However if the batch of students of the class falls under the next Scheme of regulations, the student readmitted will be considered under the new scheme. However, no Grade Allotments or SGPA/ CGPA calculations will be done for that entire Semester in which he was detained.

8.9 When a Student is detained due to lack of Credits in any year, he may be readmitted in the next year, after fulfillment of the Academic Requirements, with the Academic Regulations of the Batch into which he was first admitted. However if the batch of students of the class falls under the next Scheme of regulations, the student readmitted will be considered under the new scheme.

8.10 A student eligible to appear in the Semester End Examination in any Subject/ Course, but absent at it or failed (thereby failing to secure **P** Grade or above), may reappear for that Subject/ Course in the supplementary examination (SEE) as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/Course will be carried over, and added to the Marks obtained in the SEE supplementary examination, for evaluating his performance in that Subject.

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory or Practicals or Seminar or Drawing/Design or Industry Oriented Mini-Project or Minor Course or Project Work or Skill Development/ Value Added Courses. These evaluations shall be based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination), and a Letter Grade corresponding to the % of marks obtained shall be awarded.

9.2 For all Subjects/Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE.

9.3 Distribution and Weightage of Credits

Type of Subject	Semester	
	Period/Week	Credits
Theory	03	03
Practicals	02/03	1.0/1.5
Drawing Subjects: Engineering Drawing/Graphics Machine Drawing	 05 (2T+3P) 04(1T+3P)	 3.5 2.5
Minor Theory	02/03	01/1.5
Minor Courses	02	01
Industry Oriented Mini Project	--	02
Technical Seminar	02	01
Project work	20	10

9.3.1. Theory Subjects

Theory subjects are allotted 2 or 3 credits. The distribution shall be 30 marks for internal evaluation and 70 marks for the end examination.

There shall be two midterm internal examinations. The syllabus for the mid examination will be the first 2.5 units for the first mid examination and the remaining 2.5 units for the second mid examination.

The midterm internal marks for theory subjects are to be scaled to a maximum of 20 marks. 8 marks are allotted for assignments and 2 marks for attendance of 75% or greater. There shall be one assignment to be submitted and evaluated before each mid exam. Total internal evaluation marks is therefore 30.

The first Mid-term examination Marks and first assignment marks shall make one set of CIE Marks and the second Mid-term examination marks and second assignment marks shall make second set of CIE marks. Average of these two sets of CIE marks will be taken as the final marks secured by each candidate.

The duration of mid examination is for theory subjects 2 hours.

The duration of end examination for theory subjects is 3 hours.

9.3.2. Substitution Test

- If any candidate is absent for any theory or minor theory subject in a mid examination or both mid examinations, a substitution test covering the entire syllabus of the subject will be conducted on payment of prescribed fees before the commencement of the semester end examinations. Prior permission is to be taken from the concerned Head of the Department for writing substitution tests.

- If a candidate has missed both the mid examinations, then the marks scored in the substitution test will be halved and accordingly recorded.

9.4 Practical Subjects

For practical subjects the distribution shall be 30 marks for internal evaluation and 70 marks for the semester end examination. Out of the 30 marks allotted for internal evaluation, day-to-day work in the laboratory shall be evaluated for 20 marks and internal practical / internal drawing examination for 10 marks. Internal examinations shall be conducted by the concerned teacher with the help of any other faculty member of the department.

The end examination for practical subjects shall be conducted with an external examiner and laboratory teacher specified by the Head of the Department concerned.

The duration of end examination for practical subjects is 3 hours.

External Examiner shall be appointed by the Dean-Academics on the recommendation of the Chairman, Board of Studies of the concerned department. External examiner can be a teacher from outside the college or a teacher of the college who was not associated with the day-to-day class work of that laboratory.

The end examination in the subject of Drawing will be conducted along with the examinations of theory subjects.

9.5 Drawing Subjects

Drawing subjects are allotted marks as in theory subjects: 30 marks for internal evaluation and 70 marks for the end examination. Out of the 30 marks allotted for internal evaluation, day-to-day practice shall be evaluated for 20 marks, internal drawing examinations for 10 marks.

9.6 Electives

Departmental Electives include subjects related to the parent discipline, department or branch of engineering.

Interdisciplinary Electives include subjects offered by a department or branch of engineering to other departments or branches of engineering.

Open Electives are subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline or branch of engineering, that do not require a prerequisite course.

However, students **cannot opt** for an open elective subject offered by their own department, if it is already listed under core / elective subjects offered by that department, in any semester.

9.7 Skill Development Courses

Skill Development Courses are allotted 1 credit. The distribution of marks shall be 30 marks for internal evaluation and 70 marks for the end examination.

The end examination shall be conducted by examiners specified by the Head of the Department.

The end examination duration for Skill Development Courses is 3 hours.

9.8 Industry-Oriented Mini-Project

An industry-oriented mini-project in collaboration with an industry related to specialization of the department is to be taken up during the vacation following III year II semester examinations. The mini project work shall be submitted in report form to the Head of the Department concerned within the first two weeks of commencement of classes of IV year I semester. The marks allotted for Industry Oriented Mini Project is 100 (30 internal + 70 external). The Mini Project is to be presented in a seminar which will be evaluated by a committee for 30 marks. The committee consists of the Head of the Department, supervisor of the mini project and a senior faculty member of the department.

The external examination (viva-voce) for Mini Project shall be conducted by a committee consisting of an external examiner and an internal examiner nominated by the Head of the Department, for 70 marks. This examination is to be scheduled along with the laboratory exams of IV year I semester.

External examiner shall be appointed by the **Dean-Academics** on the recommendations of the Chairman, Board of Studies of the department. External examiner must be a teacher from outside the college.

9.9 Technical Seminar

A student shall present a technical seminar in IV year II semester. For the seminar, the student shall collect information on a specialized topic and present the same. The student will also have to submit a technical report to the department showing his / her understanding of the topic. The seminar presentation and the report shall be evaluated for 100 marks by a departmental committee consisting of the Head of the Department, seminar supervisor and a senior faculty member. There shall be **no external** examiner for technical seminar.

9.10 Project Work

Each Student shall start the Project Work during the IV Year I Semester, as per the instructions of the Project Guide/ Supervisor assigned by the Head of the Department. Out of a total of 100 marks allotted for the Project Work, 30 marks shall be for CIE (Continuous Internal Evaluation) and 70 marks for the SEE (Semester End Viva-Voce Examination). The Project Viva-Voce shall be conducted by a Committee comprising of an External Examiner, Head of the Department and Project Supervisor. Out of 30 marks allocated for CIE, 15 marks shall be awarded by the Project Supervisor (based on the continuous evaluation of student's performance throughout the Project Work period), and the other 15 marks shall be awarded by a Departmental Committee consisting of Head of the Department and Project Supervisor, based on the work carried out and the presentation made by the student and internal Viva-Voce examination.

External examiner shall be appointed by the **Dean-Academics** on the recommendations of the Chairman, Board of Studies of the concerned department. External examiner must be a teacher from outside the college.

9.11 Laboratory examination marks / sessional marks awarded by the examiners are subject to scrutiny and scaling by the Results Committee wherever necessary. The committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the committee are final and binding.

9.12 For NCC / NSS / NSO type of Courses, and/or any other Mandatory Non-Credit Course offered in a Semester, a 'Satisfactory Participation Certificate' shall be issued to the student from the concerned authorities, only after securing ≥ 65% attendance in such a Course. No marks or Letter Grade shall be allotted for these activities.

10.0 Grading Procedure

10.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 9 above, and a corresponding Letter Grade shall be awarded as in Item **10.2**.

10.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed.

% of Marks Secured (Class Intervals)	***Letter Grade (UGC Guidelines)***	***Grade Points***
90% and above (≥ 90% , ≤ 100%)	S **(Outstanding)**	**10**
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ **(Excellent)**	**9**
Below 80% but not less than 70% (≥ 70% , < 80%)	A **(Very Good)**	**8**
Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ **(Good)**	**7**
Below 60% but not less than 50% (≥ 50% , < 60%)	B **(Average)**	**6**
Below 50% but not less than 40% (≥ 40% , < 50%)	P **(Pass)**	**5**
Below 40% (< 40%)	F **(FAIL)**	**0**
Absent for the Examination	**Ab (Absent)**	**0**

10.3 A student obtaining **F** Grade in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

10.4 A Letter Grade does not imply any specific % of Marks.

10.5 A student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, he has to repeat all the Subjects/ Courses pertaining to that Semester, when he is detained (as listed in Items 8.9 - 8.10).

10.6 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits for a Course

10.7 The student passes the Subject/ Course only when he gets GP $\geq$ 5 (**P** Grade or above).

10.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

SGPA = { $\sum_{i=1}^{N} C_i\ G_i$ } / { $\sum_{i=1}^{N} C_i$ } .... for each Semester,

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the number of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the ith Subject and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for the ith Subject.

10.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

CGPA = { $\sum_{j=1}^{M} C_j\ G_j$ } / { $\sum_{j=1}^{M} C_j$ } ... for all S Semesters Registered (i.e., up to and inclusive of S Semesters, S$\geq$ 2),

where 'M' is the TOTAL number of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1^{st} Semester onwards up to and inclusive of the Semester S (obviously M>N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the number of Credits allotted to the jth-Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for the j^{th} Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

10.10 For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used.

10.11 For Calculations listed in Item 10.6 – 10.10, performance in failed Subjects / Courses (securing **F** Grade) will not be taken into account. Mandatory Courses with no credits will not be taken into consideration for calculation of SGPA/CGPA.

10.12 Passing Standards

10.12.1 A student shall be declared successful or 'passed' in a Semester, only when he gets a SGPA $\geq$ 5.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UGP, only when he gets a CGPA $\geq$ 5.00; subject to the condition that he secures a GP $\geq$ 5 (**P** Grade or above) in every registered Subject/ Course in each Semester (during the entire UGP) for the Degree Award, as required.

10.12.2 In spite of securing **P** Grade or above in some Subjects/Courses in any Semester, if a Student receives a SGPA<5.00 and/ or CGPA<5.00 at the end of such a Semester, then he 'may be allowed' to go into the next subsequent Semester (subject to fulfilling all other attendance and academic requirements as listed under Items 7-8).

10.12.3 A student shall be declared successful or 'passed' in any Non-Credit Subject / Course, if he secures a 'Satisfactory Participation Certificate' in that Mandatory Course.

10.13 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the Registered students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA and CGPA.

11.0 Declaration of Results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 10.6 – 10.11.

12.0 Award of Degree

12.1 A student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire UG E&T Programme (UGP), and secures the required number of **160** Credits (with CGPA ≥ 5.0), within 8 Academic Years from the Date of Commencement of the First Academic Year, shall be declared to have 'QUALIFIED' for the Award of the B.Tech. Degree in the chosen Branch of Engineering as selected at the time of Admission.

12.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of B.Tech degree he / she shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured
First Class with Distinction	≥ 7.75
First Class	6.75 ≤ CGPA < 7.75
Second Class	5.75 ≤ CGPA < 6.75
Pass Class	5.0 ≤ CGPA < 5.75

12.3 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used

% of Marks = (Final CGPA - 0.5) x 10

13.0 Withholding of Results

13.1 If the student has not paid fees to University/ College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

14.0 Transitory Regulations

14.1 Student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the Degree Programme, may be considered eligible for readmission to the same Subjects/Courses (or equivalent Subjects/Courses, as the case may be) and same Professional Electives/ Open Electives (or from set/category of Electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the Date of Commencement of his/her I-Year I-Semester). Further, the student will come under the current regulations on his re-admission but not the previous regulations under which he/she was first admitted.

14.2

a. A student seeking transfer to CVR College of Engineering from other Universities/ Institutions, after obtaining necessary permission from the State Government/ University has to pass all the subjects at the previous institution.

b. In case the student has failed in any subject, he has to take equivalent subject offered by this college and get a Pass grade. He should also obtain a Pass grade in those subjects of this college which the student has not studied at the previous institution, up to that semester when transfer was effective.

c. For such of those transferred students with backlogs, the college will provide one chance to write the internal examinations in the failed subject and/or subject not studied in the curriculum of this college.

d. Equivalent subjects will be notified by the college, based on case to case basis as received from the University. However, in case of Professional Electives and Open Electives, student has to opt for a subject among the subjects listed under each of the electives, as the case may be.

e. For the completed semesters which the student studied previously at another institution/ under a different scheme, Grade Points will be awarded as per the College rules and CGPA calculated after clearing backlogs, if any.

15.0 Student Transfers

15.1 There shall be no Branch transfers after the completion of Admission Process.

16.0 Scope

i) Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her".
ii) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".
iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.
iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor / Principal is final.
v) The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all Students with effect from the dates notified by the College Authorities.

17. Disciplinary Action for Malpractices by students in Exams

Sl. No.	Nature of Malpractices / Improper Conduct	Punishment
1. a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculator, Cell Phone, pager, palm computer, blue-tooth equipment or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he/she is appearing but has not made use of it. Material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination.	Expulsion from the examination hall and cancellation of the performance in that subject only.
b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language method or communicates through cell phone or any other communication equipment with any candidate or persons inside or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case will be registered against him / her.
2.	Has copied in the examination hall from any paper, book, programmable calculator, palm computer or by dictation from wireless means any material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester / year. The Hall Ticket of the candidate will be cancelled.
3.	*Impersonates* any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from the examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case registered against him.

4.	*Smuggles* in the Answer book or additional sheet or takes out or arranges to send out the question paper or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent / Assistant Chief Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer Incharge or any person on duty in or outside the examination hall, causes any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer Incharge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate (s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case will be registered against them.

7.	Leaves the exam hall *taking away answer script or intentionally* tears the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. Continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. The candidate will be reported to the police.
9.	If a student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clauses 6 to 8.	Student of the college is expelled from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a *drunken* condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester.

11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester examinations.
12.	If any malpractice is detected which is not included in clauses 1 to 11, it shall be reported to the Dean-Academics for further action to award suitable punishment.	As decided by Dean-Academics

III B.Tech. Electronics and Instrumentation Engineering (EIE)

I Semester Course Structure

Regulations: R18 (CBCS) Admission to I B.Tech. : 2018-19 With effect from 2020-21 Onwards

Sl. No.	Course Code	Courses	Category	Periods per Week		Credits	Scheme of Examination Maximum Marks			Page No.
				L	T/P/D		CIE (Continuous Internal Evaluation)	SEE (Semester End Examination)	Total	
1	66301	Signal Conditioning Circuits	PC	3	0	3	30	70	100	5
2	66302	Electronic Instrumentation	PC	3	0	3	30	70	100	7
3	66303	Process Control Instrumentation	PC	3	0	3	30	70	100	9
4	64304	Microprocessor and Microcontrollers	PC	3	0	3	30	70	100	11
5	64308	Digital Signal Processing and Applications	PC	3	0	3	30	70	100	13
6	66331	Process Control Instrumentation Lab	PC	0	3	1.5	30	70	100	15
7	64334	Signal Processing Lab	PC	0	2	1	30	70	100	16
8	64333	Microcontrollers Lab	PC	0	3	1.5	30	70	100	17
9	68332	Effective Technical Communication Lab	HS	0	2	1	30	70	100	18
			Total	15	10	20	270	630	900	
			Total Periods	25						
10	68302	Universal Human Values	MC	1	0	0	100	-	-	19
11	67305	Cyber Security	MC	1	0	0	100	-	-	21

Note: Lecture Hours (L), Tutorials (T), Practicals (P), Drawing (D)

HS: Humanities & Sciences BS: Basic Sciences MC: Mandatory Course

PC: Professional Core PE: Professional Elective

III B.Tech. Electronics and Instrumentation Engineering (EIE)

II Semester Course Structure

Regulations: R18 (CBCS) Admission to I B.Tech.: 2018-19 With effect from 2020-21 Onwards

Sl. No.	Course Code	Courses	Category	Periods per Week		Credits	Scheme of Examination Maximum Marks			Page No.
				L	T/P/D		CIE (Continuous Internal Evaluation)	SEE (Semester End Examination)	Total	
1	68352	Managerial Economics and Financial Analysis	HS	3	0	3	30	70	100	23
2	66351	Analytical Instrumentation	PC	3	0	3	30	70	100	25
3	66352	Virtual Instrumentation	PC	3	0	3	30	70	100	27
4		Professional Elective - I:								
	64360	Telemetry and Telecontrol	PE	3	0	3	30	70	100	29
	64361	Digital System Design								31
	66353	PC Based Instrumentation								33
5		Professional Elective - II:								
	66354	Automation of Industrial Processes	PE	3	0	3	30	70	100	35
	66355	Artifical Neural Networks								37
	67354	Computer Networks (IT)								39
6	66381	Industrial Automation Lab	PC	0	3	1.5	30	70	100	41
7	66382	Virtual Instrumentation-I & Analytical Instrumentation Lab	PC	0	3	1.5	30	70	100	42
8	68382	Advanced English Communication and Soft Skills Lab	HS	0	2	1	30	70	100	43
9	68381	Quantitative Ability Lab	BS	0	2	1	30	70	100	44
			Total	15	10	20	270	630	900	
			Total Periods	25						
10	68351	Essence of Indian Knowledge Tradition	MC	1	0	0	100	-	-	45
11	65358	Artificial Intelligence	MC	1	0	0	100	-	-	47

Service Course of III B.Tech. II Sem. B.Tech. (EIE)

Sl. No.	Course Code	Course	Branch & Category		Periods per Week		Credits	Scheme of Examination Maximum Marks			Pg. No.
					L	T/P/D		CIE (Continuous Internal Evaluation)	SEE (Semester End Examination)	Total	
1	66356	Instrumentation & Control Systems	ME	PC	3	0	3	30	70	100	48

Note: Lecture Hours (L), Tutorials (T), Practicals (P), Drawing (D)

HS: Humanities & Sciences BS: Basic Sciences MC: Mandatory Course

PC: Professional Core PE: Professional Elective

IV B.Tech. Electronics and Instrumentation Engineering (EIE)

I Semester Course Structure

Regulations: R18 (CBCS) Admission to I B.Tech: 2018-19 With effect from 2021-22 Onwards

S. No.	Course Code	Courses	Category	Periods per Week		Credits	Scheme of Examination Maximum Marks			Page No.
				L	T/P/D		CIE (Continuous Internal Evaluation)	SEE (Semester End Examination)	Total	
1	66401	Bio-Medical Instrumentation	PC	3	0	3	30	70	100	50
2	64412	VLSI Design	PC	3	0	3	30	70	100	52
3	66402	Industrial Internet of Things	PC	3	0	3	30	70	100	54
	Professional Elective - III:									
4	66403	Instrumentation Practices in Industries	PE	3	0	3	30	70	100	56
	66404	Robotics and Automation								58
	66405	Optoelectronics and Laser Instrumentation								60
5	Open Elective - I		OE	3	0	3	30	70	100	
			Laboratory Courses							
6	66435	VLSI DesignLab	PC	0	2	1	30	70	100	62
7	66431	Virtual Instrumentation-II Lab	PC	0	2	1	30	70	100	63
8	66432	Industry Oriented Mini Project	PC	0	0	2	30	70	100	
9	66433	Technical Seminar - I	PC	0	2	1	100	0	100	
			Total	15	6	20	340	560	900	
			Total Periods	21						

Service Course of IV B.Tech. I Sem. (EIE)

S. No.	Course Code	Courses	Branch & Category		Periods per Week		Credits	Scheme of Examination Maximum Marks			Pg. No.
					L	T/P/D		CIE (Continuous Internal Evaluation)	SEE (Semester End Examination)	Total	
Laboratory Course											
1	66434	Instrumentation & Control Systems Lab	ME	PC	0	2	1	30	70	100	64

Note: Lecture Hours (L), Tutorials (T), Practicals (P), Drawing (D)

PC: Professional Core OE: Open Elective ES: Engineering Sciences
PE: Professional Elective

IV B.Tech. Electronics and Instrumentation Engineering (EIE)

II Semester Course Structure

Regulations: R18 (CBCS) Admission to I B.Tech.: 2018-19 With effect from 2021-22 Onwards

Sl. No.	Course Code	Course Name	Category	Periods per Week		Credits	Scheme of Examination Maximum Marks			Page No.
				L	T/P/D		CIE (Continuous Internal Evaluation)	SEE (Semester End Examination)	Total	
1	Professional Elective - IV:									
	66451	Nanosensors & Applications	PE	3	0	3	30	70	100	65
	66452	MEMS and Applications								67
	66453	Power Plant Instrumentation								69
2	Professional Elective - V:									
	66454	SCADA & Distributed Control Systems	PE	3	0	3	30	70	100	71
	66455	Reliability Engineering								73
	64458	Embedded System Design								75
3	Open Elective - II		OE	3	0	3	30	70	100	
4	66481	Technical Seminar - II	PC	0	2	1	100	0	100	
5	66482	Major Project	PC	0	20	10	30	70	100	
			Total	9	22	20	220	280	500	
			Total Periods	31						

Note: Lecture Hours (L), Tutorials (T), Practicals (P), Drawing (D)

PC: Professional Core OE: Open Elective ES: Engineering Sciences
PE: Professional Elective

66301

SIGNAL CONDITIONING CIRCUITS
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Prerequisite subject: Transduction of Physical Variables, Analog circuits & IC Applications

Course Objectives:

1. To understand the importance of signal conditional circuit for resistive sensors.
2. To design the signal conditioning circuits for reactive sensors.
3. To acquire the knowledge in designing of signal conditioning circuit for self-generating sensors.
4. To acquire the knowledge in designing of digital & intelligent sensors.
5. To design analog and digital image & other sensors.

Unit I

Signal Conditioning for Resistive Sensors
Measurement of resistance, voltage dividers: Potentiometers, Applications to thermistors, Dynamic measurements, Amplifiers for voltage dividers. Wheatstone bridge: Balance and deflection measurements, Sensitivity and Linearity, Analog Linearization of resistivity sensor bridges, sensor bridge calibration and balance, Difference and average measurements and compensation, Power Supply of Wheatstone bridge, Detection methods. Interference: Interference types and reduction, Signal Circuit grounding, Shield Grounding, Isolation Amplifiers.

Unit II

Signal Conditioning for Reactance Variation Sensors
Problems and alternatives, ac bridges, sensitivity and linearity, capacitance bridge analog linearization, ac amplifiers and power supply decoupling, electrostatic shields and driven shields, ac/dc signal converters, fundamentals of amplitude modulation transducer, structure of carrier amplifiers & coherent detection. Specific signal conditioners for capacitive sensors, Synchro, Resolver, Synchro-to-resolver converters, Resolver-to-Digital and Digital-to-Resolver Converter.

Unit III

Signal Conditioning for Self-Generating Sensors
Low-drift Amplifiers: Offset and drifts in op amp, Auto zero amplifiers, Composite amplifiers, offset and drifts in instrumentation amplifiers, Electrometer and Transimpedance Amplifiers, Current measurement by integration, Cautions in designing electrometer circuits, Charge Amplifiers.Noise in Amplifiers: Noise fundamentals, Noise in Op amps, noise in Transimpedance amplifiers, noise in Charge amplifiers, noise in instrumentation amplifiers, Drift in fixed resistors, Drift in adjustable resistors (potentiometers), Noise in resistors.

Unit IV

Digital and Intelligent Sensors
Position encoders: Incremental position encoders, Absolute position encoders. Resonant sensors: Sensors based on quartz resonators, SAW Sensors, vibrating wire strain gages, vibrating cylinder sensors, digital flow meters. Voltage-to-frequency conversion, Direct quantity-to-frequency conversion, Direction quantity to time duration conversion, Direct Sensor Microcontroller interfacing, frequency measurement, period and time interval measurement, calculations and compensations, velocity measurements, Digital tachometers, communication systems for sensors, current telemetry, simultaneous analog and digital communications, sensor buses: Field bus, Intelligent sensors.

Unit V

Other Sensing Methods

Sensors based on Semiconductor Junctions: Thermometers based on Semiconductor Junctions, Magneto diodes, magneto transistors, photo diodes, position sensitive detectors, photo transistors, Semiconductor junction nuclear radiation detectors, sensors based on MOSEFET transistors. Charge coupled and CMOS Image Sensors: Fundamentals, Types of CCD and CMOS, Imaging sensors and Applications, fiber optics sensors: fiber optic basics, fiber optic sensor technologies and applications, Ultra sonic based sensors: fundamentals of Ultrasonic based sensors, Ultra sonic based sensing methods and applications, Biosensors.

Course Outcomes: At the end of the course, the student should be able to

CO1	:	Understand the importance of signal conditional circuit for resistive sensors.
CO2	:	Design the signal conditioning circuits for reactive sensors.
CO3	:	Acquire the knowledge in designing of signal conditioning circuit for self generating sensors.
CO4	:	Acquire the knowledge in designing of digital & intelligent sensors.
CO5	:	Design analog and digital image & other sensors.

Text Books:

1. Ramon Pallas Areny, John G. Webster,"Sensors and Signal Conditioning", 2nd Edition, John Wiley and Sons publications, 2000.
2. Hermann K P Neubert,"Instrument Transducers - An introduction to their performance and design", 2nd Edition, Oxford Publishers, 1975.

References:

1. Jon Wilson "Sensor Technology Hand Book", 1st Ed., Newne, 2004.
2. E.O. Doeblin, "Measurement system: Applications and Design",4th Revised edition McGraw-Hill Publications, 2003.
3. H.S. Kalsi "Electronic Instrumentation", 3rd Edition, McGraw-Hill, 2010.

66302

ELECTRONIC INSTRUMENTATION
(EIE)

Instruction	: 3 Periods / week	Continuous Internal Evaluation	: 30 Marks
Credits	: 3	Semester End Examination	: 70 Marks
		End Exam Duration	: 3 Hours

Prerequisite subject: Electronic Circuits-1, Transduction of Physical Variables and Signals and Systems.

Course Objectives:

1. To learn the various types of measuring Instruments.
2. To learn the principle and operation of galvanometer and its calibration.
3. To understand the measurement of resistance, inductance and capacitance.
4. To learn the basics of Electronic Instruments for Measuring Basic Parameters and oscilloscope operations and fundamentals of Function generator.
5. To know the various recorder principles and Wave analyzer.

Unit I

Types of measuring instrument

Ammeter and Voltmeter: Derivation for Deflecting Torque of PMMC, MI (attraction and repulsion types). Advantages and disadvantages. Energy meters and wattmeter: Electro-Dynamometer and Induction type wattmeter, compensation, creep, error, testing. Frequency Meters: Vibrating reed type, electrical resonance type, Power Factor Meters.

Unit II

Galvanometer & Potentiometers

Galvanometer: Construction, Theory and Principle of operation of D' Arsonval, Vibration Moving Magnet & Moving Coil types, and Ballistic Galvanometer, Calibration of Galvanometers. Measurement of Flux and Magnetic Field by using Galvanometers.

Potentiometer: Construction, Theory and Principle of operation of DC Potentiometers Crompton, Vernier, Constant Resistance, & Deflection Potentiometer, and AC Potentiometers Drysdale-Tinsley & Gall-Tinsley Potentiometer. Current Transformer and Potential Transformer: Construction, Theory, Characteristics and Testing of CTs and PTs.

Unit III

Measurement of Resistance, Inductance and Capacitance:

Resistance: Measurement of Low Resistance by Kelvin's Double Bridge, Measurement of Medium Resistance, Measurement of High Resistance, Measurement of Resistance of Insulating Materials, Portable Resistance Testing set Megohmmeter.

Inductance: Measurement of Self Inductance by Ammeter and Voltmeter, and AC Bridges Maxwell's, Hay's, & Anderson Bridge.

Capacitance: Measurement of Capacitance by Ammeter and Voltmeter method and AC Bridges Owen's,Schering & Wien's Bridge. Screening of Bridge Components and Wagner Earthing Device.

Unit IV

Electronic Instruments for Measuring Amplitude, Frequency and Phase

Amplified DC Meters, AC Voltmeters using Rectifiers, True RMS Voltmeter, Considerations for choosing an Analog Voltmeter, Digital Voltmeters Block Diagrams only. Oscilloscopes: Introduction, Block Diagram, Vertical amplifier, Horizontal Deflection system, Oscilloscope CRT, Electro static deflection system, Lissajous patterns, General purpose oscilloscopes, sampling oscilloscopes. Measurement of Frequency, Phase Angle, and Time Delay using Oscilloscope. Function Generator: Basics operating principle and parameter settings.

Unit V

Recorders & Wave Analyzers

Classification, Strip chart recorders, Null type recorders, X-Y recorders, Galvanometric recorders, Amplifiers for Galvanometric Recorders, pen – driving Mechanisms, Servo recorders. Wave analyzer: Principle of operation of Wave analyzer and its applications.

Course Outcomes: At the end of the course, the student should be able to

CO1	:	Develop skills in measurements by various measuring instruments.
CO2	:	Improve their knowledge in principle and operation of galvanometer and its calibration.
CO3	:	Understand the measurement procedure for resistance, inductance and capacitance.
CO4	:	Understand the basics of Electronic Instruments for Measuring Basic Parameters and oscilloscope operations and fundamentals of Function generator.
CO5	:	Understand the concepts of analog recording system and Wave analyzer.

Text Books:

1. Joshph J. Carr, “Elements of Electronics Instrumentation and Measurement”, 3rd Edition, Pearson Education.
2. H. S. Kalsi, “Electronic Instrumentation”, 3rd Edition, McGraw-Hill Education (India) private Limited, 2010.
3. A K Sawhney “A Course in Electrical and Electronic Measurements and Instrumentation” 3rd Edition, Dhanpat Rai & Co.

References:

1. David A. Bell, “Electronic Instrumentation and Measurements”, 2nd Edition, Oxford, 2007.
2. Anand, “Electronics Instruments and Instrumentation Technology” PHI.
3. Doebelin E. O., “Measurement systems”, Fourth edition, McGraw-Hill, Singapore, 1990.
4. Golding & Widdis, “Electrical Measurements and Measuring Instruments”, 5th Edition, Reem Publication.
5. Oliver & Cage, “Electronic Measurement and Instrumentation”, Tata McGraw-Hill.
6. Albert D. Helprick and William D. Cooper, “Modern Electronics Instrumentation & Measurement Techniques”, Pearson Education. Selected portion.

66303

PROCESS CONTROL INSTRUMENTATION
(Professional Elective-I)
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation Marks	:	30 Marks
			Semester End Examination Marks	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Prerequisite subject: Control System Engineering

Course Objectives:

1. To familiarize with various process components and its accessories
2. To get conversant with different control actions and its responses.
3. To get acquainted with optimum controller setting and tuning of various controller modes.
4. To acquire the knowledge in Final control elements and selection criteria of Valve.
5. To understand the concepts of multi-loop and advanced strategies for different process control application.

Unit I

Introduction

Need for process control, Process control terminology, Process variables, Load variables, Dynamics of simple pressure, flow level and temperature process, interacting and non-interacting systems, continuous and batch processes, self-regulation-Servo and Regulatory operations, Lumped and Distributed parameter models – Heat exchanger – CSTR – Linearization of nonlinear systems.

Unit II

Control actions and controllers

Basic control actions, characteristics of two position, three position, Proportional, Single speed floating, Integral and Derivative control modes – PI, PD, PID control modes, Problems. Types of Controllers: Pneumatic, Hydraulic and Electronic Controllers to realize various control actions. Practical forms of PID Controller.

Unit III

Optimum controller settings

Evaluation criteria, IAE, ISE, ITAE and 1/4th decay ratio, determination of optimum settings for mathematically described process using time response and frequency response. Tuning of Controllers: Tuning process curve reaction method, Ziegler Nichols method–damped oscillation method. Auto Tuning.

Unit IV

Final control elements:

I/P Converter, P/I converter - pneumatic, electric and hydraulic actuators – valve positioner, Control Valves: Control valves – characteristic of control valves- inherent and installed characteristics, valve body – Globe, Butterfly, diaphragm, Ball valves – Control valve sizing – Cavitations and flashing - Selection criteria.

Unit V

Multiloop control system

Feed forward control – Ratio control – Cascade control – Split range – Multivariable control and examples from distillation column and Boiler system. Advanced Strategies: Role of computers in the control of Industrial processes (plants), Model Predictive Control – Adaptive control – P&ID diagram.

Course Outcomes: At the end of the course, student should be able to

CO 1 : Learn about Process automation concepts.
CO 2 : Acquire confidence in controller's actions.
CO 3 : Understand different controller tuning procedures.
CO 4 : Study various Final control elements and their characteristics.
CO 5 : Understand the concepts of multiloop control systems.

Text Books:

1. Curtis D. Johnson,"Process Control Instrumentation Technology", Eighth Edition PHI, 2009.
2. Stephanopoulis. G, "Chemical Process Control ", Prentice Hall of India, New Delhi, 1990.

References:

1. S. K. Singh, "Computer Aided Process Control", PHI, 2004
2. Stephanopoulos, "Chemical Process Control: An introduction to Theory and Practice", Prentice Hall, New Delhi, 1999.

64304

MICROPROCESSORS AND MICROCONTROLLERS

(Common to ECE, EIE, EEE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	0	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite: Digital Logic Design, Computer Organization and Architecture

Course Objectives:

1. To learn and understand the architecture of 8086.
2. To learn and understand the architecture and programming of 8051.
3. To learn the development of the microcontroller-based system.

Unit I – 8086 Microprocessor

8086 Architecture–Functional Diagram, Register Organization, Memory Segmentation, Flag register, Signal description of 8086, Physical Memory Organization, Interrupts of 8086.

Unit II – 8051 Microcontroller

Microcontrollers and Embedded Processors, Overview of 8051 Microcontroller, Architecture, Inside the 8051, Program counter and ROM space in 8051, 8051 Flag Bits and PSW Register, 8051 Register Banks and Stack, I/O Port Programming, Addressing Modes, Bit Addresses for I/O and RAM, Arithmetic, Logic, JUMP, LOOP, CALL Instructions and Programs.

Unit III – 8051 Programming in Embedded C

Introduction to Embedded C, Data Types and Time Delay, I/O Programming, Logic Operations, Data Conversion Programs, Accessing Port ROM Space, Data Serialization using 8051 C.
8051 timers/counters – 8051 Timers/Counters, Programming 8051 Timers, Counter Programming, Programming Timer 0 and Timer 1 in 8051 C.

Unit IV – Serial port and Interrupt Programming

Basics of Serial Communication, RS 232, Serial Port Programming in C.
8051 Interrupts: Introduction to 8051 Interrupts, Interrupt Priority, and Interrupt Programming in C.

Unit V – 8051 Interfacing

LCD Interfacing Program, Keyboard Interfacing, ADC 0808/0809 Chip, DAC 0808/0809 Chip Interfacing, Sensor LM34 & LM35 Interfacing.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the architecture and organization of 8086.
CO 2	:	Explore the internal architecture of 8051 and to create ready to run programs using 8051 assemblers.
CO 3	:	Understand basic embedded C programming and working of timers/counters to develop microcontroller-based systems.
CO 4	:	Describe the serial communication feature of 8051 and how to write interrupt handler programs.
CO 5	:	Interface real-world devices such as LCDs, Keyboards, ADC and DAC with 8051

Text Books:

1. A. K. Ray and K. M. Bhurchandani, Advanced Microprocessors and Peripherals, 2nd Edition, TMH, 2006.
2. Muhammad Ali Mazidi and Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, 2nd Edition, Pearson, 2008.

References:

1. D.V. Hall, Microprocessors and Interfacing, 2nd Edition, TMH, 2006.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd Edition, Cengage Learning, 2010.
3. Liu and G. A. Gibson, Micro Computer system 8086/8088 Family Architecture, Programming and Design, PHI, 2nd Edition, 1986.

64308

DIGITAL SIGNAL PROCESSING AND APPLICATIONS
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	0	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite subjects: Signals and Systems

Course Objectives:

1. To introduce concepts of digital signal processing and applications.
2. To understand the concepts of DFT & FFT.
3. To provide the design aspects of digital filter design.

Unit I – Discrete-Time Signals & Systems

Discrete-Time Signals & Systems: Introduction to Digital Signal Processing. Discrete-Time Signals, Discrete-Time Systems, Linear Time-Invariant Systems, Linear Convolution, Stability and Causality. Linear Constant Coefficient Difference Equations. Frequency Domain Representation of Discrete-Time Signals and Systems.

Unit II – Discrete Fourier Transforms

Discrete Fourier Series, Representation of Periodic Sequences, Frequency Domain Sampling: Discrete Fourier transform (DFT), Properties of the DFT, Linear Filtering Methods based on the DFT, Overlap Save Method and Overlap Add Method. Divide and Conquer Approach to the Computation of DFT, Radix-2 Fast Fourier Transform Algorithms- DIT-FFT and DIF-FFT, Inverse FFT.

Unit III – IIR Digital Filters

Realization of IIR Systems using Direct Form-I, Direct Form-II, Cascade and Parallel Structures, Analog Filter Approximations – Butter Worth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Design Examples: Analog-Digital Transformations.

Unit IV – FIR Digital Filters

Realization of FIR Systems using Direct Form, Cascade. Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR Filters.

Unit V – Applications of DSP

Spectral Analysis of Sinusoidal Signals, Non-Stationary Signals, Random signal, Musical Sound Processing, Digital Music Synthesis, Signal Compression.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the various operations on discrete-time signals & systems
CO 2	:	Apply DFT and FFT on discrete-time signals
CO 3	:	Analyze and design an IIR digital filter
CO 4	:	Analyze and design an FIR digital filter
CO 5	:	Apply concepts of DSP in various applications

Text Books:

1. John G. Proakis and Dimitris.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4^{th} Edition, PEA, 2012.
2. Sanjit K.Mitra, Digital Signal Processing: A Computer, Based Approach, 4^{th} Edition, Tata McGraw-Hill, 2016.

References:

1. A. V. Oppenheim and R. W. Schaffer, Discrete-time signal processing, 2^{nd} Edition, PEA, 2011.
2. Li Tan, Digital Signal Processing-Fundamentals and Applications, Elsevier, 2009.
3. Emmanuel C. Ifeachor and Barrie W. Jervis, Digital Signal Processing, A Practical Approach, 2^{nd} Edition, Pearson Education, 2011.

66331

PROCESS CONTROL INSTRUMENTATION LAB
(EIE)

Practical	:	3 Periods / Week	Continuous Internal Evaluation	:	30 Marks
Credits	:	2	Semester End Evaluation	:	70 Marks
			End Exam Duration	:	3 Hours

Course Objective:

1. To gain the knowledge on integration of process control software with field devices.
2. To understand the real application of P, PI, PID controllers.
3. To analyze the process response for different control actions.

List of Experiments
(To perform any twelve experiments)

1. Electronic controllers.
2. Servo regulator operation and DC motor control.
3. Characteristics different types of Control Valves.
4. Liquid level process control unit.
5. Temperature level control unit.
6. Process tuning – Process reaction curve method.
7. Process tuning – continuous and damped oscillation method.
8. Multi loop control systems – Ratio Control.
9. Multi loop control systems – Cascade Control.
10. Feed-forward control.
11. 3 –Phase Induction motor speed controls using Mitsubishi PLC.
12. Interacting and Non- interacting systems.
13. Realization of control actions: Pneumatic controllers.
14. Operation of flow loop in plant.
15. Stepper motor speed control with Programmable Logic Controller

Course Outcomes: At the end of the course, student should be able to

CO 1	:	Gain knowledge about automation
CO 2	:	Understand real time applications in the industry functioning.
CO 3	:	Analyze interfacing between analog and digital devices.
CO 4	:	Learn to control actions using PLC's.
CO 5	:	Understand industrial control loop functionality.

64334

SIGNAL PROCESSING LAB
(EIE)

Practicals	:	2 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	1	Semester End Examination	:	70 Marks
			Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the use of simulation software like MATLAB or equivalent
2. To understand the generation of different types of signals and systems using Simulation software.
3. To gain knowledge about transform techniques for the analysis of signals

(Minimum of 12 experiments out of 13 have to be performed)

1. Simulation of Various Signals and Sequences (Periodic and Aperiodic: Unit Impulse, Unit Step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, Sinc)
2. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power
3. Find Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal
4. Convolution between Signals
5. Verification of Linearity and Time Invariance Properties of a given Continuous system
6. Find Fourier Transform of a given signal and plotting its magnitude and phase spectrum
7. Find DFT / IDFT of given DT signal
8. Find frequency Response of a given system given in transfer function/ differential equation form.
9. Implementation of LP FIR filter for a given sequence
10. Implementation of HP FIR filter for a given sequence
11. Implementation of LP IIR filter for a given sequence
12. Implementation of HP IIR filter for a given sequence
13. The impulse response of the first order and second-order systems

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	simulate the generation and operation of different types of signals and systems
CO 2	:	Apply transform techniques for the analysis of signals
CO 3	:	Simulate convolution and spectral densities of deterministic signals
CO 4	:	Simulate response of LTI system for impulse input signal
CO 5	:	Design IIR and FIR digital filters

References:

1. Rudra Pratap, Getting Started with MATLAB, Indian Edition, Oxford University Press, Inc., 2010.
2. Ram N. Patel and Ankush Mittal, Programming in MATLAB, 1st Edition, Pearson India, 2014.

64333

MICROCONTROLLERS LAB
(Common to ECE, EIE, EEE)

Practicals	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	1.5	Semester End Examination	:	70 Marks
			Semester End Exam Duration	:	3 Hours

Course Objectives:

a. Programming of 8051 Micro-controller in assembly language.
b. Programming of 8051 Micro-Controller in Embedded C.
c. Interfacing various I/O devices to 8051 Micro-Controller and Development board.

List of Experiments:

The following programs/experiments are to be written for an assembler and execute some of them with 8051/Development boards.

1. Assembly language Programming using arithmetic, logical and bit manipulation instructions of 8051
2. Programming the arithmetic, logical and bit-manipulation operations using embedded C
3. Program and verify the timer/counter of 8051 Embedded C
4. Program and verify interrupt handling of 8051 Embedded C
5. UART operation of 8051 in KEIL IDE using Embedded C
6. Advanced programming using embedded C
7. Interfacing LCD to 8051
8. Interfacing keyboard to 8051
9. Interfacing DC motor to 8051
10. LED, Switches interfacing using a development board
11. 4 × 4 matrix Keypad Interfacing using a development board
12. 16×2 LCD interfacing using a development board
13. Servo Motor control using a development board
14. Stepper Motor interfacing using a development board
15. Temperature sensor interfacing to the development board
16. Ultrasonic sensor interfacing to the development board

Note: Minimum of 12 experiments to be conducted.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Implement the Assembly Language Programs to perform various operations in 8051 Micro-Controller.
CO 2	:	Implement time delay between the events by programming the timers/interrupts in 8051 Micro-Controller.
CO 3	:	Transmit the message serially at different baud rates using UART operation in 8051 Micro-Controller.
CO 4	:	Interface various I/O Devices like DC Motor, LCD & LED to 8051 Micro-Controller
CO 5	:	Interface various I/O Devices like Keyboard, LCD, 7-Segment Display and DC Motor, Stepper Motor and Servo Motor to development boards.

68332

EFFECTIVE TECHNICAL COMMUNICATION LAB

B.Tech III year I/II semester (Common to all Branches)

Instruction	:	2 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	--	Semester End Examination	:	70 Marks
Credits	:	1	Semester End Exam Duration	:	2 Hours

Course Objectives:

1. To equip students with essentials of Technical communication for Professional environment.
2. To familiarize students with different reading strategies through reading comprehension passages.
3. To train students in multiple writing formats to meet the corporate demands.
4. To develop critical and analytical skills for real time situation through case studies
5. To inculcate ability to customize English language to meet the desired results

Syllabus:

1. Features of Technical Communication
2. Reading Process and Strategies
3. Note making
4. Summarising and Paraphrasing
5. Creative Essay Writing
6. E-mail Writing
7. Report Writing
8. Case Studies

Course Outcomes:

At the end of the course the students will:

CO 1 : Attain proficiency in features of Technical communication

CO 2 : Develop expertise in reading skills

CO 3 : Use English language appropriately to write effective reports, e-mails, notes and summaries.

CO 4 : Become proficient in Analytical and Critical Thinking Skills

CO 5 : Be empowered to use English language effectively in Technical Communication

Text Books:

1. M. Ashraf Rizvi, Effective Technical Communication, 2nd edition, McGraw-Hill Education(India) Private Limited, 2005.

References:

1. Sunita Mishra & C. Murali Krishna, Communication Skills for Engineers, published by Pearson Education, 2007.
2. N. Krishnaswamy and T. Sriraman, Creative English for Communication, Macmillan Publishers India Ltd., 2011.
3. David. A. Mcmurrey & Joanna Buckley, Handbook of Technical Writing, Thomson Press (India) Ltd, 2012.
4. Scot Ober, Contemporary Business Communication, 5th edition, Biztantra, 2004.

68302

Universal Human Values

(Mandatory Course)

Instruction: 1 period / Week Sessional Marks: 100

Credits: 0

Course Objectives:

1. To help the students appreciate the essential complementarity between 'VALUES 'and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
2. To facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

Syllabus (Lecture-wise)

L1. Understanding Value Education: a) Need for Value Education b) Basic Guidelines for Value Education c) The Process of Value Education.

L2. Self-exploration as the Process for Value Education: a) What is Self-exploration? What is its Purpose? b) Process of Self-exploration c) Natural Acceptance, Realisation and Understanding.

L3. The Basic Human Aspirations – Continuous Happiness and Prosperity: a) Exploring Happiness and Prosperity b) A Look at the Prevailing Notions of Happiness and Prosperity.

L4. The Program to Fulfil Basic Human Aspirations: a) Basic Requirements for Fulfilment of Human Aspirations b) What is Our State Today? c) What is the Solution? – The Need for Right Understanding.

L5. The Program to Fulfil Basic Human Aspirations: d) Our Program: Understand and Live in Harmony at All Levels of Living. e) Our Natural Acceptance for Harmony at All Levels of Our Living.

L6. Understanding the Human Being as the Co-existence of Self ('I') and Body: a) Understanding Myself as Co-existence of the Self and Body b) Understanding the Needs of the Self ('I') and Body c) Understanding the Activities in the Self ('I') and Body.

L7. Harmony in the Self ('I') – Understanding Myself: a) How are the Activities in 'I' are related? b) What is the Problem Today? c) Effects of the Problem. d) What is the Solution? – Realisation and Understanding – Living with Definiteness.

L8. Harmony with the Body – Understanding Sanyama and Svasthya: a) Harmony of 'I' with the Body b) What is our State Today? c) What is the way out? d) Understanding and Living with Sanyama.

L9. Harmony in the Family – Understanding Values in Human Relationships: a) Family as the Basic Unit of Human Interaction. b) Harmony in the Family c) Values in Human Relationships.

L10. Harmony in the Family - Understanding Values in Human Relationships: d) Trust e) Respect f) Gratitude.

L11. Harmony in the Society – From Family Order to World Order: a) Identification of the Comprehensive Human Goal. b) Where are we today?

L12. Harmony in the Society – From Family Order to World Order: c) Programs Needed to Achieve the Comprehensive Human Goal: The Five Dimensions of Human Endeavour.

L13. Harmony in Nature– Understanding the Interconnectedness and Mutual Fulfillment: a) The Four Orders in Nature b) Interconnectedness and Mutual Fulfillment.

L14. Harmony in Existence– Understanding Existence as Co-existence: a) An Introduction to 'Space' b) Co-Existence of Units in Space c) Existence is Co-existence.

Course Outcomes: On completion of this course, the student will be able to

CO1 : Understand the significance of values, distinguish between values and skills.
CO2 : Apply the concept of happiness and prosperity to set the goals in life.
CO3 : Evaluate the current scenario in the society, in a right manner.
CO4 : Distinguish between the needs of the self and body through principles of co-existence.
CO5 : Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships.
CO6 : Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.

Text Books:

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010.

References:

1) PL Dhar, RR Gaur, Science and Humanism, Commonwealth Publishers, 1990.
2) Rajeev Sangal, Value education; relieving peer pressure, addressing culture and stimulating studies, National convention on value education through Jeevan Vidya, IIT Delhi, India, 2007.Url: http://web2py.iiit.ac.in/publications.
3) B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
4) A.N. Tripathy, Human Values, New Age International Publishers, 2003.
5) A Nagraj, Jeevan VidyaekParichay, Divya Path Sansthan, Amarkantak, 1998.
6) E G Seebauer & Robert L.Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.

Additional resources (Available in CVRCE intranet)

- PPTs of Lectures and Practice Sessions.
- Audio-visual material.

67305/ 67358

CYBER SECURITY
(Mandatory Subject)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	100 Marks
Tutorial	:	-	Semester End Examination	:	-
Credits	:	0	Semester End Exam Duration	:	-

Prerequisites: NIL

Course objectives:

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

Course Outcomes:

The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

Unit I: Introduction to Cyber Security

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Unit II: Cyberspace and the Law & Cyber Forensics

Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

Unit III: Cybercrime: Mobile and Wireless Devices:

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit IV: Cyber Security

Organizational Implications: Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber Terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

Unit V: Privacy Issues

Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

Text Books:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. B.B. Gupta, D.P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, 2018.

References:

1. James Graham, Richard Howard and Ryan Otson, Cyber Security Essentials, CRC Press.
2. Chwan-Hwa (john) Wu, J. David Irwin, Introduction to Cyber Security, CRC Press T&F Group.

68301/68352

Managerial Economics and Financial Analysis

(Common to all branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	--	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To learn various principles of Business Economics and to make them effective business decision makers.
2. To make the students understand functional areas and potential problems in economics for efficient utilization of resources.
3. To have an overview on market structures, costs and pricing strategies.
4. To understand the basic elements involved in Financial Accounting.
5. To provide fundamental knowledge of Ratio Analysis for effective business decisions.

Unit I - Introduction Managerial Economics, Demand and Demand Forecasting

Economics: Significance of Economics, Distinction between Micro and Macro Economics. Introduction to Managerial Economics, Nature and Scope of Managerial Economics, Multidisciplinary nature of Business Economics.

Demand Analysis: Meaning of Demand, Determinants of Demand, Law of Demand and its exceptions, Elasticity of Demand Elasticity, Types of Elasticity, Measurement and Significance of Elasticity of Demand.

Demand Forecasting: Importance of Demand Forecasting, Methods of Demand forecasting, Characteristics of Good Demand Forecasting method.

Unit II - Theory of Production and Cost Analysis

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Least Cost Combination of Inputs -Returns to Scale;

Cost Analysis: Types of Costs, CVP Analysis, Determination of Break Even Point (Simple Problems)

Unit III - Market Structures & Macro Economic Concepts

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Monopolistic competition, Oligopoly.

Introduction to Macro Economic concepts useful to Business: National Income, Inflation, Money Supply, Business cycles, phases in Business cycles.

Unit IV - Financial Accounting

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger.

Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts (Simple Problems).

Unit V - Financial Analysis through Ratios

Financial Analysis: Meaning, Significance, Methods of Financial Analysis.

Concept of Ratio Analysis, Liquidity Ratios, Solvency/Leverage Ratios, Turnover/Activity Ratios, Profitability Ratios.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Familiarize with the fundamentals of Economics such as Demand function, Law of demand, Elasticity of demand and Demand Forecasting methods etc.
CO 2 : Evaluate Economies of Scale and the Break-Even Point of the business activity.
CO 3 : Understand the different Market Structures and Macro Economic concepts.
CO 4 : Able to understand the accounting system and preparation of Final Accounts.
CO 5 : Analyze Accounting Statements like Income Statement and Balance Sheet to understand financial performance of the business.

Text Books:

1. Varshney & Maheswari, Managerial Economics, Sultan Chand, New Delhi
2. P.L.Mehta, Managerial Economics, Sultan Chand, New Delhi
3. S.N.Maheswari and S.K.Maheswari, Financial Accounting, Vikas Publishing House.

References:

1. D. Salvatore, Managerial Economics, McGraw-Hill, New Delhi.
2. Pearson and Lewis, Managerial Economics Prentice Hall, New Delhi.
3. Paresh Shah, Financial Accounting for Management , Oxford University Press, India
4. Erich A.Helfert, Techniques of Financial Analysis, Jaico Publishing House, Mumbai.
5. Aryasri A.R, Managerial Economics and Financial Analysis, McGraw-Hill, New Delhi.

66351

ANALYTICAL INSTRUMENTATION
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation Marks	:	30 Marks
			Semester End Examination Marks	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Prerequisite subject: Engineering Chemistry, Transduction of Physical Variables

Course Objectives:

1. To study the various Electrodes and Analyzers.
2. To study the various Gas Analyzers.
3. To study the various Chromatographic Techniques.
4. To study the various Spectrophotometers.
5. To study the NMR Spectrophotometer and Radiation detectors.

Unit I

Basic Analyzers

Introduction to analytical Instrumentation, Compression of classical analytical techniques with instrumental Techniques. Operations of Conductivity meters, pH meters, Dissolved oxygen, hydrogen analyzers, Sodium analyzer and Silica analyzer.

Unit II

Gas Analyzers

Thermal conductivity types-Hot Wire thermal conductivity analyzer , Thermal conductivity analyzer using Thermistor, CO monitor-Infrared Gas Analyzer, Improved Version of Infrared gas Analyzer, NOX analyzer-Use of CO Laser, Laser Opto-Acoustic Spectroscopy, H2S analyzer system, Industrial analyzer circuits, oxygen analyzer, paramagnetic type, detectors.

Unit III

Chromatography

Fundamentals of chromatography, Classification, Gas chromatographic system with components-Carrier gas supply, Chromatographic column, Detectors, applications. Liquid chromatography -HPLC, principle and Instrumentation.

Unit IV

Spectrophotometers

Fundamentals of Spectroscopy, Beer Lambert's Law-Theory and problems on Beer – Lamberts Law, UV-VIS Spectrophotometer- basics of single beam, double beam-spctro photometer, IR Spectrophotometer its instrumentation and applications. FT IR Spectrometer, Atomic absorption Spectrophotometer, Atomic emission Spectrophotometer. Sources for Flame Photometers, comparison between AAS and AES. Calorific value measurements.

Unit V

Principle of Nuclear Magnetic Resonance

Instrumentation associated with NMR Spectrophotometer – Introduction to mass spectrophotometer, Principle and operation of Electron Spin Resonance (ESR.)
Nuclear radiation detectors: Ionization chamber, GM Counter, Proportional Counter, Solid state detectors.

Course Outcomes: At the end of the course, student should be able to

CO 1 : Know the various electrodes and analyzers
CO 2 : Understand various gas analyzers.
CO 3 : Understand the various chromatographic techniques.
CO 4 : Understand the various spectrophotometers.
CO 5 : Understand the NMR spectrophotometer and radiation detectors.

Text Books:

1. R. S. Khandpur, “Handbook of Analytical Instruments” Second Edition, TMH, 2006.
2. R. K. Jain, “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 1992.

References:

1. Willard H.H, Merrit L.L, Dean J.A. and Seattle F.L, “Instrumental Methods of Analysis”, CBS Publishing and Distributors, 1995.
2. Jones B.E, “Instrument Technology”, Butterworth Scientific Publ., London, 1987.
3. Skoog D.A. and West D.M, “Principles of Instrumental Analysis”, Holt Sounder Publication, Philadelphia, 1985.

66352

VIRTUAL INSTRUMENTATION

(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation Marks	:	30 Marks
			Semester End Examination Marks	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Prerequisite subjects: Transduction of Physical Variables, Electronics Instrumentation and Basic C Programming knowledge.

Course Objectives:

1. To understand the LabVIEW environment.
2. To build basic programming concepts with structures.
3. To develop virtual instruments to specific applications using LabVIEW programming.
4. To understand the design patterns and synchronizations.
5. To understand acquire, analyze and display the throughput of any compatible system.

Unit -I

Virtual Instrumentation (VI)- Introduction to LabVIEW :Historical perspectives, architecture of a virtual instrumentation, presentation & control, Function Integration, Virtual Instruments vs Traditional Instruments, advantages of VI.

LabVIEW software environment- front panel & block diagram tool bar, data types, data flow programming, tools palette, debugging tools, Concepts of VIs and sub-VIs, LabVIEW documentation resources.

Unit-II

Programming Structures in VI: Controlling programs through structures- For loop, while loop, Shift Registers, Feedback Nodes. Selection structures-case structures, sequence structures-flat & stacked structure, event structures, formula Node, math script. Timing- built-in timing functions, absolute timing functions.

Unit-III

LabVIEW Data type conversions: conversion & coercion, Enumerated types-Enums, Strings, Arrays, clusters, Error handling, Waveform graphs & charts, XY- graphs, Local & Global variables, basic File input/output for data log.

Instrument Interfaces: Current loop, GPIB, Fire wire, PCMCIA, VXI, SCSI, SCXI, PCI, PXI , PXI system controllers, Ethernet control of PXI,VISA,IVI & Instrument drivers.

Unit-IV

Design patterns: State machines-architecture, enumerated controls and type definitions, applications of design patterns- Producer & consumer, master & slave architecture-event driven applications.

Synchronization: Notifiers-send, status & wait on notification, Queues- enques & dequeues, Semaphores-create, acquire release &destroy semaphores, race conditions.

UNIT-V

DAQ System: Concepts of Data acquisition, hardware installation & configuration, Data analysis & storage, sampling & through put, DAQ Assistant, introduction to DAQmx programming, Measurements using myDAQ, configuration management.

VI Tool Sets: Distributed I/O modules, Control design & simulation, Image acquisition & Processing, Motion Control.

VI Applications: Networking basics for office & industrial applications, Active X programming, publishing measurement data in the web.

Course Outcomes: At the end of the course, the student should be able to

CO 1: Demonstrate the working of LabVIEW.
CO 2: Explain the various types of structures used in LabVIEW.
CO 3: Apply the knowledge of LabVIEW programming for simulation & analyzing the data.
CO 4: Interface physical parameters to PC and representation.
CO 5: Analyze and design different type of programs based on data acquisition & applications.

Text Books:

1. Gary Johnson, “LabVIEW Graphical Programming”, 4th edition, McGraw-Hill, Newyork, 2014.
2. Jeffrey Travis & Jim Kring, “LabVIEW for everyone”, Prentice Hall, 3rd edition, 2007.

References:

1. Jovitha Jerome, “Virtual Instrumentation Using LabVIEW”, 5th edition, Prentice Hall of India., 2013.
2. S.Sumathi and P. Surekha, “LabVIEW based Advanced Instrumentation Systems”, 1st edition, ACME Learning Pvt. Ltd, 2011.
3. S. Gupta and J P Gupta, “PC interfacing for data acquisition and Process control”, Instrument Society of America, 1994.
4. Sanjay Gupt, “Virtual Instrumentation”, LabVIEW, TMH, New Delhi, 2003.
5. Kevin James, “PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control”, Newnes, 2000.

64360

TELEMETRY AND TELECONTROL

(Professional Elective-I)
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	0	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite: Transduction of Physical Variables, Principles of Communications

Course Objectives:

1. To understand principles of telemetry, codes and multiplexing.
2. To learn the methods of satellite, modern and optical telemetry.
3. To familiarize with the principles of telecontrol methods.

Unit I

Telemetry Principles: Introduction, Functional Blocks of Telemetry System, Methods of Telemetry – Non-Electrical, Electrical, Pneumatic, Frequency.

Symbols and Codes: Bits and Symbols, Time function pulses, Line and Channel Coding, Modulation Codes, Inter Symbol Interference.

Unit II

Frequency Division & Time Division Multiplexed Systems: FDM, IRIG Standard, FM and PM Circuits, Receiving End, PLL, TDM-PAM, PAM/PM and TDM - PCM Systems, PCM Reception, Differential PCM, QAM, Protocols

Unit III

Satellite Telemetry: General Considerations, TT&C Service, Digital Transmission Systems, TT&C Sub-systems, Telemetry and Communications.

Modern Telemetry: Zigbee, Ethernet, BLANS, Internet Based Telemetering, Wireless LANs, Introduction to Multimedia.

Unit IV

Optical Telemetry: Optical Fibers Cable - Sources and detectors - Transmitter and Receiving Circuits, Coherent Optical Fiber Communication System.

Unit V

Telecontrol Methods: Analog and Digital Techniques in Telecontrol, Telecontrol Apparatus – Remote Adjustment, Guidance and Regulation - Telecontrol using Information Theory - Example of a Telecontrol System.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the functional blocks in the Telemetry System
CO 2	:	Understand the concept of multiplexing the signals for communication
CO 3	:	Understand the Digital transmission system
CO 4	:	Understand the different optical sources and detectors
CO 5	:	Understand the concepts of different Analog and Digital Techniques used in Telecontrol Systems.

Text Books:

1. D. Patranabis, Telemetry Principles, 1st Edition, TMH, 1999.
2. Swoboda G, “Telecontrol Methods and Applications of Telemetry and Remote Control”, Reinhold Publishing Corporation., London, 1991.

References:

1. Gruenberg L, Handbook of Telemetry and Remote Control, 1st Edition, McGraw-Hill, New York, 1987.
2. Young R. E, Telemetry Engineering, 1st Edition, Little Books Ltd., London, 1988.
3. Housley T, Data Communication and Teleprocessing System, 2nd Edition, PH Intl., Englewood Cliffs, New Jersey, 1987.

64361

DIGITAL SYSTEM DESIGN
(Professional Elective -I)
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	0	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite subject: Digital Circuits and IC Applications

Course Objectives:

1. To give an overview of the design of finite state machines and digital circuits using PLDs
2. To get knowledge about the ASM charts design and implementation
3. To provide the fundamentals of fault modelling and fault diagnosis in combinational circuits and sequential circuits.

Unit I - Minimization and Transformation of Sequential Machines

Finite State Model, Finite State Machine (FSM) Capabilities and Limitations, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines, Fundamental Mode Model, Flow Table, State Reduction, Minimal Closed Covers, Races, Cycles and Hazards.

Unit II - Digital Design

Digital Design using ROMs, PALs and PLAs, BCD Adder, 32–bit Adder, State Graphs for Control Circuits, Scoreboard and Controller, Shift and Add Multiplier, Array Multiplier, Keypad Scanner, Binary Divider.

Unit III - ASM Charts

Algorithmic State Machine (ASM) Charts, Derivation of ASM Charts, Realization of ASM Chart, Implementation of Binary Multiplier, Dice Game Controller.

Unit IV - Fault Modeling & Test Pattern Generation

Logic Fault Model, Fault Detection & Redundancy, Fault Equivalence and Fault Location, Fault Dominance, Single Stuck-At Fault Model, Multiple Stuck-At Fault Models, Bridging Fault Model. Fault Diagnosis of Combinational Circuits by Conventional Methods – Path Sensitization Techniques, Boolean Difference Method, Kohavi Algorithm, Test Algorithms- D Algorithm, Random Testing, Transition Count Testing.

Unit V - Fault Diagnosis in Sequential Circuits

Circuit Test Approach, Transition Check Approach, State Identification and Fault Detection Experiment, Machine Identification, Design of Fault Detection Experiment.

Course Outcomes: At the end of the course, a student should be able to

CO 1	:	Acquire knowledge about FSM design and implementation
CO 2	:	Understand the design of digital systems using PLDs.
CO 3	:	Acquire confidence in the design of digital systems using ASM Charts
CO 4	:	Get knowledge about fault detection and diagnosis of combinational circuits
CO 5	:	Understand the concepts about the testing of sequential circuits.

Text Books:

1. Charles H. Roth, Fundamentals of Logic Design, 5th Edition, Cengage Learning, 2013.
2. Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, Digital Systems Testing and Testable Design, 1st Edition, John Wiley and Sons Inc, 1994.
3. N. N. Biswas, Logic Design Theory, 1st Edition, PHI, 2001.

References:

1. Z. Kohavi, Switching and Finite Automata Theory, 2nd Edition, TMH, 2001.
2. Morris Mano and M. D. Ciletti, Digital Design, 4th Edition, PHI, 2007.
3. Samuel C. Lee, Digital Circuits and Logic Design, PHI, 1976.

66353

PC BASED INSTRUMENTATION

(Professional Elective-I)
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation Marks	:	30 Marks
			Semester End Examination Marks	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Prerequisite subjects: Logic and Switching Theory, Transduction of Physical Variables.

Course Objectives:

1. To understand the basic modules of PLC & acquire the knowledge on interfacing of field device to PLC I/O modules.
2. To understand & writing of ladder programming concepts using PLC.
3. To acquire an advanced PLC programming functions and their addressing formats.
4. Understand the troubleshooting of PLC programming.
5. To deal with design of Human machine Interface concepts.

Unit -I

Programmable logic controller (PLC) basics: Definition, overview of PLC systems, input/output Modules, power supplies and isolators, Sourcing & Sinking. Introduction to Modular & Compact Programmable Logic Controllers hardware Units and Programming Addressing Formats for different PLC's.

Computer Interfacing for Data Acquisition and Control : Interfacing Input Signals, Output system with continuous actuators Data Acquisition and Control using Standard Cards: PC expansion systems, Plug-in Data Acquisition Boards, Transducer to Control room. I/O Ports, Plug-in-slots, and PCI Bus, Backplane bus – VXI, Operators Interface, Data transfer; Scaling and linearization.

Unit -II

Basic PLC programming: on/off inputs/outputs, Creating Ladder diagrams for Basic PLC functions.

PLC Basic Functions: register basics, Timer functions and Counter functions.

Unit -III

PLC Intermediate Functions: Arithmetic functions, number comparison functions, Skip and MCR Functions, data move systems, Jump functions, Utilizing digital bits, sequencer functions, matrix functions.

PLC Advanced functions: Analog PLC operation, networking of PLC, PLC-PID functions.

Unit - IV

Alternate Programming Languages: Auxiliary commands and functions. PLC Installation, troubleshooting and maintenance. Field bus: Introduction, concept. HART protocol: Method of operation, structure, and applications. Smart transmitters, smart valves and smart actuators.

Unit-V

HMI in automation: Introduction to HMI, Architecture Of HMI, Human Interface subsystem, Operator Panel, Construction of the panel, Interfacing with control subsystem, Types of mimic panels, Advance Human Interface System, Intelligent Operator Panel, Operator Station, Data logging Station.

Course Outcomes: At the end of the course, student should be able to

CO1: Understand the importance PC in the field of Instrumentation
CO2: Develop concepts of programming of Allen Bradley PLCs.
CO3: Design a Project on control by using PLC as controller
CO4: Able to write advanced programming language applications.
CO5: Develop ability in designing human machine interface.

Text Books:

1. John W. Webb & Ronald A Reis, “Programmable Logic Controllers – Principles and Applications”, 5th edition, Pearson, 2015.
2. Frank D. Petruzella, “Programmable Logic Controllers, fourth edition”, McGraw-Hill, India, 2016.

References:

1. Mike Tooley, “PC Based Instrumentation and Control”, Third Edition, Elsevier, 1995.
2. Kevin James,“PC Interfacing and Data Acquisition Techniques for Measurement, Instrumentation and Control”, Elsevier, 2011.
3. David Bailey, Edwin Wright Newnes, “Practical SCADA for Industry”, an imprint of Elsevier,2003.
4. John Park and Steve Mackay, “Practical Data Acquisition for Instrumentation and Control Systems”, 1st Edition, Newnes, 2003.

66354

AUTOMATION OF INDUSTRIAL PROCESSES

(Professional Elective-II)
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Evaluation	:	70 Marks
			End Exam Duration	:	3 Hours

Prerequisite subject: Process control Instrumentation

Course Objectives:

1. To study the various Elements of Computer Controlled Process and Distributed control Systems.
2. To study the Control System Design and controller tuning.
3. To study the Computer control loop.
4. To study the Design of Feed Forward Controller.
5. To study the Intelligent Control and Distributed Digital Control

Unit I

Introduction to Computer Control

Role of computers in the control of Industrial processes (plants).Elements of Computer Controlled Process / Plant. Classification–Batch, Continuous, Supervisory and Direct Digital Controls. Architecture – Centralized, Distributed and Hierarchical Systems. Man Machine or Human Computer Interface (HCI).
Building Blocks: Process Control Requirements of Computers. Process related variables. Computer Network. Communications in Distributed control Systems. Smart Sensors and Field bus.

Unit II

Control System Design –I

Control System Design using Heuristics, Structural Controllability and Relative Gain Array. Controller Design Regulator design and other design considerations. Controller Tuning – P, PI, PID, and Ziegler-Nicholas method, Computer aided Control System Design.

Unit III

Control System Design –II

Computer control loop, Modified Z – Transform, Zero-order hold equivalence, First order system with time delay, Converting continuous time controller to discrete time domain, Design of controllers based on discrete time model – Deadbeat and Dahlin's algorithms.

Unit IV

Design of Feed Forward Controller

Block Diagram, Feed Forward control algorithms – dynamic, static, Deadbeat. Cascade, Predictive and Adaptive Control: Cascade Control – Dynamic response, Types, Implementation. Predictive Control – Model based and Multivariable System. Adaptive Control – Adjustment, Schemes, and Techniques.

Unit V

Advanced Strategies

Inferential Control. Intelligent Control. Statistical Process Control. Algorithms for Processes with Dead Time – Smith Predictor (SP), Analytical Predictor (AP), Optimal Control.
Distributed Digital Control: Programmable logic controllers (PLC), Architecture, Selection. Overview of Distributed Digital Control System (DCS). DCS Software configuration. DCS Communication – Data Highway. DCS Supervisory computer Tasks. DCS Integration with PLCs and Computers.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Understand the elements of Computer Controlled Process and Distributed control Systems.
CO 2 : Learn Control System Design and controller tuning.
CO 3 : Understand Computer control loop.
CO 4 : Learn design Of Feed Forward Controller.
CO 5 : Understand Intelligent Control and Distributed Digital Control.

Text Books:

1. S. K. Singh, “Computer Aided Process Control”, Fourth edition, PHI, 2007.
2. M. Chidambaram, “Computer Control of Processes”, Narosa, 2003.

References:

1. Krishna Kanth, “Computer-based Industrial Control”, PHI, 1997.
2. S. Bennet, “Real Time Control: An Introduction”, second edition, Pearson Education India, 2003.

66355

ARTIFICIAL NEURAL NETWORKS

(Professional Elective-II)

(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Course Objectives:

1. To Identify & analyze the principles of Artificial Neural Networks.
2. To design a practical approach for using Artificial Neural Networks in various Technical, Organizational and Economical applications.

Unit I

Introduction
Neural network, Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks.
Learning Process 1
Error Correction learning, Memory based learning, Hebbian learning.

Unit II

Learning Process 2
Competitive Boltzmann learning, Credit Assignment Problem, Memory Adaption, Statistical nature of the learning process.

Single Layer Perceptrons
Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, Least mean square algorithm, Learning curves, Learning rate annealing techniques, Perception –convergence theorem, Relation between Perception and Bayes classifier for a Gaussian Environment.

Unit III

Multilayer Perceptron
Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, Feature Detection.

Back Propagation
Back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

Unit IV

Self-organization Maps
Two basic feature mapping models, Self-organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive pattern classification, Hierarchal Vector quantization, contextual Maps.

Unit V

Neuro Dynamics
Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors' as a recurrent network paradigm.

Hopfield Models: Hopfield models, computer experiments

Course Outcomes: At the end of the course, the student should be able to

CO 1: Understand the basics of Neural Networks and its functioning.
CO 2: Identify the various types of networks and its special features.
CO 3: Implement the Neural Networks using several softwares in different applications.
CO 4: Understand the concept of self-organization maps
CO 5: Gain the knowledge about Neuro dynamics and Hopfield models.

Text Book:

1. Simon Haykin, "Neural networks: A comprehensive foundations", 2nd Edition, Pearson Education, 2004.

References:

1. B. Vegnanarayana, "Artificial neural networks", Prentice Halll of India P Ltd 2005.
2. Li Min Fu, "Neural networks in Computer intelligence", TMH, 2003.
3. James A Freeman David M S Kapura, "Neural networks", Pearson Education 2004.

67354

COMPUTER NETWORKS

(Common to IT & EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
			Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites:

1. Mathematical Foundations of Computer Science

Course Objectives:

1. To learn computer networking models.
2. To understand computer networking theory and various protocols used in all layer.
3. To Design and implement various protocols of network, transport and application layer.
4. To understand security and various methods to implement security in computer networks.

Unit-I: Introduction

Uses of Computer Networks, Network Hardware, Network Software, Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model, Example Networks,

The Physical Layer: The Theoretical Basis for Data Communication, Guided Transmission Media, Wireless Transmission, Digital Modulation and Multiplexing, The Mobile Telephone System.

Unit-II: The Data Link Layer

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Elementary Data Link Protocols, Sliding Window Protocols.

The Medium Access Control Sublayer:

The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless LANs, Data Link Layer Switching.

Unit-III: The Network Layer

Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service

Internetworking: The Network Layer in The Internet, The IP Version 4 Protocol, IP Addresses,3 IP Version 6, Internet Control Protocols

Unit-IV: The Transport Layer

The Transport Service, Elements of Transport Protocols, Congestion Control Algorithms-Transport Layer.

Transport Layer II: The Internet Transport Protocols: UDP, The Internet Transport Protocols: TCP, Performance Issues.

Unit-V: The Application Layer

DNS--The Domain Name System, Electronic Mail, The World Wide Web, Realtime Audio and Video

Network Security: Cryptography, Symmetric-Key Algorithms, Public-Key Algorithms, Digital Signatures.

Course Outcomes: At the end of the course, the student will be able to

CO 1	:	Understand network hardware and software issues and reference models.
CO 2	:	Demonstrate various error correction and detection techniques, framing techniques & channel access protocols.
CO 3	:	Realize address mapping and routing protocols in network layer.
CO 4	:	Identify the differences between connection oriented & connection less services congestion control techniques and QOS in transport layer.
CO 5	:	Demonstrate user-level network programs using the underlying network protocols at application layer.

Text Books:

1. Andrew S Tanenbaum, Computer Networks, 5^{th} Edition, Pearson Education, 2011.
2. Behrouz A. Forouzan, Data Communications and Networking, 5^{th} Edition, TMH, 2009.

References:

1. James F. Kurose, and K.W.Ross, Computer Networking: A Top-Down Approach, 7^{th} Edition, Pearson Education, 2017.
2. W.Tomasi, Introduction to Data Communications and Networking, Pearson Education, 2009.
3. S. Keshav, Engineering Approach to Computer Networks, 2^{nd} Edition, Pearson Education, 2008.

66381

INUDSTRIAL AUTOMATION LAB
(EIE)

Practicals	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	1.5	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the basic instructions of ladder programming.
2. To perform advanced PLC programming for speed control applications.
3. To gain knowledge in writing the PLC programming for industrial process control applications.
4. To perform the wiring of field devices to industrial controllers
5. To develop HMI(Human Machine Interface) screens for various industrial applications

LIST OF EXPERIMENTS
(To perform any twelve experiments)

1. Implementation of logic gates using PLC (Programmable Logic Controller).
2. Sequential control of field devices (lights) using PLC.
3. Study and scaling of analog input-output signals on PLC analog I/O modules.
4. Simulation of traffic signaling system using GUI (Graphical User Interface).
5. Automatic water level control using PLC.
6. DC motor switching time control using PLC.
7. Basic VFD operation by using PU & EXT modes of operation.
8. VFD Communication via CC-Link IE field communication protocol.
9. Remote I/O configuration using CC-Link communication.
10. Control speed of three phase induction motor using PLC through encoder module.
11. Basic servo positioning by using single axis module (simple motion module).
12. X-Y table operation by using simple motion module (servo control).
13. Basic HMI screen development for digital & analog I/O operations.
14. Seven segment display operations control on PLC.
15. HMI screen development for String control & historical data operations.

Course Outcomes: At the end of the course, the student should be able to

CO1 : Understand the basic instructions of ladder programming.
CO2 : Perform advanced PLC programming for speed control applications.
CO3 : Gain knowledge in writing the PLC programming for industrial process control applications.
CO4 : Perform the wiring of field devices to industrial controllers.
CO5 : Develop HMI screens for various industrial applications.

66382

VIRTUAL INSTRUMENTATION-I & ANALYTICAL INSTRUMENTATION LAB
(EIE)

Practical	:	3 Periods / Week	Continuous Internal Evaluation	:	30 Marks
Credits	:	1.5	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Course Objectives:

1. To understand and analyze the principle and operation of Spectrometer.
2. To understand and analyze the purity of water.
3. To understand the designing concepts of pH and Conductivity.
4. To learn basic programming using LabVIEW Software.
5. To develop the programs using graphs and charts with LabVIEW Software.

List of Experiments

(To perform any twelve experiments)

1. Flame Photometer (Flame emission spectroscopy).
2. Turbidity measurement.
3. pH meter.
4. Study of GM counter characteristics and its applications.
5. Water purity measurement.
6. Spectrometer: UV and VIS spectrometer.
7. Oxygen gas analyzer.
8. Conductivity meter.
9. LabVIEW basic Programming using Loops and Case Structures.
10. Programming of Arrays and Clusters using LabVIEW.
11. Basic Programming of Strings and Event Structures using LabVIEW.
12. Programming of Formula Node and Math script using LabVIEW.
13. LabVIEW basic Programming using Graphs and Charts

Course Outcomes: At the end of the course, the student should be able to

CO1	:	Understand the principle and operation of Spectrometers.
CO2	:	Acquire, analyze and display the results of purity of water sample.
CO3	:	Gain knowledge on pH and conductivity measurement.
CO4	:	Perform the wiring of field devices to industrial controllers.
CO5	:	Gain knowledge to develop programs using Graphs and charts in LabVIEW

68331/68382

ADVANCED ENGLISH COMMUNICATION & SOFT SKILLS LAB
(Common to all Branches)

Instruction	:	2 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	--	Semester End Examination	:	70 Marks
Credits	:	1	Semester End Exam Duration	:	2 Hours

Course Objectives:

1. To equip the students with the requisite communication skills for the real time environment.
2. To develop decision making, time management and negotiation skills required in the professional context.
3. To familiarize students with latest resume writing and interview skills
4. To develop as independent learners through book review
5. To develop holistic soft skills.

Syllabus:

1. Effective Communication
2. Introduction to Soft Skills
3. Negotiation Skills
4. Group Discussion
5. Decision Making and Problem Solving
6. Interpersonal/ Intrapersonal Skills
7. Time Management
8. Presentation Skills
9. Resume Writing
10. Book Review

Course Outcomes: Students will

CO 1 : Evolve as effective communicators.
CO 2 : Emerge as decision makers, time managers and good negotiators.
CO 3 : Gain proficiency in resume writing and requisite interview skills
CO 4 : Collate ideas and information and organize them relevantly and coherently.
CO 5 : Be empowered to use soft skills in the global context.

References:

1. Meenakshi Raman & Sangeeta Shrama, Technical Communication: Principles and Practice, 3rd Edition, Oxford University Press, 2015.
2. Nishitesh & Dr. Bhasker Reddi, Soft Skills & Life Skills, The Dynamics of Success, BSC Publishers & Distributors, 2012.

68381

Quantitative Ability Lab
(Common to all Branches)

Instruction	:	2 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	--	Semester End Examination	:	70 Marks
Credits	:	1	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To introduce Number Systems, Percentages and Profit & Loss questions
2. To introduce Interest, Speed Time and Distance questions
3. To introduce Ratio and Proportion, Progressions and Inequality questions
4. To introduce Averages, clocks &calendars questions
5. To Practice general problems in Placement, CAT and GRE etc. tests

Contents

1. Number Systems
2. Percentages
3. Profit and Loss
4. Interest (Simple and Compound)
5. Speed, Time and Distance
6. Time and Work
7. Averages
8. Ratio and Proportions
9. Progressions
10. Inequalities
11. Permutation and Combination
12. Mixtures and Allegations
13. Mensuration
14. Clocks and Calendars
15. Geometry

Course Outcomes: At the end of the course, the student is able to

CO 1: Solve the problems using Number Systems, Percentages and Profit & Loss
CO 2: Solve the problems using Interest, Speed Time and Distance
CO 3: Solve the problems using Ratio and Proportion, Progressions and Inequality
CO 4: Solve the problems using Menstruation, Geometric, Clocks & Calendars questions
CO 5: Practice general problems in Placement, CAT and GRE etc. tests

Text Books:

1. R S Aggarwal, Quantitative aptitude, S Chand & Co., 2012.
2. Quantitative aptitude, Upkar’s.

References:

1. Arun Sharma, How to prepare for Quantitative Aptitude, 3rd Edition, Tata McGraw-Hill, 2011
2. P K Agarwal, A Hand book of test of reasoning & Quantitative aptitude, S Chand & Co., 2012.

68351

Essence of Indian Knowledge Tradition

(Mandatory Course for all branches)

Instruction	:	1 Period / week	Continuous Internal Evaluation*	:	100 Marks
Credits	:	-			

Course Objectives :

The course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sankrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I for Undergraduate Courses focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic care system.

Course Content :

*Pedagogy: Brief lectures followed by Problem based learning group discussion, collaborative mini projects. Continuous Internal Evaluation (CIE) based participation, assignments and reports on critical case studies.

1. Basic structure of Indian Knowledge System(5 hours)

   A brief on Vedic literature as a treasure-house of knowledge and wisdom and some basic doctrines as found in the Vedas and in the Upanisads that continue to influence the modern thought:
   a) Asthadasa Vidyas: Veda, Upaveda (Ayurveda, Dhanurveda, Gandharva Veda, Sthapatya Veda etc.)
   b) Vedanga (Shadangas: Siksha, Kalpa, Niruktha, Vyakarana (Grammar), Chandas, Jyothisha (Astrology))
   c) Upanga: (Dharma Sastra, Meemamsha, Purana, Tharka).
   d) Some Important Vedic Concepts: Samhitas, Brahmanas, Aranyakas; Sat and Asat, Mutual Triad, Law of Karma.
   e) Upanisads: Essence of main Upanishds and teachings for a holistic life.
   (Reference: IGNOU Study Material)

2. Modern Science and Indian Knowledge System(5 hours)

   a) Growth of scientific, technical and medical knowledge in India through ages – Ayurveda-Vedic Mathematics– Astronomy.
   b) Modern Physics/ Quntum Physics and Vedanta; Holistic Science and Vedanta: A comparative study.
   c) Engineering aspects in ancient traditional literature:
   Relevance of ancient Indian science and technology today. Philosophy of ancient Indian technology, how is different from modern technology? Ancient Indian Scientific methods. Development in different branches of Science in Ancient India: Contributions of Scientists of Ancient India (Ex. Aryabhatta and Varahamihira in the fields of Astronomy and Mathematics; Contribution of Charaka and Sushruta).

   Glimpses of ancient Indian science and technology, a few examples from:
   - Material Technology: Mining, Metals and Metallurgy, Iron Making and craftsmanship, Wootz Steel Technology. Extraction of Zinc in ancient India, Glass making, Bead making Techniques, Ceramic Technology.
   - Water Harvesting Technology, Irrigation Systems
   - Town planning, Building construction, Sanitation
   - Agriculture and Textile Technology
   - Aeronautical Engineering

3. Yoga and Holistic Health Care(2 hours)
   a) Yoga Sutras of Patanjali– Concept of Yoga, The essence of aphorisms of Pantanjali Maharshi on Yoga.
   b) Some Practical aspects of Pranayama and Yogaasanas, Concept of Holistic Health and Influence of Yogic practices on health. Effect of Yoga & Meditation on Consciousness & Mindfulness.

4. Case Studies(2 hours)

   1. Study on experiences of some Indian Philosophers and Modern Scientists.
      Views of great leaders (Swami Vivekananda, Gandhiji etc.) on Ancient knowledge tradition.
   2. Unity in Diversity in India.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	To gain a general idea of the vast Vedic literature and their content and to grasp the relevant concepts of the Vedas and appreciate its relevance in the modern world.
CO 2	:	Understand, connect up and explain basics of Indian Traditional Knowledge in Modern Scientific Perspective.
CO 3	:	Understand Yoga psychology as both a positive and a normative science and its contribution for a holistic health.
CO 4	:	Understand the views of our great philosophers to correlate their efforts to achieve unity in diversity.

References:

From AICTE Model Curriculum:

1. V. Sivaramakrishnan (Ed.), Cultural Heritage of India – Course Material, Bharatiya Vidya Bhavan, 5^{th} Edition, 2014.
2. Swami Jitatmanand, Modern Physics and Vedanta, Bharatiya Vidya Bhavan
3. Swami Jitatmanand, Holistic Science and Vedanta, Bharatiya Vidya Bhavan
4. Fritz of Capra, Tao of Physics.
5. Fritz of Capra, The Wave of Life.
6. VN Jha (Eng. Trans.). Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam.
7. Yoga Sutra of Patanjali, Commentary by Swami Vivekananda, Ramakrishna Mission, Kolkatta.
8. GN Jha (Eng. Trans.). Ed. RN Jha, Yoga-Darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi, 2016.
9. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakashan, Delhi, 2016.
10. P B Sharma (English translation), Shodashang Hridayam.

Additional References:

1. Introduction to Vedas and Upanisads, IGNOU-Course material.
2. Swami Vivekananda on the Vedas and Upanishads, Sister Gayatriprana, the Vedanta Society of Southern California.
3. Physics: An Integral Part of Vedic Wisdom, Dr. S.R. Verma, Veda-Vidya, Vol. 24, July-December 2014.
4. Vedanta and Science, Swami Tathagatananda.
5. Sanskrit Literature and the Scientific Development in India, Justice Markandey Katju, Judge, Supreme Court of India, speech delivered on 27.11.2010 at Banaras Hindu University, Varanasi.
6. Science of the Sacred, Ancient Perspectives for Modern Science, Compiled by Davis Osborn.
7. Critical Review of Emergence of The Ayurvedic : Tradition In Vedic Literature, Pallavi Varshney and Swastik Suresh, IJSR 2015; 1(7): 24-27, www.sanskritjournal.com
8. Yoga and psychotherapy, Christine Jeuland Ware.

65304 / 65358

ARTIFICIAL INTELLIGENCE
(Mandatory Subject)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	100 Marks
Tutorial	:	-	Semester End Examination	:	-
Credits	:	0	Semester End Exam Duration	:	-

Course Objectives: To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

Unit I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

Unit II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem.

Unit III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non- monotonic Reasoning, Other Knowledge Representation Schemes Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

Unit IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

Unit V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

Text Book:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, 3rd edition, Prentice- Hall, 2010.

References:

1. Elaine Rich, Kevin Knight, Shivasankar B. Nair, Artificial Intelligence, The McGraw-Hill publications, 3rd edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th edition 2009.

66356

INSTRUMENTATION AND CONTROL SYSTEMS
(ME-III – II Sem.)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Course Objectives:

1. To know the basic knowledge of the functional blocks of measurement systems.
2. To understand the working of various physical variable Temperature and pressure Measuring instruments.
3. To understand the working of various physical variable Level, Flow, Speed and Acceleration measuring instruments.
4. To understand the working of various physical and Electrical variables Stress, Humidity, Force, Torque and Power measuring instruments.
5. To understand the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

Unit I - Basic principles of measurement

Measurement systems, generalized configuration & functional descriptions of measuring instruments – examples. Dynamic performance characteristics –sources of error, Classification and elimination of error.

Measurement of Displacement

Theory and construction of various transducers to measure displacement– Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Basics of Calibration.

Unit II - Measurement of Temperature

Classification – Ranges – Various Principles of measurement– Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers.

Measurement of Pressure

Units – classification – different principles used. Manometers, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, McLeod pressure gauge.

Unit III - Measurement of Level

Direct method – Indirect methods – capacitive, ultrasonic, magnetic, cryogenic fuel level indicators – Bubler level indicators.

Measurement Flow: Rota meter, magnetic, Ultrasonic, Turbine flow meter, Hot– wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical Tachometers–Electrical tachometers–Stroboscope, Non-contact type of tachometer.

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.

Unit IV

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter.

Measurement of Force, Torque and Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

Unit V

Control Systems: Introduction, Importance-Classification-Open and closed systems and Examples of Control Systems with block diagrams – Temperature, position and speed control systems.

Mathematical Models: Differential equations, Impulse response and transfer function – translational & rotational mechanical systems.

Transfer Function: Transfer function of Hydraulic systems, Pneumatic systems, Thermal systems.

Block Diagram: Representation, Algebra, reduction techniques. Signal Flow Graph: Representation and reduction by Mason's gain formula.

Course outcomes: At the end of the course, the student should be able to

CO1	:	Know the basic knowledge of the functional blocks of measurement systems.
CO2	:	Understand the working of various physical variable Temperature and pressure measuring instruments.
CO3	:	Understand the working of various physical variable Level, Flow, Speed and Acceleration measuring instruments.
CO4	:	Understand the working of various physical and Electrical variables Stress, Humidity, Force, Torque and Power measuring instruments.
CO5	:	Understand the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

Text Books:

1. D.S Kumar, "Mechanical Measurements and Control", Metropolitan Book Co. Pvt. Ltd, 1979.
2. I.J. Nagarath, M.Gopal, "Control Systems Engineering", 5th Edition, New Age International (P) Ltd., 2007.

References:

1. Doebelin Ernest O, Dhanesh N Manik, "Measurement Systems: Application and Design", 5thEdition, Tata McGraw-Hill, 2004.
2. R.K. Jain, "Mechanical and Industrial Measurements", Khanna Publishers, 2006.
3. B.C.Nakra, K.K.Choudhary, "Instrumentation, measurement and analysis", TMH, 1985

66401

BIOMEDICAL INSTRUMENTATION

(EIE)

Instruction	:	3 Periods / Week	Continuous Internal Evaluatior	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Prerequisite subjects: Transduction of Physical Variables, Electronics Instrumentation

Course Objectives:

1. To deal with bio medical instrumentation system and their characteristics & to study the generation of bio signals.
2. To study and acquire ECG signal for analysis.
3. To understand and analyze EEG and EMG
4. To study blood pressure, blood flow and respiratory measurement.
5. To deal with design and operation of Therapeutic equipments.

Unit I

Basics of medical instrumentation system: Block diagram of Medical Instrumentation System, Performance requirements, General constraints in design of medical instrumentation system. Bio amplifier, Bio potential electrodes – tissue interface. Types of Bio potential electrodes - surface, internal, microelectrodes, Silver-Silver chloride electrode.

Bioelectric signals: Sources of bioelectric signals, Generation of bioelectric signal, Resting potential, action potential and refractory periods, propagation methods of action potential.

Unit II

Electrocardiography: Electrical conduction system of the heart, electrodes and their placement, Standard 12 – lead configurations, ECG recording set up, Interpretation of ECG waveform with respect to events of cardiac cycle, Characteristics of normal ECG, Cardiac arrhythmias and the associated changes in ECG.

Unit III

Electroencephalography: Review of brain structure and function, Generation of EEG Signal, Electroencephalogram, electrodes and their placement, Block diagram of 8 channel Electroencephalogram, 10-20 electrode system.

Electromyography: Generation of EMG signal, Block diagram of Electromyography, Electrodes and their placement, study of neuromuscular junction, nerve conduction velocity using EMG.

Unit IV

Blood pressure measurement: Blood pressure, direct and indirect methods of blood pressure measurements, Phonocardiography, blood flow measurement.

Respiratory Instrumentation: Mechanism of respiration, Spirometry, Pnemuotachograph ventilators and their modes of operation.

Unit V

Therapeutic equipment: Pacemaker-synchronous, asynchronous and rate responsive pacemakers, Defibrillator and cardio-vector, Electrotherapy and its applications, Dialysis and its significance- peritoneal and hemo-dialyzers.

Course Outcomes: At the end of the course, the student should be able to

CO1: Understand the basic components of medical instrumentation system
CO2: Develop skill in analyzing the ECG
CO3: Acquire confidence in designing medical recorders like EEG and EMG
CO4: Obtain basic knowledge on blood pressure meters and the significance of Respiratory monitoring.
CO5: Develop ability in designing therapeutic equipments.

Text Books:

1. Khandpur R.S, “Hand Book of Biomedical Instrumentation”, Tata McGraw-Hill, 1994.
2. John G. Webster, “Medical Instrumentation – Application and Design”, 3rd Ed., John Wiley and sons Inc., 2003.

References:

1. Joseph J. Carr ad John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education, 2001.
2. Bronzino Joseph D, “Hand Book of Biomedical Engineering”, CRC Press, 1995.

64412

VLSI DESIGN
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	0	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Electronic Circuits –I, Analog Circuits and IC Applications, Digital Circuits and IC Applications.

Course Objectives:

1. To learn IC fabrication technologies and layouts for CMOS logic
2. To understand the design and implementation of Combinational and sequential circuits
3. To gain knowledge of different memory design styles and CMOS testing

Unit I –MOS Technology and Electrical Properties of MOS Circuits

MOS Technology: MOS VLSI technology, Basic MOS transistors, Enhancement and Depletion mode transistor operation, NMOS, PMOS, CMOS, Bi-CMOS fabrication and technology, Electrical properties of MOS Circuits: I_{ds}-V_{ds} relationships, Threshold voltage (Vt), Transconductance (g_m), output conductance (g_{ds}), figure of merit (ω_0), MOS transistor circuit model, Nonideal I-V Effects: Channel length modulation, Body effect, Leakage currents, Latch-up in CMOS process.

Unit II – Combinational Circuit Analysis and Circuit Families

Combinational Circuit Analysis: NMOS Inverter and CMOS Inverter design & analysis, Alternative forms of pullup for combinational circuits, Pull-up and Pull-down ratios, Interconnect -Resistance, Capacitance, Delay, Power Dissipation, Circuit Families: Pseudo NMOS, Static CMOS, Dynamic Circuits, Domino Logic, Pass transistor circuits, transmission gate logic.

Unit III – Technology Rules and IC Design styles

Technology Rules: MOS Layers, Stick Diagrams, Design Rules and Layout, 2 µm CMOS Design Rules, Layouts for NMOS and CMOS logic gates, VLSI Design: Full custom ASIC Design Flow, Standard Cell-based ASIC Design Flow, FPGA Design Flow, CPLD and FPGA basic architectures.

Unit IV – Data path Subsystems and Sequential Circuit Design

Data path Subsystems: Barrel Shifter, Adders: Single bit addition, Ripple Carry Adder, Carry Look Ahead Adder, Carry Select Adder, Carry Save adder, Carry Skip Adder, Multipliers: Unsigned Array Multiplier, Booth Multiplier, One/Zero Detector, Parity Generator, Magnitude Comparator, Sequential Circuit Design: Conventional CMOS Latch and Flip-Flop Design, Counters, Linear Feedback Shift Registers.

Unit V – Array Subsystems, Verification & Testing

Array Subsystems: Categories of memory arrays, 6T SRAM Cell read & Write operation, 1T DRAM Cell, ROM, PROM, Flash memory, Verification & Testing: Logic Verification, Logic verification principles, Need for testing, Fault Models, Design for manufacturability.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Familiarize with the basics of MOSFET and different IC fabrication technologies
CO 2	:	Understand the basic electrical properties of MOS and CMOS circuits
CO 3	:	Develop the layouts for NMOS, CMOS logic circuits and understand the design flow
CO 4	:	Analyze and design various CMOS combinational and sequential circuits
CO 5	:	Understand the concept of memory implementation and need for testing and design for testability.

Text Books:

1. Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, Essentials of VLSI circuits and systems, 1st Edition, Prentice Hall India, 2005.
2. Neil H.E Weste, David Harris and Ayan Banerjee, CMOS VLSI Design – A Circuits and systems perspective, 3rd Edition, Pearson, 2009.

References:

1. John. P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & Sons Inc 2007.
2. Wayne Wolf, Modern VLSI Design, 4th Edition, Pearson Education, 2015.
3. K. Lal Kishore and V S V Prabhakar, VLSI Design, 1st Edition, I.K International, 2009.

66402

INDUSTRIAL INTERNET OF THINGS
(EIE)

Instruction	:	3 Periods / Week	Continuous Internal Evaluatior	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the elements of IIOT.
2. To learn the concept of M2M with necessary protocols.
3. To implement the web-based services on IoT devices.
4. To know the Python packages and Raspberry PI platform widely used in IoT applications.
5. To learn the case studies illustrating IoT design and security issues.

Unit I - Elements of IIoT

IIOT - Definition, characteristics, Evolution of Connected Devices, IoT enablers, Base-Line Technologies, Connectivity Layers, IoT vs M2M, Sensing, Actuation, IoT enabled Technologies, IoT challenges

Unit II - Basics of Networking Protocols

Sensor Networks, Machine-to-Machine Communications, IoT components, Functional Components of IoT, IoT interdependencies, IoT Service Oriented Architecture, Functionality Based IoT Protocol Organization, Communication Protocol: MQTT, AMQP

Unit III - IoT Physical Devices and End points

Connectivity Protocols: IEEE 802.15.4, ZigBee. Introduction to Arduino, Arduino pin diagram, Arduino IDE, Controlling LED with Arduino, interfacing temperature sensor with Arduino. Introduction to Raspberry PI, Interfaces (serial, SPI, I2C).

Unit IV - Introduction to Cloud Connectivity

Programming Raspberry PI with Python - Controlling LED, Interfacing an LED and Switch, Interfacing a Light Sensor with Raspberry PI, Capturing Image using Raspberry PI. Python packages - JSON, HTTPLib, URLLib, SMTPLib, RPi.GPIO.

Unit V - Technologies

Web socket, Xively and Django – Framework – case study (Temperature Data), Deployment templates , Case Study: Agriculture, Healthcare, Activity Monitoring

Course Outcomes: After completion of course, students will be able to:

CO 1: Understand the characteristics, protocols and communication models required for logical design of IIoT.
CO 2: Understand the differences between IoT and M2M networks and configurations.
CO 3: Understand the hardware platforms for implementing and interfacing the IoT based board with different peripheral devices and serial communication devices.
CO 4: Integrate devices and develop an application that can communicate through IoT Cloud.
CO 5: Understand various case studies in IoT design and Security in IoT.

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", Published by Universities Press, 2015, 1st Edition.
2. Matt Richardson and Shawn Wallace, "Getting Started with Raspberry Pi", Reilly (SPD), 2014.

References:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition Academic Press, 2014.
2. Cuno Pfister, "Getting Started with the Internet of Things", 1st Edition, Maker Media, 2011.

66403

INSTRUMENTATION PRACTICES IN INDUSTRIES

(Professional Elective-III)
(EIE)

Instruction	: 3 periods/week	Continuous Internal Evaluation	: 30 marks
Credits	: 3	Semester End Examination	: 70 marks
		End Exam Duration	: 3Hours

Prerequisite subject: Transducers and Application, Electronic Instrumentation, Process Control Instrumentation.

Course Objectives:

1. Identify and quantitatively estimate different materials required for the manufacturing of Cement, Pulp, Paper, food, Power and pharmacy.
2. Understand the principles of different manufacturing processes in Cement Industry, Nuclear Industry.
3. To Know the different Petrochemical Industries working process and Measurements in Refineries Petrochemical Industries.
4. Recognize the Primary Flight Instruments principle and operation
5. To understand Measurement of aircraft Engine parameters and Fuel Quantity and Fuel Flow

UNIT I

Manufacture of pulp: Raw materials, Pulping processes, Craft pulping, Soda pulping, Sulfite pulping, Semi chemical pulping, Mechanical and Thermo mechanical pulping.

Manufacture of paper: Wet Processing, Fourdrinier Machine, Coated Papers, Special Papers. Wet-end Instrumentation

UNIT II

Cement Industries: Portland cements, other cements, Lime, Gypsum, Miscellaneous Calcium Components, and Magnesium Components.

Nuclear Industries: Nuclear Reactions, Uranium and Thorium Fission, Uranium as An Energy Source, Nuclear Fuels, Nuclear Reactors, Fusion Reactions, Fusion, Processing Nuclear Materials, Isotopes and Isotope Separation, Protection from Radioactivity, Waste Disposal.

UNIT III

Petrochemical Industries: Constituents of petroleum, products of Refining, processing-separation processes, conversion processes, Reforming, hydration and hydrolysis, Chemical treatment, Alkylation De-Alkylation and Hydrode Alkylation. Cracking and Pyrolysis, Halogenation and Hydro-halogenation. Hydration and Hydrolysis.

Instrumentation in Petrochemical Industries: Differential Pressure Transmitter, Thermocouples, Infrared Pyrometer, Mass Flow Meters, Potentiometric Level Transmitter, Vacuum Measurement.

UNIT IV - Flight Instrumentation-I

Primary Flight Instruments (principle of operation): Pitot Static System for The Measurement of Aircraft Speed, Aneroid Barometer and Altimeter, Gyroscope and Its Properties, Methods of Operating Gyroscopic Flight Instruments, Gyro Horizon, Vacuum Driven Gyro Horizon, Electric Gyro Horizon.

Heading Indication Instrument (Principle of Operation): Direct Reading Magnetic Compass, Liquid Damping Direct Reading Compass and Liquid Expansion Compensating Direct Reading Compass, Remote Indicating Compass System.

UNIT V - Flight Instrumentation-II

Measurement of Engine Speed, Engine Temperature, and Aircraft Pressure (Principle of Operation): Mechanical Tachometers, Electrical Tachometers, Air Temperature Sensors to Measure Rat And Sat, Radiation Pyrometer System, Methods Of Measuring Pressure, U-Tube Manometer, Direct Reading Pressure Gauges, Remote Indicating Pressure Gauges.

Measurement of Fuel Quantity and Fuel Flow (Principle Of Operation): Float Type Fuel Quantity Indicating System, Capacitance Type Fuel Gauge System, Fuel Flow Measurement, Independent And Terraced Flow Meter System.

Course Outcomes: At the end of the course, the student should be able to

CO1: Understand the different materials required for the manufacturing of Cement, Pulp, Paper, food, Power and pharmacy.
CO2: Know the principles of different manufacturing processes in Cement Industry, Nuclear Industry.
CO3: Identify the different Petrochemical Industries working process and Measurements in refineries Petrochemical Industries.
CO4: Acquire the Primary Flight Instruments principle and operation
CO5: Understand Measurement of aircraft Engine parameters and Fuel Quantity and Fuel Flow.

Text Books:

1. Austin G.T. Shereeves, “Chemical Process Industries”, Fifth Edition, McGraw-Hill.
2. Pallet, E.H.J, “Aircrafts Instruments and Integrated Systems”, Pearson, Second Edition, 2012

References:

1. D Patranabis “Principles of Industrial Instrumentation”, Second Edition, McGraw Hill, 2001.
2. John R Lavigne, “An Introduction to Paper Industry Instrumentation”, Miller Freeman Publications, California, 1977.
3. Liptak B.G. “Instrumentation in Process Industries”, Chilton Book Company, 1994.
4. Liptak B.G. “Process Measurement and Analysis”, Third Edition, Chilton Book Company, 1996.

66404

ROBOTICS AND AUTOMATION

(Professional Elective-III)

(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Prerequisite subject: Control Systems Engineering

Course Objectives:

1. To gain the knowledge on various parts of robots and fields of robotics.
2. To understand various power actuators & sensors.
3. To understand the basic kinematics & grippers.
4. To gain the knowledge on manipulator control & trajectory planning.
5. To achieve the knowledge on robot specific applications.

Unit I - Basic Concepts

Definition and origin of robotics, different types of robotics, various generations of robots, degrees of freedom, Asimov's laws of robotics, dynamic stabilization of robots.

Unit II - Various Power Actuators and Sensors

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

Unit III - Kinematics and Grippers

Basic forward kinematics & Solution of inverse kinematics problem, manipulator dynamics, Jacobian matrix, end effectors: various types of grippers & design considerations.

Unit IV - Manipulator control and Path Planning

Construction of manipulators, force control, electronic and pneumatic manipulator control circuits, trajectory planning, hill climbing techniques, robot programming languages.

Unit V - Case Studies

Multiple robots, machine interface, robots in manufacturing and non-manufacturing applications, robot cell design, selection of robot.

Course Outcomes: At the end of the course, the student should be able to

CO1: Gain the knowledge on various parts of robots and fields of robotics.
CO2: Understand various power actuators & sensors.
CO3: Understand the basic kinematics & grippers.
CO4: Gain the knowledge on manipulator control & trajectory planning.
CO5: Achieve the knowledge on robot specific applications.

Text Books:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", First edition, McGraw-Hill Singapore, 1996.
2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", First edition, Allied Publishers, Chennai, 1998.

References:

1. Deb. S.R., "Robotics technology and flexible Automation", Second edition, John Wiley, USA 1992.
2. Asfahi C.R., "Robots and manufacturing Automation", Second edition, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., "Robotics Engineering-An integrated approach", First edition, Prentice Hall of India, New Delhi, 1994.

66405

OPTOELECTRONICS AND LASER INSTRUMENTATION

(Professional Elective-III)
(EIE)

Instruction	:	3 Periods / Week	Continuous Internal Evaluatior	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Prerequisite subject: Transduction of Physical Variables

Course Objectives:

1. To understand the principles of optics.
2. To learn the working principle of various light sources and detectors.
3. To understand the different industrial applications of optical fiber.
4. To understand the principle and design of laser.
5. To learn the various applications of laser in instrumentation.

Unit I - Optical Fibers and Their Properties

Introduction to optical fibers , Principles of light propagation through a fiber, Numerical aperture, Attenuation in optical fiber, Pulse dispersion, Waveguide dispersion, Different types of fibers and their properties, source coupling, splicing and connectors.

Unit II - Light sources and detectors

Light Sources and detectors: LED, LD, Photo diode, LDR, PIN & APD. Optical fiber communication system, Transmitter and Receiving Circuits, Coherent Optical Fiber Communication System, Electro-optic, Magneto optic and Acousto-optic Modulators.

Unit III - Fiber Optic Sensors

IR sources and detectors, Interferometer method of measurement of length, Moire fringes Measurement of pressure, Temperature, Current, Voltage, Liquid level and strain , fiber optic Gyroscope.

Unit IV - Laser Fundamentals

Fundamental characteristics of lasers , Three level and four level lasers , Properties of laser , Laser modes, Q-switching and mode locking , Cavity damping ,Types of lasers : Ruby, Nd-Yag, He-Ne, CO_2,Dye Laser.

Unit V - Laser Instrumentation

Industrial applications of lasers, laser welding, hole drilling, laser cutting, laser Doppler velocity meter, laser heating.

Medical Applications: Lasers and tissue interaction, laser instruments for surgery, removal tumors of vocal cords, plastic surgery, dermatology, endoscopy.

Course Outcomes: At the end of the course, the student should be able to

CO1 : Understand the basics of fiber optics and its properties
CO2 : Improve skills by using optical methods for communications
CO3 : Acquire knowledge on working of fiber optic sensors
CO4 : Gain knowledge on laser and its operation
CO5 : Improve knowledge on several applications of Lasers

Text Books:

1. J. M. Senior, "Optical fiber communication-Principles and Practice", Third edition, Prentice Hall of India, 2009.
2. AjoyGhatak, "Optics", Third edition, Tata McGraw-Hill, New Delhi, 2005.

References:

1. K.Thyagarajan and A. K. Ghatak, "Lasers: Theory and Applications", Macmillan publishers, India 2010.
1. John Ready, "Industrial applications of Lasers" 2nd Edition, Academic Press, 1997.
2. Wilson and Hawkes, "Optoelectronics – An Introduction" Third Edition, Pearson Education, 1998.

64435

VLSI DESIGN LAB
(EIE)

Instruction	:	2 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	1	Semester End Evaluation	:	70 Marks
			End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the various digital design circuits using CAD tools
2. To understand the Verilog programming skills to design the circuits
3. To understand and study the output from various VLSI designs in the simulation environment.

Total of twelve experiments to be conducted (Total 12=8+4)

List of Experiments

E-CAD (Electronic Computer-Aided Design) Verilog Programs

1. Realization of Boolean expressions using three modelling styles
2. Design of 1-bit adder & subtractor using a decoder
3. Design of combinational circuits Using Multiplexer.
   i) Parity generator and checker   ii) 2-bit Multiplexer
4. Design of 4-bit comparator using a 1-bit comparator.
5. Design of 2-bit ALU (adder, subtractor, multiplier and comparator)
6. Design of Flip Flops: JK, D and T using Preset and Clear
7. Design of Synchronous and Asynchronous 4-bit counter
8. Design of Sequence detector using Moore/ Mealy machine
9. Design of serial adder using Moore/ Mealy machine
10. Design of 4-bit Universal Shift Register

VLSI Schematic Design Using CADENCE Software tool

11. Implementation of all Basic Logic gates
12. CMOS inverter
13. CMOS Universal gates
14. CMOS 1-bit comparator
15. CMOS 1-bit Full adder

Course outcomes: At the end of the course student should able to

CO 1	:	Acquire the knowledge simulation of basic Boolean expressions
CO 2	:	Understand the design of digital circuits and applications.
CO 3	:	Acquire confidence in the design of sequential circuits using FFS
CO 4	:	Simulate using Custom design tools
CO 5	:	Design and implement the basic combinational circuits using tools.

66431

VIRTUAL INSTRUMENTATION-II LAB

(EIE)

Instruction : 3 Periods / week	Continuous Internal Evaluation : 30 Marks
Credits : 1	Semester End Examination : 70 Marks
	End Exam Duration : 3 Hours

Course Objectives:

1. To develop virtual instruments to specific applications using LabVIEW programming
2. To understand acquire, analyze and display the throughput of any compatible system.
3. To understand various interfacing modules using LabVIEW.
4. To study the generation of bio signals and acquire ECG for analysis.
5. To study blood pressure and pulse sensor measurement.

LIST OF EXPERIMENTS

(To perform any twelve experiments)

1. Study and experimental analysis of temperature sensor response through Data acquisition using LabVIEW.
2. Experimental analysis of strain& level sensing element by data acquisition using LabVIEW.
3. Study and analysis of Image processing using myRIO.
4. Investigation of various signals through myRIO.
5. Realization of different functional units (Function Generator, Oscilloscope, Analog input & output, Digital multimeter & Variable Power supply) using NI ELVIS II+.
6. Implementation of impedance analyzer using NI ELVIS II+.
7. Acquire, analyze and present an ECG signal using Virtual Instrumentation and also implementing an algorithm to calculate its heart rate.
8. Analysis of Blood Pressure sensor response using iworx.
9. Performance investigation of Gas pressure sensor by iworx
10. Study of Pulse sensor using iworx environment.
11. Performance evaluation of Spirometer by iworx
12. Study of Hand Dynamometer through iworx.
13. Building a VI to simulate and study the performance of First order and second order systems.
14. Acquire, analyze and present an EEG signal using virtual instrumentation with LabVIEW.
15. Apply different windowing techniques on the give input signal.

Course Outcomes: At the end of the course, the student should be able to

CO 1: Understands interfacing of different types of physical parameters to PC.

CO 2: Apply the knowledge of LabVIEW programming for simulation & analyzing the data.

CO 3: Analyze and design different type of programs based on data acquisition & applications.

CO 4: Develop knowledge on analysis of various biosensors with LabVIEW environment.

CO 5: Obtain knowledge on ECG signals, hand dynamometer working with iworx.

66434

INSTRUMENTATION AND CONTROL SYSTEMS LAB

(ME IV –I Sem.)

Instruction	: 2 periods/week	Continuous Internal Evaluation	: 30 marks
Credits	: 1	Semester End Examinations	: 70 marks
		End Exam Duration	: 3Hours

Course Objectives:

1. To know the basic knowledge of the working of measurement instruments
2. To equip the students with the basic knowledge of Physical variables: Displacement, Temperature, Pressure, Strain, Acceleration, Flow, Speed, Level measurements.
3. To identify various instruments used to measure Physical Parameters.
4. To know the basic knowledge of the working of Calibrating instruments
5. To know the basic knowledge of the working of measurement instruments and control operations.

List of Experiments (Minimum Ten experiments have to be completed)

1. Study and Calibration of LVDT transducer for displacement measurement
2. Temperature measurement using resistance temperature detector (RTD)
3. Temperature measurement using Thermocouple
4. Study and Calibration of Pressure Gauge
5. Measurement of strain using Strain gauge
6. Measurement of acceleration using Accelerometer
7. Flow measurement using Rota meter
8. Speed measurement using Stroboscope
9. Displacement measurement using capacitive transducer
10. Water level measurement using capacitive transducer
11. Servo regulator operation & DC motor speed control

Course outcomes: At the end of the course, student shall be able to

CO1: Know the basic knowledge of the working of measurement instruments
CO2: Equip the students with the basic knowledge of Physical variables: Displacement, Temperature, Pressure, Strain, Acceleration, Flow, Speed, Level measurements.
CO3: Identify various instruments used to measure Physical Parameters.
CO4: Know the basic knowledge of the working of Calibrating instruments
CO5: Know the basic knowledge of the working of measurement instruments and control operations.

66451

NANOSENSORS & APPLICATIONS

(Professional Elective-IV)
(EIE)

Instruction	:	3 Periods / Week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Prerequisite subject: Control System Engineering

Course Objectives:

1. To be conversant with nanoscience fundamentals and basic sensors' properties
2. To understand the transduction principles of various schemes.
3. To get Acquainted with various structures of inorganic and organic sensors
4. To acquire the knowledge in various physical applications of nanosensors
5. To understand the applications of various nanobiosensors.

UNIT I - Fundamentals of nanoscience and Sensor Characteristics

Definition of a nano-system –Nanotechnology Initiatives –challenges and future prospective of nanoscience. Diffusion in Nanomaterials, Nanoscale heat Transfer; catalysis by gold nanoparticles; transition metal atoms on Nanocarbon Surfaces; molecular structure of fullerene, carbon nano tube, graphene and nano diamonds, Electrical, Optical, Mechanical, and Vibrational properties of carbon allotropes.

Sensor characteristics: Active and passive sensors -static characteristic -accuracy, error, precision, resolution, sensitivity, selectivity, noise, drift, detection limit -reproducibility, hysteresis, stability, response time, recovery time, dynamic range -dynamic characteristics -zero order, first and second order sensors.

UNIT II - Transduction principles

Photoelectric effect -photo dielectric effect -photoluminescence effect -electroluminescence effect -chemiluminescence effect -Doppler effect -Barkhausen effect -Hal effect -Ettinshausen effect -thermoelectric effect -peizoresistive effect –piezoelectric effect -pyroelectric effect -Magneto-mechanical effect (magnetostriction) -Magneto resistive effect.

UNIT III - Nanotechnology Enabled Sensors

Inorganic Sensors: Density of states (DOS) -DOS of 3D, 2D, 1D and 0D materials -Nano optical sensors-Nano mechanical sensors-Magnetically engineered spintronic sensors.

Organic Sensors:Surface interactions-covalent coupling, adsorption, physical entrapment, chemical entrapment -using protein in nanodevices -antibodies in sensing -antibody in nano particle conjugates -enzymes in sensing -enzyme nanoparticles hybrid sensors -transmembrane sensors.

UNIT IV - Other Applications

Nanolithography and NanoPatterning, Gas Sensing with Nanostructured Thin Films, Phonons in Sensing Applications, Oscillators based on Nanoparticles, The Analysis of Proteins, Enzymes in Sensing Applications.

UNIT V - Medical Applications

Cantilever sensors for diagnosis of diabetes mellitus and cancer-Nano-tube based sensors for DNA detection and capnography-Nanowire based electrical detection of single viruses and biomolecules - ultrasensitive detection of pathogenic biomarkers and single bacteria.

Course Outcomes: At the end of the course, student should be able to

CO 1 : Learn about nano-science fundamentals.
CO 2 : Acquire confidence in various transduction principles.
CO 3 : Understand different structures of inorganic and organic sensors.
CO 4 : Develop concepts in various physical applications of nanosensors
CO 5 : Expertise in various applications of nanobiosensors.

Text Books:

1. KouroshKalantar, Zadeh& Benjamin Fry, “Nanotechnology-Enabled Sensors”, Springer, New York, 2010.
2. Rajmohan Joshi, “Biosensor”, Isha Books, New Delhi, 2006.

References:

1. Vijay K. Varadan, Linfeng Chen and Sivathanupillai, “Nanotechnology Engineering in Nano and Biomedicine”, John Wiley, Canada, 2011.
2. Pradeep T, “Nano: The Essentials Understanding Nanoscience and Nanotechnology”, Tata Mc-Graw Hill, New Delhi, 2012.

66452

MEMS AND APPLICATIONS

(Professional Elective-IV)

(EIE)

Instruction	:	3 Periods / Week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Prerequisite subject: Engineering Chemistry, Applied Physics.

Course Objectives:

1. To learn the fabrication process of MEMS (Micro-Electro-Mechanical-System).
2. To understand the Photolithography and Micromachining.
3. To understand the MEMS transducers and MEMES actuators.
4. To learn the modeling of capacitor transducer.
5. To learn the modeling of Piezoelectric and Thermal transducer.

Unit I - Introduction to MEMS

MEMS(Micro-Electro-Mechanical-Systems) introduction, uses of MEMS, substrate and adding material, introduction, the silicon substrate, additive technique, oxidation, additive technique: physical vapor deposition, other additive techniques.

Unit II - MEMS Fabrication

Creating and transferring patterns, photolithography: introduction, keeping it clean, photoresist, working with resist, masks, resolution, permanent resists.
Creating structures, micromachining, introduction, bulk micromachining processes, surface micromachining, process integration.

Unit III - MEMS Transducers: I

Introduction of modeling, units, the input-output concept, physical variables and notation, preface to the modeling chapters.

MEMS Transducers-An overview: transducer, distinguishing between sensors and actuators, response characteristics of transducers, MEMS sensors, principles of operation.

MEMS Actuators: Principles of operation, signal conditioning, RF applications and optical applications. Piezo resistive transducers: introduction, modeling Piezo resistive transducers, piezo resistive pressure sensor.

Unit IV - MEMS Transducers: II

Capacitive transducers: introduction, capacitor fundamentals, modeling a capacitor sensor, capacitive accelerometer.

Unit V - MEMS Transducers: III

Piezoelectric transducers: introduction, modeling piezoelectric materials, mechanical modeling of beams and plates, cantilever piezoelectric actuator.
Thermal transducers: introduction, basic heat transfer, hot-arm actuator.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Understand the fabrication process in industry in the context of MEMS.
CO 2 : Identify several techniques used in MEMS fabrication.
CO 3 : Understand the different types of transducers in MEMS technology.
CO 4 : Acquire knowledge in exploring capacitive transducers as MEMS transducer.
CO 5 : Identify thermal and piezo electric transducers for MEMS.

Text Books:

1. Thomas M. Adams and Richard A. Layton, “Introductory MEMS Fabrication and Applications”, Springer US, 2014.
2. Mohamed Gad-el-Hak, “MEMS: Applications”, CRC Press, 2005.

References:

1. Tai-Ran Hsu, ”MEMS and Microsystems: Design and manufacture”, McGraw-Hill, 2002.
2. Chang Liu, “Foundation of MEMS”, 2nd Edition, Pearson, 2005.

66453

POWER PLANT INSTRUMENTATION
(Professional Elective-IV)
(EIE)

Instruction	:	3 Periods / Week	Continuous Internal Evaluation	: 30 Marks
Credits	:	3	Semester End Examination	: 70 Marks
			End Exam Duration	: 3 Hours

Prerequisite subject: Transducers and Applications, Process Control Instrumentation, Analytical Instrumentation

Course Objectives:

1. Understand and analyze the process of power generation and measurement and control of different plant parameters.
2. Identify and understand the techniques for measuring different electrical and non-electrical parameters..
3. To know the Combustion Control process in Boilers
4. Understand and analyze the process of Turbine Monitoring And Control
5. To analyze and identify pollutants in flue gases and industrial waste generated during the process of power generation.

UNIT I - An Overview Of Power Generation

Brief survey of methods of power generation: Hydrothermal, Nuclear, Solar, Wind. Importance of instrumentation for power generation, Thermal power plant- Building blocks, Classification of Boiler, working of the Boiler Process, Types of High Pressure boilers, concepts of PI diagrams, Cogeneration.

UNIT II - Electrical Parameters

Current, Voltage, Power, Frequency meter, power factor meter, Trivector meter.

Non Electrical parameters

Feed flow of water, fuel, air and steam in a Thermal power plant. Temperature, Pressure, Level, radiation detectors, Smoke density measurements, dust monitor.

UNIT III - Combustion Control in Boilers

Combustion control: Boiler feed water Circulation, Control of Main header Pressure, air fuel ratio control, furnace draft and excessive air control drum level (three element control) main and reheat steam temperature control, burner tilting up, bypass damper, super heater.
Spray and gas recirculation controls, BFP recirculation control, Hot well and deaerator level control, Pulverized control, Computers in Power Plants.

UNIT IV - Turbine Monitoring And Control

Condenser vacuum control, gland steam exhaust pressure control, Speed, Vibration, Shell temperature monitoring and control, Lubricating oil temperature control, Hydrogen – generator cooling system.

UNIT V - Analyzers In Power Plants

Thermal conductive type, Oxygen analyzer, Infrared type analyzer, Spectrum analyzer, Hydrogen purity meter.

Chromatography, pH meter, Conductivity cell – fuel analyzer, Brief survey of pollution monitoring and control equipment.

Course Outcomes: At the end of the course, the student should be able to

CO 1: Monitor & Control Parameters in power plants.
CO 2: Acquire confidence in identifying measuring systems in power Plants.
CO 3: Understand role of instrumentation in power plants.
CO 4: Understand and analyze the process of Turbine Monitoring and Control
CO 5: Develop Innovate ideas to improve plant efficiency, reduce leakages, losses and use technologies for designing and developing pollutant free industrial environment.

Text Books:

1. El-Wakil M.M, “Power Plant Technology”, Tata McGraw-Hill, 1985
2. K. Krishnaswamy, M. PonniBala, “Power Plant Instrumentation”, PHI Learning Pvt. Ltd., 2011.

References:

1. Elonka S.M., KohalA.L.,”Standard Boiler Operations Questions and Answers”, TMH, 1994 New Delhi.
2. Modern Power Station Practice, vol. 6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.

66454

SCADA & DISTRIBUTED CONTROL SYSTEM

(Professional Elective-V)
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Prerequisite subject: PC Based Instrumentation

Course Objectives:

1. To understand the SCADA (Supervisory Control and Data Acquisition) architecture & elements of SCADA system.
2. To develop knowledge on Remote Terminal &Master Terminal Units.
3. To acquire knowledge on DCS (Distributed Control Systems).
4. To develop skills on several communication protocols for DCS.
5. To gain knowledge on HART & Field bus communication protocol.

Unit I - Introduction to SCADA

Definition of SCADA, elements of SCADA (Supervisory Control and Data Acquisition) system, application area, limited two way system, real time system, communication access and master slave, scan interval, Murphy's law and remote control, safety instrumented system, regulatory requirement, communication: long distance, protocol, modem, synchronous and asynchronous.

Unit II - RTU, MTU and wiring

RTU: Structure of RTU, CPU, Analog I/O, Pulse I/P, Digital I/Os, Communication Interface, Power supply, RTU Rack and enclosure, test and maintenance of RTU, requirements for RTU system.

MTU: Master Terminal Unit, hardware structure, Functions of MTU, Configuration of MTU, Redundant MTU system, Sensors, Actuators, wiring standardization and maintenance.

Unit III - Distributed Control System (DCS)

Evolution, Architectures, Comparison, Local control unit, Process interfacing issues, Communication facilities.

Unit IV - Interfaces in DCS

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

Unit V - HART and Field Bus

Evolution of signal standards, HART communication protocol, communication modes, HART networks, control system interface, HART and OSI model, Field bus introduction, General field bus architecture, Basic requirement of field bus standard, Field bus topology, Inter operability.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the SCADA architecture & elements of SCADA system.
CO 2	:	Develop knowledge on Remote Terminal & Master Terminal Units.
CO 3	:	Acquire knowledge on distributed control systems.
CO 4	:	Develop skills on several communication protocols for DCS (Distributed Control System).
CO 5	:	Gain knowledge on HART & Field bus communication protocol.

Text Books:

1. Stuart. A. Boyer "SCADA ", 3rd Edition, ISA, 2010.
2. Michael P. Lukas, "Distributed Control System", First Edition, Van Nostrand Reinhold Co., Canada, 1986.

References:

1. Stuart A. Boyer "SCADA-Supervisory Control and Data Acquisition System", 3rd Edition, ISA publication.
2. Dobrivoje Popovic and Vijay Bhatkar "Distributed Computer Control for Industrial", 1st Edition, Marcel Dekker Inc., 1990.
3. David Bailey, Edwin Wright "Practical SCADA for Industry", 1st Edition, Newnes, (an imprint of Elsevier), 2003.

66455

RELIABILITY ENGINEERING
(Professional Elective-V)
(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			End Exam Duration	:	3 Hours

Course Objectives:

1. To understand essentially what is meant by reliability and distinguish it from quality.
2. To calculate reliability of the system knowing reliability of components.
3. To calculate reliability of systems connected in series and parallel and combination thereof.
4. To improve reliability and manage reliability of instruments and system.
5. To gain knowledge about economics of reliability engineering

Unit I

Basic Concepts of Reliability: Introduction, Reliability and quality, Failures and failure modes, Causes of failures and reliability, Maintainability and availability, History of reliability, reliability literature.

Unit II

Reliability Mathematics: Introduction, Random experiment, Probability, Random variables, Distribution functions, Discrete distribution, Continuous distribution, Numerical characteristics of random variables, Laplace transform.

Component Reliability and Hazard Models Introduction, Component reliability from test data, Mean time to failure, Time – dependent hazard models, Stress – Dependent hazard models, Derivation of reliability function using Markov, Treatment of field data.

Unit III

System Reliability Models: Introduction – Systems with series components – Systems with parallel components – k-out-of-m systems – Non series parallel systems – Systems with – mixed – mode failures – Fault – tree technique.

Unit IV

Maintainability and Availability Concepts: Introduction – Maintainability function – Availability function – Frequency of failures – Two-unit parallel systems with repair – k-out-of-m systems – Preventive maintenance.

Reliability Improvement: Introduction – Improvement components – Redundancy – Element redundancy – Unit redundancy – Stand by redundancy – Optimization – Reliability – cost trade – off.

Unit V

Economics of Reliability Engineering: Economic issues – Manufacture's cost – Customer's cost – Reliability achievement cost – models – Reliability utility cost models – Depreciation cost models – Availability – cost – model of parallel systems.

Reliability Management: Reliability programming – Management policies and decision – Reliability management by objectives – Reliability group – Reliability data: Acquisition and analysis – Managing people for reliability.

Course Outcomes: At the end of the course, student will be able to

CO1 : Understand essentially what is meant by reliability and distinguish it from quality.
CO2 : Calculate reliability of the system knowing reliability of components.
CO3 : Calculate reliability of systems connected in series and parallel and combination thereof.
CO4 : Improve reliability and manage reliability of instruments and system.
CO5 : Gain knowledge about economics of reliability engineering

Text Books:

1. R. Billington, RN Allan, “Reliability Evaluation of Engineering Systems”, BS Publications 2007.
2. Dr. A.K. Gupta, ”Reliability, Maintenance and safety Engineering”, Laxmi Publications, 2009.

References:

1. Patrick DT, “Reliability Engineering”, 4th Edition, Wiley India, 2002.
2. Naikan, “Reliability Engineering and life testing”, PHI, 2008.
3. B.S. Dhillon, “Engineering Maintenance a Modern Approach”, CRR Publications, 2002.
4. RC Misra, “Maintenance Engineering and Management”, PHI, 2012.

64458

EMBEDDED SYSTEM DESIGN

(Professional Elective-V)

(EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	0	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite: Microprocessors and Microcontrollers

Course Objectives:

1. To introduce the Embedded System as a system different from the general computing system.
2. To obtain the knowledge of the different processing elements used in embedded systems.
3. To introduce and to signify the use of a real-time operating system with an embedded system through hardware-software co-design.

Unit I – Introduction to Embedded Systems

Definition of Embedded System, Distinguish between Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Applications, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit II – Typical Embedded System

The core of the Embedded System: General Purpose and Domain-Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Unit III – Application & Domain-Specific Embedded System

Washing Machine - Application-Specific Embedded Systems, Automotive - Domain-Specific Examples of Embedded Systems, Embedded Firmware, Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real-Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

Unit IV – Design of Embedded Systems using 8-bit Microcontroller

Factors to be Considered in Selecting a Controller, advantages of 8051 Microcontroller in Embedded Systems, Design with 8051, 8052 Microcontroller, 8051/8052 Variants; Hardware-Software Co-Design and Program Modeling: Fundamental Issues in Hardware-Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language (UML), Hardware Software Trade-offs.

Unit V –Case Studies

Digital Camera- Introduction, User’s Perspective, Designer’s perspective, Informal Functional Specifications, Non-functional Specifications, Executable Specifications, Implementation 1: 8051-based design, Implementation 2: Fixed Point FDCT, Implementation 3: Hardware FDCT, Mobile Phone- Requirements, Architecture, Synchronization, Automatic Chocolate Vending Machine-Software Architecture, Synchronization. Smart Card- Architecture.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand an embedded system and to know its applications
CO 2	:	Experience common aspects of embedded system development
CO 3	:	Understand different embedded application and domain-specific systems
CO 4	:	Know hardware software development to design embedded systems
CO 5	:	Familiarize with embedded system designs

Text Books:

1. Shibu K. V, Introduction to Embedded Systems, 2nd Edition, McGraw-Hill, 2009.
2. Frank Vahid and Tony D. Givargis, Embedded System Design: A Unified Hardware /Software Introduction, John Wiley, 2002.

References:

1. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 2nd Edition, Tata McGraw-Hill, 2008.
2. Lyla, Embedded Systems, Pearson, 2013.
3. David E. Simon, An Embedded Software Primer, Pearson Education, 2007.

B.Tech. IV year – I Semester (R18-CBCS)
Open Elective-I

Sl. No.	Subject Code	Department	*Subject*	Periods per Week		Credits	Scheme of Examination Maximum Marks			Pg. No.
				L	T/P/D		CIE (Continuous Internal Evaluation)	SEE (Semester End Examination)	Total	
1	61411	CE	Transportation Systems	3	0	3	30	70	100	3
2	61412	CE	Water Conservation and Rainwater Harvesting	3	0	3	30	70	100	5
3	65412	CSE	Fundamentals of Object Oriented Programming Using Java	3	0	3	30	70	100	7
4	65413	CSE	Fundamentals of Operating Systems and Shell Programming	3	0	3	30	70	100	9
5	65414	CSE	Statistical Analysis with R	3	0	3	30	70	100	11
6	64409	ECE	Consumer Electronics	3	0	3	30	70	100	13
7	64410	ECE	Communication Systems	3	0	3	30	70	100	15
8	62408	EEE	Electric & Hybrid Vehicles	3	0	3	30	70	100	17
9	62409	EEE	Energy Management	3	0	3	30	70	100	18
10	66406	EIE	Basics of Sensors & Transducers	3	0	3	30	70	100	20
11	66407	EIE	Environmental Instrumentation	3	0	3	30	70	100	22
12	67410	IT	Basics of Data Base Management Systems	3	0	3	30	70	100	24
13	67411	IT	Cyber Security	3	0	3	30	70	100	26
14	63414	ME	Basics of Automobile Engineering	3	0	3	30	70	100	28
15	63415	ME	Engineering Materials	3	0	3	30	70	100	30
16	68401	H&S	Basics of Human Anatomy & Physiology	3	0	3	30	70	100	31
17	68402	H&S	Entrepreneurship	3	0	3	30	70	100	33
18	68403	H&S	Basics of Psychology	3	0	3	30	70	100	35
19	68404	H&S	Applied Finance	3	0	3	30	70	100	37
20	68405	H&S	Fundamentals of Data Science	3	0	3	30	70	100	39

Note: Students cannot opt for an Open Elective subject offered by their own / parent department and also the subject which they already studied. Open Electives offered by CSE & IT cannot be opted by students of CSE & IT.

B.Tech. IV year – II Semester (R18-CBCS)

Open Elective-II

Sl. No.	Subject Code	Department	*Subject*	Periods per Week		Credits	Scheme of Examination Maximum Marks			Pg. No.
				L	T/P/D		CIE (Continuous Internal Evaluation)	SEE (Semester End Examination)	Total	
1	61456	CE	Green Building Technology	3	0	3	30	70	100	41
2	61457	CE	Disaster Planning & Mitigation	3	0	3	30	70	100	43
3	65460	CSE	Fundamentals of Web Programming	3	0	3	30	70	100	45
4	65461	CSE	Fundamentals of Computer Networks	3	0	3	30	70	100	47
5	64455	ECE	Fundamentals of Wireless Communications	3	0	3	30	70	100	49
6	64456	ECE	MATLAB for Engineers	3	0	3	30	70	100	51
7	62456	EEE	Electrical Safety	3	0	3	30	70	100	53
8	62457	EEE	Solar Energy Systems	3	0	3	30	70	100	55
9	66458	EIE	Fundamentals of Bio-Medical Instrumentation	3	0	3	30	70	100	57
10	66459	EIE	Fundamentals of Industrial Automation	3	0	3	30	70	100	59
11	67457	IT	Programming Using Python	3	0	3	30	70	100	61
12	67458	IT	Basics of IoT	3	0	3	30	70	100	63
13	63456	ME	Elements of Mechanical Engineering	3	0	3	30	70	100	65
14	63457	ME	Rapid Prototyping	3	0	3	30	70	100	67
15	68451	H&S	Polity and Politics in India	3	0	3	30	70	100	69
16	68452	H&S	Appreciation of Contemporary English Literature	3	0	3	30	70	100	71
17	68453	H&S	Fundamentals of Human Food and Nutrition	3	0	3	30	70	100	73
18	68454	H&S	Management Science	3	0	3	30	70	100	75
19	68455	H&S	Social Psychology	3	0	3	30	70	100	77

Note: Students cannot opt for an Open Elective subject offered by their own / parent department and also the subject which they already studied. Open Electives offered by CSE & IT cannot be opted by students of CSE & IT.

61411

TRANSPORTATION SYSTEMS

(Open Elective-I: Common to all branches except CE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Nil

Course Objectives:

1. To comprehend transportation systems and highway planning
2. To acquire the knowledge of traffic regulations and road safety
3. To explicate various railway track components
4. To elucidate characteristics of an airport
5. To comprehend waterway transportation and navigation aids

Unit I – Introduction to Transportation Systems

Transportation Systems-Introduction – Types of modes - Highway development in India - Jayakar committee, Motor vehicle act, NHAI, Highway planning - Surveys and master plan, 21^{st} Century road development - Highway alignment - Factors affecting alignment.

Unit II - Traffic Regulation and Road Safety

Traffic Regulation and Road Safety-Traffic signs - Road markings – Intersection conflict points-Traffic signals-Types of signals, Road Accidents, Causes of Accidents and its preventive measures – Design elements and capacity–Grade separated intersections - Travel demand management - Traffic management measures - Introduction to road safety, Traffic Calming.

Unit III - Railways

Railways -Introduction to permanent way-Cross section of permanent way - Functions of various components like rails, sleepers and ballast - Rail fastenings - Sleeper density - Cant and negative super elevation - Degree of curve - Crossings and turn outs.

Unit IV - Airways

Airways-Aircraft characteristics – Airport site selection – Runway capacity and configuration – Taxiway configuration – Apron – Hanger - Airport layout – Runway orientation – Wind rose diagrams – airport marking and lighting.

Unit V – Waterways

Waterways-History of water transportation, Definition - harbors, ports, docks, tides and waves - Classification of harbors – Port site selection - Layout of an artificial harbor and components – breakwater – Dry and wet docks - Navigational aids – light house and mooring accessories.

Course Outcomes: At the end of the course, students will be able to

CO 1 : Enumerate the factors affecting alignment of Highways
CO 2 : Follow road safety measures
CO 3 : Compute super-elevation in railway designs
CO 4 : Suggest suitable Airport runway
CO 5 : Prepare a suitable layout for harbors

Text Books:

1. S. K. Khanna and C.E.G. Justo*, Highway Engineering,* Nemchand & Bros., 2011.
2. Subramanian K P, *Textbook on Highway, Railway, Airport and Harbour Engineering,* Scitech Publications (India), Pvt. Ltd.

References:

1. S.P. Bindra*, Highway Engineering,* Dhanpat Rai & Sons, 2008.
2. M. M. Agarwal*, Railway Engineering,* Prabha & Co., 2016.
3. S. K., Arora *M. G., and Jain S.S.Airport Planning and Design, Khanna,* Nemchand and Brothers, 2009.

61412

WATER CONSERVATION AND RAINWATER HARVESTING

(Open Elective-I: Common to all branches except CE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Nil

Course Objectives:

1. To comprehend hydrological processes and issues related to water conservation
2. To explicate urban hydrological cycle and storm water management
3. To estimate the drought assessment and mitigation
4. To impart the knowledge of rainwater harvesting and methods of rainwater harvesting
5. To understand processes involved in participatory water conservation

UNIT I - Assessment of Surface and Sub-surface water resources

Surface and Sub-surface water resources- Hydrologic cycle, ground water resources, surface water resources, water balance, and water scarcity.

UNIT II - Urban Storm Water Management

Urban Storm Water Management-Urban hydrologic cycle, major problems, storm water management objectives and limitations; urban storm water management practices (Structural and Non-structural Management measures)– Detention and retention concepts– Flow and storage capacity of urban components–Temple tanks. Urban storm water conservation methods.

UNIT III - Drought Management and Assessment

Definition of drought Causes of drought, measures for water conservation an augmentation, Drought- contingency planning-Drought Assessment -Drought Severity Assessment – Meteorological Hydrological and Agricultural methods – Drought Indices.

UNIT IV - Rainwater Harvesting

Rainwater Harvesting -Need for artificial recharge and rain water harvesting. Recharge Structures: various artificial recharge structures: recharge ponds - recharge pits – percolation ponds - Rainwater harvesting in urban areas: RWH structures - design - construction. Recharge Estimation & Maintenance: Estimation of probable runoff from an area including roof tops - maintenance and monitoring of RWH structures. Exploration techniques and selection of artificial recharge zones.

UNIT V - Participatory Water Conservation

Participatory Water Conservation-Community - level rainwater harvesting. Global Challenges - Social – Economic – Environmental - Solutions –Political - Water Marketing – Water Rights - Consumer education – Success Stories Case Studies.

Course Outcomes: At the end of the course, students will be able to

CO 1	:	Describe hydrological processes and issues related to water conservation
CO 2	:	Solve urban storm water management problems
CO 3	:	Estimate impact of droughts and their mitigation
CO 4	:	Apply different methods of rainwater harvesting
CO 5	:	Handle the global challenges of water conservation

Text Books:

1. Jaya Rami Reddy*, Hydrology,* Laxmi Publications, 2011.
2. K. Sivasubramaniyan*, Water Management,* SIMRES Publication, Chennai, 2011

References:

1. David Keith Todd*, Groundwater Hydrology,* John Wiley & Sons, 1993.
2. *Rainwater Harvesting Techniques to augment Groundwater*- Ministry of Water Resources.
3. E.M. Tideman*, Watershed Management,* Omega Scientific Publishers, 1996.

65412

FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING USING JAVA

(Open Elective-I: Common to all branches except CSE, IT and CSIT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Data Structures through C

Course Objectives:

1. The student should able to understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using Java language.
2. The student should be able to identify, define exception and implement exception handling mechanism in the application domain.
3. The student should be able to apply multi-threading and thread level synchronization to improve the performance of the applications.

Unit I - Introduction to Java and Building Blocks of Java Language

Introduction to Java and Building Blocks of Java Language: Basics of Java: History/ Background of Java, Java Buzzwords, Java Virtual Machine and Byte code, Java Environment setup, Java Program structure, Data Types, Variables -- Scope and Life Time, Operators, Expressions, Type Conversions and Type Casting, Conditional statements and Control statements, Simple Java Programs, Java C and Java command flags.

Encapsulation: Classes and Objects, Classes: Class structure, class components, Objects: Object declaration, Reference variables, Constructors - default Constructor, Parameterized Constructors, Constructor overloading, this keyword and its uses, Arrays concept, static modifier, Access modifiers, Wrapper classes.

Methods and Packages: Passing parameters to methods– Passing primitive types and Passing Objects, Method Overloading, Garbage collection, java.lang.System.gc(), finalize(), Packages – package access, class path setting, package access rules.

Unit II - OOP Concepts

OOP Concepts: Inheritance, Inheritance concept, super class and subclass relationship, principle of substitution, effect of access modifiers on inheritance. Usage of super (field, method, constructor) and final (field, class, method) keywords, Polymorphism- method overriding, dynamic method dispatch.

Abstract Classes and Interfaces: Abstract classes -- concept, usage, Interfaces– declaration, implementation and applications, components of an interface, extending interfaces.

String Handling: String class, String APIs

Unit III - Dealing Exceptions and I/O

Dealing Exceptions and I/O: Exceptional Handling: Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, Built in Exceptions, Custom exceptions, Introduction to Java I/O package.

Unit IV – Multithreading

Multithreading: Fundamentals, Thread Life Cycle, Ways of creating threads - Thread class and Runnable interface, Thread priorities, Creating multiple threads, core methods of Thread class, Thread Synchronization.

Unit V - GUI Development

GUI Development: AWT, Basics of GUI Programming, Event handling – Delegation event model, event sources, event listeners, event classes, adapter classes, nested classes and interfaces, handling keyboard and mouse events.

Swing: Containers, components, layout managers, frames and windows, panels, buttons, checkboxes, radio buttons, combo boxes, lists, labels, color choosers, file choosers, text fields, text areas, tool tips.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Design and implement object oriented concepts like encapsulation, abstraction and data hiding using programming constructs offered by java language.
CO 2	:	Realize the power of inheritance, interfaces and packages.
CO 3	:	Understand and demonstrate the concepts of exception handling and java io streams.
CO 4	:	Demonstrate knowledge and understanding of multi-threading in java.
CO 5	:	Design and develop java applications using AWT and Swings for providing solutions to real world problems.

Text Books:

1. Herbert Schildt, *Java: The complete Reference*, 9th Edition, Oracle Press.
2. Cay S. Horstmann and Gary Cornell, *Core Java, Volume II- Advanced Features*, 9th Edition, Prentice Hall.

References:

1. Cay S. Horstmann and Gary Cornell, *Core Java, Volume I: Fundamentals*, 9th Edition, Prentice Hall.
2. Kathy Sierra and Bert Bates, *Head First Java*, 2nd Edition, O’reilly Publications.

65413

FUNDAMENTALS OF OPERATING SYSTEMS AND SHELL PROGRAMMING

(Open Elective-I: Common to all branches except CSE, IT and CSIT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Data Structures through C, Computer Organization

Course Objectives:

1. To introduce the operating system abstraction of devices.
2. To offer different memory management techniques and implementation mechanisms for efficient use of memory.
3. To give clear understanding on filters.
4. To make students to write automated scripts.

Unit I – Operating System Overview, Process Management

Operating System Overview: Operating System Functions and Services, Overview of Computer Operating Systems, Distributed and Special Purpose Systems, System Calls and System Programs, Operating System Structure.
Process Management: Process Concepts, Scheduling-Criteria, Scheduling Algorithms.

Unit II – Synchronization, Deadlocks

Synchronization: The Critical-Section Problem and Peterson’s Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.
Deadlocks: Deadlock Characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

Unit III – Memory-Management Strategies

Memory-Management Strategies: Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.
Virtual-Memory Management: Virtual Memory and Demand Paging, Introduction to Page Replacement & Page-Replacement Algorithms.

Unit IV – Simple Filters, Filters Using Regular Expressions

Simple Filters: Cat, Head, Tail, Cut, Tr, Uniq, Comm, Filters Using Regular Expressions: Patterns, Regular Expressions, grep family, Regular Expressions Supported by grep family, Searching Based on Content.

Unit V – Korn Shell Programming

Basic Script Concepts, Expressions, Decisions, Making Selections, Repetition, Special Parameters and Variables, Changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Acquire Basic Knowledge about different functions, structures and design features of contemporary operating systems.
CO 2	:	Classify different Process Scheduling, Synchronization, and Deadlock algorithms.
CO 3	:	Appreciate Virtual Memory Implementation.
CO 4	:	Process Text Files that represent different Use cases.
CO 5	:	Develop Interactive Menu Driven Shell Scripts.

Text Books:

1. Abraham Silberchatz, Peter B.Galvin and Greg Gange, *Operating System Concepts*, 8^{th} Edition, John Wiley, 2008.
2. Behrouz A. Forouzan and Richard F.Gilberg, *Unix and Shell Programming*, Brooks/Cole Thomson Learning, 2003.

References:

1. Graham Glass and King Ables, *Unix for Programmers and Users*, 3^{rd} Edition, Pearson Education, 2003.
2. Kenneth Rosen, Douglas Host, Rachel Klee and Richard Rosinski, *Unix Programming Environment*, 2^{nd} Edition, TMH, 2007.

65414

STATISTICAL ANALYSIS WITH R

(Open Elective-I: Common to all branches except CSE, IT and CSIT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To use R for statistical programming, computation, graphics, and modeling.
2. To write functions and use R in an efficient way.
3. To fit some basic types of statistical models.
4. To use R in their own research.
5. To be able to expand their knowledge of R.

UNIT I - Introduction

Variables, Data Types, Vectors, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes. R Programming Structures, Control Statements, Loops, - Looping Over Non-vector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quick sort Implementation-Extended Example: A Binary Search Tree.

UNIT II - Doing Math and Simulation in R

Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions of Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files,

UNIT III - Graphics

Creating Graphs, The Workhorse of R Base Graphics, the plot() Function, Adding Lines: The abline() Function, Changing Character Sizes: The cex Option, Changing the Range of Axes: The xlim and ylim Options – Customizing Graphs, Saving Graphs to Files.

UNIT IV - Probability Distributions and Basic Statistics

Probability Distributions, Binomial Distribution, Poisson and Normal Distributions, Descriptive Statistics, Covariance and Correlation t, F, Chi-square and ANOVA tests.

UNIT V - Linear Models

Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests.

Course Outcomes: After completion of the course, students should be able to:

CO 1	:	Get motivation for learning a programming language.
CO 2	:	Access online resources of R and import new function packages into the R workspace.
CO 3	:	Import, review, manipulate and summarize data-sets in R.
CO 4	:	Explore data-sets to create testable hypothesis and identify appropriate statistical tests.
CO 5	:	Perform appropriate statistical tests using R; Create and edit visualizations.

Text Books:

1. Sandip Rakshit, *Statistics with r Programming*, McGraw-Hill.
2. A K Verma, t*he Art of R Programming*, Cengage Learning.
3. Lander, *R for Everyone*, Pearson.

References:

1. Paul Teetor, *R Cookbook*, Oreilly.
2. Mani Sekhar, *Programming with R*, Cengage Learning.
3. Norman Matloff, t*he Art of R Programming*, No Starch Press.

64409

CONSUMER ELECTRONICS

(Open Elective-I: Common to all branches except ECE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To obtain a basic knowledge of using consumer electronic systems and products
2. To understand the working of audio and video systems
3. To learn technical aspects of various home appliances

Unit I – Audio systems

Microphones, Characteristics of Microphones, Types of Microphone-Carbon, Crystal, Ribbon, Wireless. Head Phones - Types of headphones, Crystal, Dynamic, Electrostatic, Hearing Aids, Loud Speakers, Ideal Loud Speaker, Basic and Crystal Loud Speakers, Loud Speaker Construction and PA Systems, Home theatre system, Optical Recording and Reproduction Systems – CDs, DVDs, Blue Ray Technology.

Unit II – Television, Cable and DTH

Elements of TV Communication System, Scanning, Composite Video Signal, Need for Synchronizing and Blanking Pulses, Dispersion & Recombination of Light, Primary and Secondary Colors, Attributes of Color, Luminance Signal, Chrominance Signal, Color TV, NTSC Systems, PAL Systems, Block Diagram of TV Receiver, LCD, Plasma and OLED TV Fundamentals, Block Diagram and principles of working of Cable TV and DTH.

Unit III – Special purpose electronics

Xerography, Photocopier, CFL, LED Lamps, Applications and Advantages. Solar Lamp, Water Purifier, Automated Teller Machine (ATM), Electronic Funds Transfer, Point of Sale Terminal. Security devices: Biometric Attendance Monitoring System, Biometric Sensors, Home Automation System.

Unit IV – Telecommunication systems

Telecommunication Systems, Line System Characteristics, Radio System Characteristics, Telephone Receiver and Handsets, Answering Machines, Signaling, Switching System Principles, Telephone Network, Non-Voice Traffic, Optical Fiber Cable, Types, Advantages and Disadvantages of Optical Fiber, Cellular Mobile Systems- Block Diagram. Satellite Communications.

Unit V – Home appliances

Microwaves, Microwave Oven Block Diagram, Types of Microwave Ovens, Washing Machine Hardware, Types of Washing Machines, Air Conditioning, Components of Air Conditioning Systems, Water and Air Conditioning Systems, Refrigeration principle, Refrigeration Systems, Domestic Refrigerators.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Learn about different types of loudspeakers, microphones and audio systems
CO 2	:	Understand the fundamentals of television and working on cable TV and DTH
CO 3	:	Understand security systems and special purpose electronic devices
CO 4	:	Obtain a basic understanding of telephones and cellular phones
CO 5	:	Understand the working principles of different home appliances

Text Books:

1. S. P. Bali, *Consumer Electronics*, Pearson Education India, 2005.
2. M L Anand, *Consumer Electronics*, Khanna Publishers, 2006.

References:

1. Philip Hoff and Philip Herbert Hoff, *Consumer Electronics for Engineers*, Cambridge University Press.
2. R. G. Gupta, *Audio and Video system: Principles, maintenance and Troubleshooting*, TMH, 2010.
3. C. P. Arora, *Refrigeration and Air conditioning*, Tata McGraw-Hill, New Delhi, 1994.

64410

COMMUNICATION SYSTEMS

(Open Elective-I: Common to all branches except ECE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course objectives:

1. To understand the basic concepts of analog and digital modulation & demodulation techniques.
2. To understand various types of noise and effect on communication systems
3. To understand the channel capacity and importance of error-correcting codes

Unit I – Introduction

Communication system – Electronic Communication System, Optical Communication System, Radar System, Microwave System and Satellite Communication System, Noise- External Noise, Internal Noise, Noise Figure, Noise Temperature.

Unit II – Amplitude Modulation

Need for Modulation, Amplitude Modulation, Generation of AM Waves, Demodulation of AM Waves, DSBSC – Generation of DSBSC Waves, Coherent Detection of DSBSC Waves, Single Side Band Modulation, Generation of SSB Waves, Demodulation of SSB Waves, Vestigial Sideband Modulation (VSB).

Unit III – Angle Modulation

Theory of Frequency and Phase Modulation, Generation and Detection of FM, Pre-emphasis and De-emphasis, Comparison of Wideband and Narrowband FM Modulation & Demodulation, Comparison of AM & FM.

Unit IV – Digital Modulation

Sampling Theorem for Baseband and Passband Signals, Pulse Code Modulation (PCM), Introduction, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quaternary Shift Keying (QPSK), Quadrature Amplitude Modulation (QAM) and Bandwidth Efficiency, M-ary Modulation, BER and Probability of Error.

Unit V – Information Theory and Coding

Information Capacity, Bits, Bit rate, Baud, Error Control: Error Detection - Redundancy, Echoplex, Longitudinal Redundancy Check, Vertical Redundancy Check, Cyclic Redundancy Check, Checksum, Forward Error Correction- Hamming Code.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand various communication systems and sources of noise
CO 2	:	Learn the different types of amplitude modulation and demodulation techniques
CO 3	:	Learn the different types of angle modulation and demodulation techniques
CO 4	:	Understand the different types of digital modulation and demodulation techniques
CO 5	:	Derive the channel capacity and improve the performance using error-correcting codes.

Text Books:

1. G. Kennedy, *Electronic Communication Systems*, 4^{th} Edition, McGraw-Hill, 2008.
2. Wayne Tomasi, *Introduction to Data Communication and Networking*, Pearson, 2005.

References:

1. Taub & Schilling, *Principles of Communication Systems*, TMH, 1998.
2. Simon Haykin, *Communication Systems*, John Wiley, 1998.
3. J. C. Hancock, a*n Introduction to the Principles of Communication Theory*, TMH, 1998.

62408

ELECTRIC AND HYBRID VEHICLES

(Open Elective-I: Common to all branches except EEE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

This course introduces the fundamental concepts, principles, analysis and design of hybrid, electric and fuel cell vehicles.

Course Objective:

1. To understand the working of different configurations of electric vehicles, and its components, hybrid vehicle configuration and performance analysis.

Unit I - Electric Vehicles

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

Unit II - Battery

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

Unit III - DC& AC Electrical Machines

Motor and Engine rating, Requirements, DC machines, Three phase A/C machines, Induction machines, permanent magnet machines, switched reluctance machines.

Unit IV - Electric Vehicle Drive Train

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

Unit V - Hybrid Electric Vehicles

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

Course Outcomes: At the end of the course student will be able to

CO 1 : Understand the basic performance of electric vehicles and dynamics of vehicle motion.
CO 2 : Understand the complete working and characteristics of batteries.
CO 3 : Understand ratings and requirements of DC/AC machines.
CO 4 : Understand the performance electric driven trains and hybrid electric vehicles.

Text Books:

1. Iqbal Hussain*, Electric & Hybrid Vechicles* – Design Fundamentals, Second Edition, CRC Press, 2011.
2. James Larminie*, Electric Vehicle Technology Explained*, John Wiley & Sons, 2003.

References:

1. MehrdadEhsani, YiminGao, Ali Emadi, "*Modern Electric, Hybrid Electric*, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
2. Sandeep Dhameja, "*Electric Vehicle Battery Systems*", Newnes, 2001.

62409

ENERGY MANAGEMENT

(Open Elective-I: Common to all branches except EEE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. This course aims to provide students the information on energy sources, the purpose of managing the energy and also provide information on Demand side management.
2. This subject deals with present scenario of energy in the world and India, energy conservation methods, General aspects of energy management, energy planning, different energy instrument methods and green buildings, economic analysis of energy and the demand side management.

Unit I - General Aspects of Energy conversion

Energy situation – world and India, energy consumption, Conventional and Non-Conventional Sources of Energy, Energy, Conversion routes, Direct and indirect way of Energy Conversion, Fundamental of Energy conservation, and Energy conservation schemes, Basics of Energy Demand and Supply.

Unit II - General aspects of energy management

Objective of energy management, principle of energy management, energy management skills and strategies, planning, controlling, monitoring, reporting – energy manager, qualities and functions, maximizing system efficiency, optimizing the input energy requirements.

Unit III - Energy Action Planning

Key elements, Force field analysis, Energy policy purpose, perspective, Contents, Formulation, Ratification, Organizing – location of energy management, Top management support, Managerial function, Roles and responsibilities of energy manager, Accountability.

Motivating-motivation of employees: Information system-designing barriers, Strategies; Marketing and communicating-training and planning.

Unit IV - Energy Instruments and Green buildings

Energy Instruments- watt meter, thermocouples, pyrometers, lux meters, tongue testers, application of PLC‘s.

Energy consumption in buildings, construction cost vs life cycle cost, building design, Heating Ventilation and Air Conditioning systems (HVAC), building data loggers and advanced controls, energy conservation act 2001.

Unit V - Energy Economic Analysis and Demand Side Management

The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – numerical problems. Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning, Load management, load priority technique, peak clipping, peak shifting, valley filling.

Course Outcomes: After completion of the subject the student will be able understand

CO 1 : Various types of energy sources available and present energy scenario in India as well as in the world.
CO 2 : Analyze the General aspects of energy management.
CO 3 : Introduction to energy planning and management.
CO 4 : Various energy measuring instruments and concept of green building.
CO 5 : Analysis of economic factors those are included in the savings and organization in the demand side management.

Text Books:

1. Arry C. White*, Industrial Energy Management Systems*, Philip S. Schmidt and David R. Brown, Hemisphere Publishing Corporation, New York, 1994.
2. Chakrabarti and Amlan*, Energy Engineering and Management*, 2nd Edition, PHI Learning Pvt. Ltd.

References:

1. *Energy management*, W.R. Murphy & G. McKay Butter worth, Heinemann, 2007.
2. *Energy management*, Paul o' Callaghan, 1st edition, McGraw-Hill Book company, 1998
3. *Energy efficient electric motors*, John. C. Andreas, 2nd edition, Marcel Dekker Inc. Ltd, 1995.

66406

BASICS OF SENSORS & TRANSDUCERS

(Open Elective-I: Common to all branches except EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Credits	:	3	Semester End Examination	:	70 Marks
			Semester End Exam Duration	:	3 Hours

Course Objectives:

1. Deals with concept of measurement and sensors.
2. To study the various temperature sensors in detail.
3. To understand and analyze displacement and ranging Sensors
4. To study the construction and operation of strain gauge and pressure sensors.
5. Deals with understanding and application of Flow and Speed sensors

Unit I - Introduction to Measurement

General concepts and terminology, functional elements of measurement system with examples, sensors and transducers, Performance Characteristics, classification and selection of sensors, calibration techniques.

Unit II - Temperature Sensors

Concept and terminology, Thermocouple-Law, Construction of Thermocouple, Compensating circuits, Advantages and disadvantages of thermocouple.

Resistance Thermometer-Construction and application of Metal Resistance Thermometer
Thermistor – construction – types – applications of Thermistor, IC Sensors

Unit III - Displacement and Ranging Sensors

Displacement sensors: Introduction, Potentiometer, LVDT, RVDT, Capacitive, Encoders.

Ranging Sensors: RF beacons, Ultrasonic ranging, Reflection beacons, Laser Ranging sensor (LIDA)

Unit IV - Strain Gauge and Pressure Sensors

Strain gauge: Introduction, types and construction of strain gauges application.

Pressure sensors: General concept and Terminology, Simple U-tube manometer, Bourdon gauge, Diaphragm.

Unit V - Flow and Speed sensors

Flow sensors: Rota meter, hot wire anemometer, turbine flow meter, Electromagnetic, Ultrasonic and Laser Doppler anemometer.

Speed sensors: Tachometers, Photo electric, and Stroboscope.

Course Outcomes: At the end of the course, student should be able to

CO 1 : Understand the basic concepts of measurement
CO 2 : Improve skills in selecting a suitable sensor/transducer for a given temperature Measurement.
CO 3 : Acquire confidence in applying various transducer principles for displacement measurement.
CO 4 : Obtain knowledge on Strain gauge and Pressure sensors
CO 5 : Develop ability in analyzing the Flow and Speed sensors

Text Books:

1. Sawhney A K and Puneet Sawhney, "*A Course in Mechanical Measurements and Instrumentation Control*", Dhanpat Rai & Co Pvt. Ltd, 2005.
2. D. Patranbis, "*Sensors and Transducers*", TMH, 2003.

References:

1. Jon Wilson, "*Sensors Technology Handbook*", Newn age, 2004.
2. Arun Ghosh, "*Introduction to Measurements and Instrumentation*", PHI, 2nd Edition, 2007.

66407

ENVIORNMENTAL INSTRUMENTATION

(Open Elective-I: Common to all branches except EIE)

Instruction	:	3 Periods / Week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite subjects: Electronics, Instrumentation.

Course Objectives:

1. To discuss various types of pollution and quality of water monitoring.
2. To understand the ground water monitoring
3. To introduce the instrumentations for waste water monitoring.
4. To deal with air pollution and sound pollution measurement.
5. To discuss the weather station instrumentation

UNIT I

Introduction: Various types of environmental pollution and measurement, Necessity of instrumentation & control for environment, sensor requirement for environment.

Quality of water monitoring: Standards of raw & treated water, sources of water & their natural quality, Water quality parameters: Thermal conductivity, detectors, pH analyzers and their application, conductivity analyzers & their application. Water treatment: Requirements of water treatment facilities, process design.

UNIT II

Ground water monitoring: Level measurement in ground water monitoring wells, laboratory analysis of ground water samples, instrumentation in ground water monitoring, instrumentation in assessment of soil & ground water pollution.

Unit III

Waste Water and Flow Monitoring System: Automatic waste water sampling, optimum waste water, Sampling, waste water measurement techniques. Instrumentation set up for waste water treatment plant.

Flow monitoring: Open channel and Non- open waste water flow measurement.

Unit IV

Air Pollution and Sound Pollution Monitoring Systems: Definitions, energy- environment relationship, importance of air pollution, Air sampling methods & equipments, analytical methods for air pollution studies. Control of air pollution.

Sound pollution: Basics of sound pollution, its effect to environment. Acoustic noise measurement & monitoring.

Unit V

Instruments in Weather station Instruments in Weather station- Barometer, Rain gauge, Ceilometers. Global environmental analysis, Rover Environmental Monitoring station (REMS).

Course Outcomes: At the end of the course, student should be able to

CO 1 : Understand the basic concepts of Pollution measurement
CO 2 : Improve skills in selecting a suitable sensor/transducer for ground water measurement
CO 3 : Acquire confidence in applying various principles waste water measurement.
CO 4 : Obtain knowledge on Air Pollution and Sound Pollution Monitoring Systems
CO 5 : Develop ability in analyzing the instruments used in weather station.

Text Books:

1. Peany Howard S, Donal R Rowe and George TachoBanoylous Teddy, "Environmental Engineering". McGraw-Hill Education; First edition (1 July 2017), ISBN-13: 978
2. Randy D. Down & Jay H. Lehr, "Environmental Instrumentation & Analysis Handbook", Wiley-Blackwell (7 October 2004), ISBN-13: 978-0471463542

References:

1. Gilber M Masters, "Environmental Engineering and Science", Pearson Education (1997).
2. Kenneth Wark, Cecil F.Warner, Wayne T.Davis, "Air Pollution: Its Origin and Control", Pearson,3rd edition (13 November 1997), ISBN-13: 978-0673994165.

67410

BASICS OF DATABASE MANAGEMENT SYSTEMS

(Open Elective-I: Common to all branches except IT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite: NIL

Course Objectives:

1. Understand the basic concepts and architecture of DBMS.
2. Build conceptual models using ER model.
3. Understanding the concepts of SQL and insight knowledge to write SQL Queries.
4. Gain basic knowledge of PL/SQL and able to write programs in PL/SQL.
5. Understanding the concepts of Normalization and different Normal Forms.
6. Knowledge about Transaction Processing and Concurrency Control.

Unit I

Introduction, Database VS File System, Characteristics of Database System, Advantages of DBMS, Architecture of DBMS, Database schema, Three schema architecture, Data Independence, Data Models - ER Model, Relational Model, Database users and administrators, Classification of DBMS.

Unit II

ER Model – Entity Types, Entity Sets, Attributes and keys, Relationships, Relationship Types and Roles, Constraints on Relationship types, weak entities, Concepts design with ER Model, different ER Notations, Case Studies – ER diagrams.

Relational Model: Introduction to the Relational Model, Different Constraints over Relations, Key Constraints, Enforcing Integrity Constraints.

Unit III

Structured Query Language: Database languages, DDL & DML commands, Form of basic SQL Query, Examples of basic SQL queries, Applying different constraints on tables, NULL values, Logical Operators, Comparison Operators, Pattern Matching, SQL functions – Numeric Functions, String Functions, Date functions, Aggregate Functions, Conversion Functions, Group By and Having Clauses, Introduction to views, Examples.

Unit IV

Advanced SQL: Nested Queries, Set Operations, JOINS, DCL and Transaction Control Commands.

PL/SQL: Basics of PL/SQL, Control Structures, Cursors, Procedures, Functions, Triggers.

Unit V

Schema Refinement, Problems Caused by Redundancy, Decompositions, and Problems related to Decomposition, Reasoning about FDS, FIRST, SECOND, THIRD Normal Forms.

Transaction Management: Introduction to Transactions, ACID Properties, Anomalies in Concurrent Execution of Transaction, Lock Based Concurrency Control, Introduction to Crash Recovery.

Course outcomes: At the end of the course, the student will be able to

CO 1 : Gain knowledge about the basic concepts of DBMS.
CO 2 : Students can able to build conceptual models using ER diagrams and convert in relational model.
CO 3 : Write SQL Queries to retrieve data from different databases.
CO 4 : Write PL/SQL programs and Database Design using Normalization.
CO 5 : Get knowledge about how DBMS process Transactions using concurrency control mechanisms

Text Books:

1. Elamasri Navathe, Database Management System, 5^{th} Edition, Pearson.
2. Raghu Rama Krishnan, Johannes Gehre, Database Management Systems, 3^{rd} Edition, TMH.

References:

1. P.K. Das Gupta, Database Management System Oracle SQL and PL/SQL, PHI, 2009.
2. Silberschatz, Korth, Database System Concepts, 4^{th} Edition, TMH.
3. C.J. Date, Introduction to Database Systems, 8^{th} Edition, Pearson.

67411

CYBER SECURITY

(Open Elective-I: Common to all branches except IT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite: NIL

Course Objectives:

1. To learn about cyber crime and how they are planned
2. To learn the vulnerabilities of mobile and wireless devices
3. To learn about legal aspects related to cybercrimes
4. To learn about IPR and cybercrimes

Unit I

Introduction to Cybercrime: Introduction, Cybercrime and Information security, who are Cyber criminals, Classifications of Cybercrimes, Cyber crime: The legal Perspectives and Indian Perspective, Cyber crime and the IndianITA2000, A Global Perspective on Cybercrimes.

Cyber offenses: How criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, cyber stalking, Cyber café and Cyber crimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

Unit II

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/ Cell phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

Unit III

Cybercrimes and Cyber security: the Legal Perspectives: Introduction: Cyber crime and Legal Landscape around the world, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber crime Scenario In India, Digital signatures and the Indian IT Act, Amendments to the Indian IT Act, Cyber crime and Punishment Cyber law, Technology and Students: Indian Scenario.

Unit IV

Understanding Computer Forensics

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Life cycle, Chain of Custody concept, Network Forensics, Approaching a computer, Forensics Investigation, Challenges in Computer Forensics, Special Tools and Techniques Forensics Auditing.

Unit V

Cyber security: Organizational Implications

Introduction, Cost of Cyber crimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Course outcomes: At the end of the course, the student will be able to

CO 1 : Comprehend the various dynamics of cybercrimes.
CO 2 : Master the usage of tools and techniques for forensic analysis of a cybercrime committed in an organization.
CO 3 : Develop a plan for securing mobile and wireless devices against cybercrimes.
CO 4 : Understand the existing cyber laws and how to employ them in taking legal action against cyber criminals.
CO 5 : Realize the full impact of cybercrimes on IPR of organizations.

Text Books:

1. Cyber Security: Understanding Cybercrimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley India.
2. Introduction to Cyber Security, Chwan-Hwa (John) Wu and J. David Irwin, CRC Press-T&F Group.

Reference:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

63414 **BASICS OF AUTOMOBILE ENGINEERING**

(Open Elective – I: Common to all branches except ME)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam duration	:	3 Hours

Course Objectives:

1. To understand the concept and working of different types of Automobile engines, their components, its power supply units and fuel supply systems.
2. To understand the concept and working of lubrication system, cooling system and ignition system of an engine.
3. To understand the concept and working of different pollutants emitted from Automobile engines and their effects on environment.
4. To understand the concept and working of charging circuit, starting system, Transmission system, Suspension system and different types of braking system.

Unit I

Introduction to Automobiles and Fuels Systems

Introduction: Components of four wheeler automobile-chasis and body-power unit-power transmission-rear wheel drive, front wheel drive,4 wheel drive, basic working principle of 2 stroke &4 stroke engines. Engine construction.
Fuel system: Fuel supply systems for S.I &C.I

Unit II - Cooling, Ignition and Electrical Systems

Cooling System: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System.

Ignition System: Function of an ignition system, battery ignition system, Magneto coil ignition system, Electronic ignition system.

Electrical system: Charging circuit, Lightening systems, Horn, Wiper, Fuel gauge-oil pressure gauge, engine temperature indicator etc

Unit III - Transmission and suspension systems

Transmission system: Clutches, propeller shaft, universal joint, differential rear axles.

Suspension system: Objects of suspension systems.

Unit IV - Braking and steering systems

Braking system: Mechanic brake system, Hydraulic brake system and pneumatic brakes.

Steering system: Types of steering mechanism-Ackerman steering mechanism, Davis steering mechanism, Steering gears-types, steering leakages

Unit V – Emission and Energy Alternatives

Emission from Automobiles: Pollution standards National and international – pollution control–Techniques, Energy alternatives- Solar, Photo-voltaic, hydrogen, Biomass, Alcohols, LPG, CNG, liquid fuels and gaseous fuels, electrical-their merits and demerits.

Course Outcomes: After completion of the course the student will be able to

CO 1	:	Explore the concept of automobiles and fuel system.
CO 2	:	Explain various cooling, ignition and electric system of an automobile.
CO 3	:	Explain various transmission and suspension system of an automobile.
CO 4	:	Explain various braking and steering system of an automobile.
CO 5	:	Prescribe a method to reduce the pollution use engineering technique or alternative fuel.

Text Books:

1. Kirpal Sing, *Automotive Mechanics – Vol. 1 & Vol. 2,* Standard Publications, 2011.
2. William Crouse, *Automobile Engineering,* 10^{th} Edition, Tata McGraw–Hill Publications, 2017.

References:

1. Newton Steeds & Garrett, *the Motor Vehicle,* Butterworth-Heinemann Ltd., 1997.
2. K.K. Ramalingam, *Two Wheelers Theory, Operation and Maintenance*, SciTech Publications, 2010.

63415

ENGINEERING MATERIALS

(Open Elective – I: Common to all branches except ME)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam duration	:	3 Hours

Course Objectives:

1. To gain knowledge about the uses and applications of various ferrous metals and alloys.
2. To gain knowledge about the uses and applications of various non ferrous alloys.
3. To gain knowledge about the uses and applications of various ceramics.
4. To understand various polymers.
5. To understand applications of composites.

Unit I - Ferrous alloys

Introduction, designations and classifications for steels, simple heat treatment methods, effect of alloying elements.

Unit II - Non ferrous alloys

Introduction, properties and applications, Al alloys, Mg alloys, Cu alloys and Titanium alloys.

Unit III - Ceramic materials

Introduction, properties and applications of ceramics, glasses and refractories.

Unit IV - Polymers

Introduction, classification of polymers, polymerization, degree of polymerization, typical thermoplastics and thermo sets.

Unit V - Composites

Introduction, classification, properties and applications of polymer matrix, Metal matrix ceramic and laminar composites.

Course Outcomes: After the completion of the course, the student will be able to

CO 1	:	Identify ferrous alloys for a particular application and also suggest a heat treatment technique for improvement of properties.
CO 2	:	Classify various non ferrous materials for design applications.
CO 3	:	Explore the applications of ceramics.
CO 4	:	Figure out various thermosetting and thermoplastics required for designing of composites.
CO 5	:	Describe various composites and write their applications.

Text Books:

1. Donald R Askland and Pradeep P Phule, *The science and engineering of materials*, 4th Edition, Thomson Publishers, 2003.
2. Kodgire, *Material Science and Metallurgy for Engineers*, 31st Edition, Everest publishing house, 2011.

References:

1. William D Callister, *Introduction to material science and engineering*, John Wiley & sons, 2007.
2. W F Smith, *Principles of material science and engineering,* Tata McGraw–Hill publications, 1994.

68401

BASICS OF HUMAN ANATOMY AND PHYSIOLOGY

(Open Elective-I: Common to all branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To impart basic concepts of the human body, cell, and blood.
2. To study the structure, components and functioning of the cardiovascular and respiratory system.
3. To study anatomy and physiology of the musculoskeletal system and nervous system.
4. To study anatomy and physiology of the digestive system, excretory system and endocrine system.
5. To develop awareness of the acid base balance, fluid and electrolyte regulation in the human body.

UNIT I – Introduction to Human Body -Cell, Blood

Overview of organ systems, Introduction to basic terminologies like Directional, planes and cavities of the body. Cell- Structure and cell organelles, Tissues – Epithelial, connective, muscular and nerve tissues, Plasma Membrane- Structure and functions, transport across membrane, Blood Composition-RBC, WBC and Platelets.

UNIT II - Cardiovascular and Respiratory Systems

Structure of heart, Circulation types, Cardiac cycle, ECG, Heart sounds, Blood pressure, Regulation of BP, Respiration - Parts of respiratory system, Mechanics of respiration, Carbon dioxide and oxygen transport, Types of hypoxia.

UNIT III - Nervous System and Musculoskeletal Systems

Nerve cell anatomy, Functions of nervous system, Brain anatomy and hemispheres, Spinal cord anatomy, PNS, Autonomic Nervous system, Skeletal System –Functions, Types of bones, Anatomy of long bone, Structural and functional classification of joints, Functions of muscular system, Types of muscles , Physiology of muscle contraction.

UNIT IV - Digestive and Excretory Systems

Digestive system- Organization, Movements of GI tract, Digestion at various parts (Mouth to Large Intestine), Accessory organs of Digestion (Salivary glands, Liver, Pancreas, Gall Bladder), Excretory System - Functions of urinary system, Microanatomy and functions of Nephron, Physiology of urine formation, endocrine system.

UNIT V – Acid Base Balance and Fluid and Electrolyte Regulation

Normal human body pH, water compartments, regulation of water intake and output, Electrolytes – intake, output and regulation, Buffer systems – Bicarbonate, phosphate and protein, Definitions of Acidosis, Alkalosis, Hypoxemia, Hypercapnia, Hypovolemia, Regulation of sodium, Potassium, and Chloride.

Course Outcomes: At the end of the course, the student should be able to

CO 1: Thoroughly understand and identify the parts of the human body.
CO 2: Understand the anatomical position of the human body organs and their functioning.
CO 3: Emphasize the importance of pH limits, regulation of fluids and electrolytes.
CO 4: Develop awareness of human body parts utility in the effective design of biomedical Systems.
CO 5: Know the hormonal imbalance and its consequences.

Text Books:

1. Human Anatomy and Physiology, Padma B Sanghani, Tata McGraw-Hill Education Private Limited, 2012.
2. Ross and Wilson Anatomy and Physiology in Health and Illness 12th edition Anne Waugh & Allison grant. Churchill, Livingstone Elsevier.

References:

1. Textbook of Medical Physiology, Arthur C, Guyton, John Hall.E, 12th Edition, W.B. Saunders Company, 2006.
2. Textbook of Anatomy, Abdomen and Lower Limb, Vishram Singh, Volume – II, 2nd Edition, Elsevier India, 2014.

68402

ENTREPRENEURSHIP

(Open Elective-I: Common to all Branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objective:

The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

Unit I - Entrepreneurial Perspectives

Introduction to Entrepreneurship, Entrepreneur and Functions - Traits of an Entrepreneur, Difference between Entrepreneur and Manager, Entrepreneurship, Process of Entrepreneurship - Entrepreneurial Decision making Process, Role of Entrepreneurship in Economic Development, Social responsibility of Entrepreneurs, Domestic and Overseas Business Opportunities.

Unit II - Innovation and Business Plan

Sources of new Ideas, Methods of generating ideas, Innovation, Types of Innovation, Business Plan Significance of Business Plan, Using and Implementing the Business Plan, Product Planning & Development Process

Unit III - New Venture Creation

Forms of Business Registration, Joint Ventures, Features and Objectives/Motives behind the Joint Ventures, Merger: Importance and Problems of Merger, Acquisition or Takeover, Difference between Merger and Acquisition, Franchising, Advantages and Disadvantages of Franchising, Initial public offering (IPO), IPO Process, advantages and disadvantages.

Unit IV - Government Support for Entrepreneurship

Government Schemes to Support for Innovation and Entrepreneurship and Technology, Business Incubation, Management of MSMEs, Challenges of MSMEs, Preventing Sickness in Enterprises, Financial institutions supporting small and Medium Enterprises.

Unit V - Strategic perspectives in Entrepreneurship

The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Management of Intellectual property rights, Introduction to Total Quality Management, women Entrepreneurship, strategies to develop Women Entrepreneurs.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Hone entrepreneurial problem-solving and develop entrepreneurial decision-making skills.

CO 2 : Explore the various opportunities for establishing start-ups and prepare business plan.

CO 3 : Enable the understanding on the various forms of Business organizations and capital sources.

CO 4 : Enable the understanding of various government schemes and financial institutions support towards Entrepreneurship.

CO 5 : Gives insight into the strategic perspectives in Entrepreneurship including women entrepreneurs.

Text Books:

1. Robert Hisrich and Michael Peters, *Entrepreneurship*, 10^{th} Edition, McGraw-Hill, 2016
2. Marc J Dollinger, *Entrepreneurship: Strategies and Resources*, 4^{th} Edition, Marsh Publications, 2008.
3. D.F.Kuratko and T.V.Rao, *Entrepreneurship, A South – Asian Perspective*, 3^{rd} Edition, Cengage, 2012.

References:

1. Arya Kumar, *Entrepreneurship*, 4^{th} Edition, Pearson, 2015.
2. Vasant Desai*, the Dynamics of Entrepreneurial Development and Management*, Himalaya Publishing House, 2015.
3. Robert J. Calvin, *Entrepreneurial Management*, TMH, 2004.
4. Gurmeet Naroola, *the Entrepreneurial Connection*, TMH, 2001.
5. Bill Bolton and John Thomson, *Entrepreneurs: Talent, Temperament and Technique*, Butterworth- Heinemann, 2001.
6. Aruna Kaulgud, *Entrepreneurship Management*, Vikas Publishing House, 2003.

68403

BASICS OF PSYCHOLOGY

(Open Elective-I: Common to all the Branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course objectives:

1. To provide comprehensive overview of psychology, its evolution and its significance in different fields.
2. To develop understanding about several bases of human behavior.
3. To introduce inter and intrapersonal skills as self, motivation and personality.
4. To make students aware of their learning style, memory, perception and decision making skills.
5. To enable students learn about psychological disorders and causative factors and various therapies to cope up.

Unit I - Introduction to Psychology

Nature of Psychology, Meaning, Scope of Psychology, Evolution of the Discipline of Psychology and developments in Psychology in India, role of Psychology in other disciplines, Schools of psychology, emerging fields in Psychology, branches of Psychology

Unit II - The Bases of Human Behavior

Evolutionary Perspective on Human behavior, bases of human behavior, Brain and behavior: structure and Relationship with Behavior Nervous System and Endocrine System, Genetic Bases of Behavior, cultural bases of human behavior, Socialization: Enculturation and Acculturation.

Unit III - The Self, Motivation and Personality

Self: Self-concept: Self-Esteem and Self-Regulation; Culture and Self; Motivation: Definition and types, Biological, Social and General motives, Maslow‘s Need Hierarchy Theory and McClelland‘s Theory of Achievement Motivation.

Personality: Concept of personality, Type and Trait Approaches to Personality, Different trait approaches: Psychodynamic, Humanistic, Behavioral and Cultural, Assessment of Personality: self-Report Measures, behavioral Analysis, and projective Measures.

Unit IV - Cognitive Processes

Attention: Definition, Types of Attention, Factors Influencing Attention

Perception: Definition, Meaning and Nature, Principles of Perceptual Organization.

Learning: Definition, Meaning, Nature, Learning Styles.

Memory: Definition and Nature, Information Process, Stages, Kinds of Memory

Forgetting: Definition and Nature, Causes – Theory of Decay and Interference, Methods and Techniques to Improving Memory.

Thinking: Definition, Nature, Types of thinking, reasoning, problem-solving, steps in Problem solving & decision making.

Unit V - Psychological Disorders, Therapeutic Approaches and Counseling

Concepts of Abnormality and Psychological Disorders, Causal factors associated with abnormal Behavior: biological factors, genetic factors, Classification of Disorders: DSM and ICD, Major Psychological Disorders: Anxiety, Somato-form, Dissociative, Mood disorders, Schizophrenic. Development and Behavioral disorders: ADHD, Autism, Substance Related.

Types of therapies: Psycho-dynamic, Humanistic, Cognitive, Behavior.

Counseling: Nature, Characteristics of an effective Counselor, Stages of Counseling.

Course outcomes:

CO 1: Students will realize significant role of mind in every field.
CO 2: Students will know scientific reasons of their behavior.
CO 3: Students will modify their behaviors by cultivating right perception and, positive self and personality.
CO 4: Students will learn new methods of improving learning, attention and memory.
CO 5: Students will be able to recognize symptoms of abnormal behavior and will be aware of right line of therapy.

Text Books:

1. Parameswaran, E.G. and Beena, C, an Invitation to Psychology, 1st Edition. Neel Kamal Publications, Hyderabad, 2002.
2. Robert S. Feldman, Understanding Psychology, 10th Edition, Tata McGraw-Hill, 2012.

References:

1. Braj Kumar Mishra, Psychology: The Study of Human Behavior, PHI (EEE) India 2016
2. Morgan C.T., and King. R.A. Weisz, J.R. & Scholpler, J, Introduction to Psychology, 7th Edition, Tata McGraw-Hill.
3. Girishwar Misra, Handbook of Psychology in India (Handbooks Series), Oxford Publications.
4. Butcher, James, N. Susan, Maneka, Abnormal Psychology, Pearson Education, 5th edition, 2002.
5. Saundra K. Cicceralli, Psychology, 5th Edition, Pearson.
6. Margaret W. Matlin, Cognitive Psychology, 8th Edition, John Wiley & Sons, International student edition 2013.

68404

APPLIED FINANCE

(Open Elective-I: Common to all branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

The objective of the course is to provide exposure to the students about theory and functioning of the monetary and financial sectors of the economy. It highlights the organization, structure and role of financial markets and institutions. The course aims to provide an overview equity investments, bonds, mutual funds, derivatives and venture capital investments.

Unit I - Money and Banking

Concept and Functions of Money, constituents of money supply in India, Instruments of Credit, Overview of Indian Banking System, Role and functions of Reserve Bank of India. Monetary Policy and its instruments. Foreign Exchange regulation.

Unit II - Overview of Indian Financial System

Introduction to Indian Financial System, Components of Indian Financial System – Capital Markets and Money Markets: Characteristics and Functions, Primary Markets, Secondary Markets: Role and Functions, BSE and NSE, SENSEX and NIFTY, Derivative trading: concept and types of derivative. An overview of commodity markets in India.

Unit III - Common Stocks and Bond Investments

Introduction to Common Stock, Characteristics, Types of Common Stock, Fundamental Analysis, Technical Analysis and Random Walk theory, Equity Cult, Employee Stock Options. Bonds: meaning and concept, Features of Bonds, Types of Bond Investments, Case studies of successful investors: Warren Buffet, Templeton, Peter Lynch.

Unit IV - Mutual Funds

Concept and Rationale of Mutual Fund Investments, Types of Mutual Fund Schemes, concept of NAV, Penetration of Mutual Fund Industry in India, AUM as a percentage of GDP, Top performing Mutual Funds in India – ELSS, SIP, Alpha SIP, US mutual funds: retirement funds,401/k.

Unit V - Venture Capital Financing

Venture Capital, Meaning and Concepts, Evolution, Characteristics of Venture Capital financing, Equity funds and Hedge funds, Growth of Venture Capital Industry. Wealth creation by corporates.

Course Outcomes: On successful completion of this course, students will be able to

CO 1	:	Demonstrate knowledge in basic concepts related to money and banking, types of money and instruments of monetary control.
CO 2	:	Demonstrate knowledge about financial markets and Dynamics of Stock Markets
CO 3	:	Understand the various investment avenues and identify the Investment strategies for successful Investment in Capital Markets.
CO 4	:	Demonstrate knowledge on mutual funds and the rationale behind mutual fund investment.
CO 5	:	Demonstrate the ability to differentiate between conventional capital and venture capital.

References:

1. S. Guruswamy*, Financial institutions and Markets* 3rd Edition, Tata McGraw-Hill.
2. V.A.Avadhani, *Investment and Securities Market of India,* Himalaya Publishers,
3. Gordon and Natarajan, *Financial Markets and services,* 10th Edition, Himalaya Publishing House.
4. Puneethavathy Panidan, *Security Analysis and Portfolio Management,* 2nd Edition Vikas Publishing,
5. Zvi Bodie and Alex, Investments, 10th Edition McGraw-Hill.

68405

FUNDAMENTALS OF DATA SCIENCE

(Open Elective–I: Common for all branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To learn the basic concepts of statistics in data science.
2. To apply exploratory data analytics in data science.
3. To use machine learning in data science.
4. To understand recommendation systems in data science.
5. To apply feature generation and feature selection algorithms in data science.

UNIT I - Introduction to Data Science

What is Data Science - Big Data and Data Science - Datafication - Current landscape of perspectives - Skill sets needed Statistical Inference - Populations and samples - Statistical modeling, probability distributions, (Discrete and Continuous)- fitting a model using R

UNIT II - Exploratory Data Analysis and the Data Science Process

Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Real Direct (online real estate firm).

Data Visualization - Basic principles, ideas and tools for data visualization - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset.

Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists.

UNIT III - Basic Machine Learning Algorithms

Concept of Linear Regression - k-Nearest Neighbors (k-NN) – k-means - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling APIs and other tools for scrapping the Web.

UNIT IV - Multivariate Analysis and Recommendation Systems

Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition – Clustering Analysis- Principal Component Analysis - Exercise: build your own recommendation system.

UNIT V - Feature Generation and Feature Selection-Applications

Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests.

Course Outcomes: At the conclusion of the course, students should be able to:

CO 1: Describe the Data Science process and how its components interact.
CO 2: Apply basic tools to carry out the exploratory data analysis.
CO 3: Apply basic machine learning algorithms for predictive modeling.
CO 4: Identify common approaches used for Feature Generation and selection algorithms.
CO 5: Identify and explain fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine.

Text Books:

1. Cathy O'Neil and Rachel Schutt, *Doing Data Science, Straight Talk from the Frontline*, O'Reilly, 2014.
2. Ian H, Written and Eibe frank, *Data Mining: Practical Machine Learning tools and Techniques*, 2nd Edition, Imprint. Elsevier, Morgan Kaufmann publishers, 2006.
3. Donald F Morrison, *Multivariate Statistical Methods*, McGraw-Hill.
4. George A F Seber, *Multivariate Observations*, John Wiley & Sons.

References:

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman, *Mining of Massive Datasets*. V 2.1, Cambridge University Press. 2014. (free online)
2. Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, MTT, 2012.
3. Foster Provost and tom Fawcett, *Data Science for Business: What you need to know about data Mining and data-Analytic Thinking,* Safari Books Online, O'Relly Media Inc., 2013.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman, *Elements of Statistical Learning: Data Mining, Inference and Prediction,* 2nd Edition, Springer, 2009.

61456

GREEN BUILDING TECHNOLOGY

(Open Elective-II: Common to all branches except CE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Nil

Course Objectives:

1. To comprehend the concept of green buildings
2. To acquire the knowledge of different environmental issues
3. To understand the concepts of ecologically balanced building designs
4. To impart the knowledge of building resources and building infrastructure for Green building construction.
5. To evaluate the indoor air quality and building rating system for green buildings and to explicate the role of Green building technology and the indoor air quality of buildings.

Unit I – Introduction

Introduction to Green Buildings-Aspects of sustainability-sustainability development goals-Green building materials-concept of green buildings.

Unit II - Macro Environment, Micro-environment

Macro Environment-Elements of climate, weather, water cycle, carbon cycle, Environmental quality, deforestation, climatic change, ozone depletion and implications.

Micro-environment - Natural environment vs built environment. Living environment characteristics and components of urban ecosystem solar radiation, heat flow, air – movement, land use, drainage and sanitation.

Unit III - Concepts of Green Field Development

Concepts of Green Field Development-Brown field development, environmental impact and ecological balance, FAR, layouts, sustainable site development, vegetation, landscape elements, alternative services and technologies, rain water harvesting, on site sewerage retention, treatment, recycle and reuse.

Unit IV - Building Resources, Building Infra Structure

Building Resources- Passive energy system design, building envelope, orientation and components of building, fabric and shading, high rise buildings, modular building construction, curtain walls, sourcing and recycling of building materials, alternative calcareous, metallic and non-metallic materials.

Building Infrastructure-Active energy systems in buildings, Utilities and services, building automation, electro–mechanical systems, lifts and transportation, captive power plant and equipment, operation and maintenance.

Unit V - Indoor Air Quality, Building Rating Systems

Indoor Air Quality-Fresh air requirement standards, sick building syndrome and pollutants. Building Rating Systems-Building auditing, points system, components and weightage. Agencies and institutions-GBC, TERI etc., green buildings in the contexts of Indian subcontinent.

Course Outcomes: At the end of the course, students will be able to

CO 1 : Apply the green building concepts
CO 2 : Solve the micro and macro environmental issues of sustainable buildings
CO 3 : Design ecologically balanced buildings for the environmental sustainability
CO 4 : Build the resources and the building infrastructure
CO 5 : Construct Green star rated buildings

Text Books:

1. *Koenigsberger, O.H., Manual of Tropical Housing and Building,* Orient Longman Publisher, Chennai, 2015.
2. *Odum P. Eugene, Ecology and Environment,* 2^{nd} Edition, Oxford and IBH Publishers, 2015.

References:

1. *Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery,* 3^{rd} Edition, John Wiley & Sons, November 2012.
2. *Francis D. K. Ching and Ian M.* Shapiro, *Green Building Illustrated,* 3^{rd} Edition, John Wiley & Sons, 8 April 2014.

61457

DISASTER PLANNING & MITIGATION

(Open Elective-II: Common to all branches except CE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Nil

Course Objectives:

1. To comprehend the basic concepts of disasters
2. To evaluate the impacts of disasters and assess the risk reduction techniques
3. To understand the issues and policies involved in the disaster management
4. To explicate capacity building concepts and planning of disaster management
5. To assess the role of NGO, Government bodies and Public in the disaster mitigation

Unit I - Concepts and Types

Understanding disasters- Concepts and definitions of disaster, hazard, vulnerability, capacity, risks, hazard and vulnerability profile in India, major disasters in India.

Disasters and Hazards- Difference between hazard and disaster, disaster classifications-natural (floods, droughts, cyclones, earthquake, tsunami, landslide, land subsidence, coastal-erosion, river-erosion and fire etc.); and manmade disasters (artificial flooding in urban areas, chemical-spills, nuclear disasters, mine disasters, transportation accidents and terrorist strikes etc.)

Unit II - Impact of Disasters &Disaster Monitoring and Risk Reduction

Disaster Impacts- Physical, Economic, Social and Emotional; Techniques of monitoring disaster; predictability, forecasting and early warning; communications & IT Tools;

Disaster Risk Reduction-Disaster Management Cycle – its phases; mitigation, preparedness, response and recovery.

Unit III - Disaster Management

Disaster Management-Management issues related to disaster, national Policy on disaster management objectives, Disaster Management Act 2005, Institutional and legal arrangements, Financial arrangements under disaster management act.

Organizational structure for disaster management in India - Preparation of state and district disaster management plans.

Unit IV - Capacity Building

Capacity Building-Concept - Structural and Nonstructural Measures, Capacity development themes, elements of capacity building, levels of capacity building, UNDP capacity building Incident Response System (IRS): Training on IRS, Do’s and Don’ts for common disasters-Cyclones, Floods, Earthquakes etc.

Unit V - Coping with Disasters and Infrastructure

Concepts of Disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management.

Role of NGOs, Government Bodies and Public, Social and Economic Development of Disaster-prone areas. Disaster related infrastructure development.

Course Outcomes: At the end of the course, students will be able to

CO 1: Classify the disasters and hazards

CO 2: Suggest a suitable monitoring technique for disasters

CO 3: Prepare disaster management plan

CO 4: Prepare disaster mitigation plan

CO 5: Suggest suitable safety plan for industries

Text Books:

1. *Pradeep Sahni, Disaster Risk Reduction in South Asia,* Prentice Hall, 2004.
2. *Singh B.K., Handbook of Disaster Management: Techniques and Guidelines,* Rajat Publication, 2008s.

References:

1. *Ghosh G.K., Disaster Management,* APH Publishing Corporation, 2006.
2. *Ghosh G.K., Disaster Management: Emergency Planning,* APH Publishing Co., New Delhi, 2006.
3. *Manual on Disaster Management,* National Disaster Management, Agency Govt. of India.

65460

FUNDAMENTALS OF WEB PROGRAMMING

(Open Elective-II: Common to all branches except CSE, IT and CSIT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Java

Course Objectives:

1. To learn the basics of HTML elements
2. To learn the basics of java Console and GUI based programming
3. To introduce XML and processing of XML Data with Java
4. To introduce Server side programming with Java Servlets and JSP
5. To introduce Client side scripting with Javascript.

Unit I - Introduction to HTML, CSS

Introduction to HTML: A review of all basic elements (Phrase and Presentation elements, Links, Images, Tables, Lists, Frames and Forms).

CSS: Syntax structure, using style sheets, borders, margins, box model, fonts, and other advanced elements.

Unit II - JavaScript, XML

JavaScript: Introduction to JavaScript, data types, operators, loop structures, conditions, functions, Arrays, Objects, Regular expressions, error handling, JS HTML DOM.

XML: Syntax, namespaces, DTD, Schema, XSLT, XML Processors

Unit III - Database Technologies

Database Technologies: JDBC Drivers and types, JDBC Configuration (Database URLs, Registering a driver, connecting to a database), Executing SQL statements (Statement and ResultSet classes), query execution (Prepared Statements and Callable Statements, Meta Data (Database Meta Data and ResultSet Meta Data).

Web Servers: An introduction to the various Web Servers, Web application structure and deployment in Tomcat.

Unit IV - Servlet Technology

Servlet Technology: Servlets necessity, Servlet lifecycle, The Servlet API packages and class and interface hierarchy, Basic servlet program template, Handling requests and responses, Using form parameters, Using ServletContext and ServletConfig objects, Using initialization parameters (both context and config level), Session management (cookies, Seesion API, URL Rewriting).

Unit V - JSP Technology

JSP Technology: The Anatomy of a JSP Page, JSP Lifecycle, Scripting elements (Scriptlets, expressions, declarations, comments), JSP Directives, JSP Standard actions, JSP Implicit objects, JSP page scope.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Write html, CSS codes.
CO 2	:	Demonstrate JavaScript, XML, DHTML and related Technologies.
CO 3	:	Implement the Database Connectivity and Component Technologies like Beans.
CO 4	:	Deploy the servlet technology & API.
CO 5	:	Construct the fundamentals of JSP.

Text Books:

1. Jon Duckett, *Beginning HTML, XHTML, CSS, and JavaScript*, Wrox Publications, 2010
2. Bryan Basham, Kathy Sierra and Bert Bates, *Head First Servlets and JSP*, 2nd Edition, O'Reilly Media, 2008
3. Cay Horstmann and Gary Cornell, *Core Java: Advanced Features, Volume II*, 9th Edition, Prentice Hall, 2013. (Only Chapter 4 for Database Programming).

References:

1. E-resource: http://www.w3schools.com
2. Martin Hall and Larry brown, Core Servlets and JSPs, Volume I and II, Pearson

65461

FUNDEMENTALS OF COMPUTER NETWORKS

(Open Elective-II: Common to all branches except CSE, IT and CSIT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisites: Fundamentals of Operating Systems and Shell Programming

Course Objectives:

1. To learn the basic concepts of data communications and computer networking models in wide sense.
2. An understanding of computer networking theory, including principles involved in the protocols designed for application layer, transport layer, network layer and data link layer of a networking stack.
3. An understanding of specific implemented protocols covering application layer, transport layer, network layer and data link layer of the Internet (TCP/IP) stack.
4. Pre-requisite knowledge to enable students to study more advanced topics in computer networking.

UNIT I - Introduction

Introduction: Data communication Networks, The internet, Protocols and standards, Networks Models: The OSI Model, TCP/IP protocol Suite, Addressing, Physical Layer and Media Transmission Media, Switching: Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks.

UNIT II – Data Link Layer

Data Link Layer: Introduction, Block Coding, Cyclic Codes, Checksum, Data Link Control: Framing, Flow and Error Control protocols, Noiseless Channels, Noisy Channels, Multiple Access, IEEE Standards, Standard Ethernet, Connecting Devices, Backbone Networks, VirtualLANs.

UNIT III - Network Layer

Network Layer: Logical Addressing, Internet Protocol, Address Mapping, Error Reporting and Multicasting, Address Mapping, Forwarding and Routing: Unicast Routing Protocols, Multicast Routing Protocols.

UNIT IV - Transport Layer

Transport Layer: Process-Process Delivery: UDP, TCP, Congestion Control and Quality of Service, Data Traffic, Congestion, Congestion Control, Two Examples, Quality Service.

UNIT V - Application Layer

Application Layer: Domain Name System, Remote Logging, Electronics Mail and File Transfer Protocol, WWW and HTTP.

Course Outcomes: After completion of the course, students should be able to:

CO 1	:	Represent the data in various coding formats.
CO 2	:	Implement different routing protocols.
CO 3	:	Select components and network for particular application.
CO 4	:	Have experience in designing communication protocols.
CO 5	:	Implement QOS based network services.

Text Books:

1. Games F. Kurose and K.W.Ross, *Computer Networking: A Top down approach feature in the internet*, 3rd Edition, Pearson education, 2012.
2. Behrouz A.Forouzan, *Data Communications and Networking*, 4th Edition, TMH, 2009.

References:

1. A.S.Tanenbaum, *Computer Networks*, 4th Edition, Pearson Education, 2008.
2. W.Tomasi, *Introduction to Data Communications and Networking*, Pearson education, 2009.
3. S.Keshav, *Engineering approach to Computer Network*, 2nd Edition, Pearson education, 2008.

64455

FUNDAMENTALS OF WIRELESS COMMUNICATIONS

(Open Elective-II: Common to all branches except ECE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To learn about cellular concepts
2. To understand the large scale and small-scale fading
3. To acquire knowledge on multiple access techniques
4. To understand a wireless system

Unit I – The Cellular Concept-System Design Fundamentals

Introduction, Frequency Reuse, Handoff Strategies, Practical Handoff Considerations, Interference and system capacity –Co-channel Interference and System Capacity, Channel planning for Wireless Systems, Adjacent Channel Interference.

Unit II – Path Loss

Trunking and Grade of Service, Cell Splitting, Sectoring, Channel allocation, Path loss, Free space propagation model, Link budget design, Two ray propagation model, Outdoor propagation model-Okumura model.

Unit III – Fading

Wireless Channel: Multipath fading, parameter s of multipath channels, Doppler shift, Delay spread, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of small-scale fading.

Unit IV – Multiple access techniques

Multiple access technique for wireless communications: Introduction to multiple accesses, FDMA, TDMA, CDMA, CSMA; Duplexing schemes, FDD, TDD.

Unit V – Introduction to wireless communication systems

Evolution of cellular communications, examples of wireless communication systems
GSM-Services and features, System Architecture, GSM channel types, the Frame structure for GSM.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the fundamentals of mobile and cellular communications, system design and cell capacity.
CO 2	:	Understand the path loss model
CO 3	:	Analyze the wireless channel and fading
CO 4	:	Acquire knowledge of multiple access techniques
CO 5	:	Study the evolution of the wireless system and the GSM system

Text Books:

1. Theodore S. Rappaport, *Wireless Communications: Principles and Practice*, 2nd Edition, PHI, 2002.
2. William Stallings, *Wireless Communication and Networking*, PHI, 2003.

References:

1. P. Nicopolitidis, M. S. Obaidat, G. I Papadimitriou and A. S. Pomportsis, *Wireless Networks*, John Wiley & Sons, LTD, 2003.
2. Xiaodong Wang and H. V. Poor, *Wireless Communication Systems*, Pearson Education, 2004.
3. Kamilo Feher, *Wireless Digital Communications*, PHI, 1999.

64456

MATLAB FOR ENGINEERS

(Open Elective-II: Common to all branches except ECE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To learn MATLAB environment and its programming fundamentals
2. To provide the different programming concepts such as functions, commands, plots in MATLAB.
3. To familiarize the use of Simulink in MATLAB

Prerequisite: NIL

Unit I

Introduction To MATLAB, MATLAB Environment, The Workspace, Creating M File, Variables, Arrays: Vectors and Matrices, Operators, Expressions, Statements, Working with Complex Numbers, Mathematical Operations, Functions for Input and Output, Good Programming Style, Basic Operations on Vectors, Strings, String Functions, Cell Array, Creating Cell Array, Matrix Functions, Matrix Operations.

Unit II

Loops: for Loops, while Loops, Branching (Conditional Statements) - if Statement, if else Statement, else if Statement, Switch Statement, Built-in Functions and User-Defined Functions, Handles, Function Handles in M-Files, Inline Functions, Command/Function Duality, Function Name Resolution, Debugging M-Files.

Unit III

Data Files: Saving and Recalling Data, Saving a Session as Text, C Style read/write, MATLAB Graphics; Basic 2-D Graphs and Different Types of Plots, 3-D Plots, Handle Graphics, Editing Plots, Saving, Printing and Exporting Graphs.

Unit IV

Introduction to Simulink, Mathematical Operations, Functions for Input and Output, Different Loops, Different Controlling Operators, Plots, Built-in Functions and User-Defined Functions, Real Time Simulation.

Unit V

Vectors as Arrays and Other Data Structures, Update Processes, Frequencies, Bar Charts, Histograms, Sorting, Structures, Cell Arrays, Classes and Objects, Complex Functions, Interpolation and Series, Numerical Differentiation and Integration.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the fundamentals of MATLAB programming
CO 2	:	Program using different commands in MATLAB
CO 3	:	Save output of the program into files and in different plots
CO 4	:	Understand the concepts of Simulink
CO 5	:	Utilize data structure and other special functions in MATLAB

Text Books:

1. Hahn & Valentine, *Essential MAT LAB for Engineers and Scientists*, 5th Edition, Academic Press, 2013.
2. In build help menu in MATLAB/SIMULINK.

References:

1. Amos Gilat, *MATLAB an Introduction with Applications*, 5th Edition, Wiley.
2. C. F. Van Loan and K.- Y. D. Fan, *Insight through Computing: A MAT LAB Introduction to Computational Science and Engineering*, SIAM Publication, 2009.

62456

ELECTRICAL SAFETY

(Open Elective-II: Common to all branches except EEE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. Concepts and Statutory requirements of electrical safety and information about electrical Hazards.
2. Protection systems for electrical Hazards and selection and installation of protection systems.

Unit I - Concepts and Statutory Requirements

Introduction – electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid-cardio pulmonary resuscitation (CPR).

Unit II - Electrical Hazards

Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy- current surges-Safety in handling of war equipments-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity –definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc ignition energy-national electrical safety code ANSI. Lightning, hazards, lightning arrestor, installation – earthing, specifications, earth resistance, earth pit maintenance.

Unit III - Protection Systems

Fuse, circuit breakers and overload relays – protection against over voltage and under voltage – safe limits of amperage – voltage –safe distance from lines-capacity and protection of conductor-joints-and connections, overload and short circuit protection-no load protection-earth fault protection.

FRLS insulation-insulation and continuity test-system grounding-equipment grounding-earth leakage circuit breaker (ELCB)-cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment – safety in handling hand held electrical appliances tools and medical equipments.

Unit IV - Selection, Installation, Operation And Maintenance

Role of environment in selection-safety aspects in application - protection and interlock-self diagnostic features and fail safe concepts-lock out and work permit system-discharge rod and earthing devices- safety in the use of portable tools-cabling and cable joints-preventive maintenance.

Unit V - Hazardous Zones

Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe equipment-their selection for different zones-temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies.

Course Outcomes: At the end of the course student will be able to

CO1 : Learn concepts and statutory requirements for electrical safety.
CO2 : Learn electrical hazards and protection system for electrical hazards.
CO3 : Learn to select, installation, operation and maintenance of protection system for electrical safety.

Text Books:

1. *Electrical Safety Engineering*, Fordham Cooper. W, Butterworth and Company, London, 1986.
2. *Accident prevention manual for industrial operations*, N.S.C., Chicago, 1982.

References:

1. *Indian Electricity Act and Rules*, Government of India.
2. *Power Engineers – Handbook of TNEB*, Chennai, 1989.
3. *Electrostatic Hazards in powder handling*, Martin Glov, Research Studies Pvt. Ltd., England, 1988.

62457

SOLAR ENERGY SYSTEMS

(Open Elective-II: Common to all branches except EEE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. Basics of solar Energy, solar radiation geometry, Devices used to measure solar radiation
2. Different types of solar energy collectors used in solar thermal applications.
3. Classification of solar Cells, Solar Photovoltaic system components.
4. Methods to generate electrical Energy from Solar Thermal and Solar PV Technologies.
5. Applications of solar Energy in different areas using solar thermal & Solar PV Technologies.

Unit I - Solar Energy Basics

The sun as a source of energy, the Sun and Earth Radiation Spectrums, Extra-terrestrial and Terrestrial Radiations, Solar insulation, Spectral Energy Distribution of Solar Radiation Solar radiation on the earth surface -Depletion of solar radiation - Absorption, scattering. Beam radiation, Diffuse and Global radiation.

Solar Radiation Geometry. - Earth-Sun angles – Solar angles, Solar time - Local apparent time (LAT), equation of time (E).Empirical Equations for Estimating Solar Radiation Availability on Horizontal Plane and Inclined Plane.

Measurement of solar radiation – Pyranometer, pyrheliometer, Sunshine recorder, Surya-mapi.

Unit II - Solar Thermal Systems

Classification of Solar Collectors, Solar Flat Plate Collectors, Solar Concentrating Collectors, Concentrating collector performance - concentration ratio, useful energy gain, energy losses, efficiency.

Line- focusing and point-focusing concentrators: parabolic trough, parabolic dish, heliostat field with central receiver, Fresnel lenses, compound parabolic concentrator. Sun tracking mechanisms.

Unit III - Solar Photovoltaic Systems

Classification of Solar Cell, Solar Cell Fundamentals, Solar Cell Characteristics, Solar Module, Panel and Array Construction, Maximizing The Solar PV Output and Load Matching, Maximizing Power point tracker (MPPT), Balance of System Components, System sizing.

Unit IV - Solar Power Plants

Solar Thermal: Solar thermal electric power plants based on parabolic trough, solar central receiver, parabolic dish-Stirling engine. Concentrated solar power using Fresnel lenses. Solar tower concepts - Tower design - Heliostat design - Receiver types, tracking and control systems Solar Ponds for Electricity production.

Solar Photo-Voltaic: Classification of Solar PV Power plants**-** Central Power Station Design, Distributed System**-** Stand Alone system, Grid Connected system, Hybrid Solar PV System. System Sizing.
Comparative Study: Solar Thermal Power plant Vs Central Solar PV Plant

Unit V - Solar Energy Applications

Solar Thermal : Solar Water Heater, solar evacuated tubes for air heating & Water heating, Solar Passive Space-Heating and Cooling Systems, Solar Refrigeration and Air-Conditioning Systems, Solar Cookers, Solar Furnaces, Solar Green House, Solar Dryer, Solar Distillation.

Solar Photo-Voltaic: Stand-alone devices for distributed power supply in remote and rural areas, Solar Lanterns, Solar Water Pumps, and Solar Street Lightning. Miscellaneous Applications Viz. Solar Power Satellites, Solar Chargers, Solar Cars.

Course Outcomes:

CO 1: Define various solar angles, identify various solar devices to measure solar radiation on plane and inclined surfaces.
CO 2: Classify various solar energy collectors, solar thermal energy extraction mechanisms using different collectors.
CO 3: Differentiate various types of solar Cells; understand solar cell characteristics and MPPT Mechanism.
CO 4: Learn different methods of Electrical power generation using solar thermal and solar PV Technologies.
CO 5: Identify the applications of solar energy in various areas in different methods using solar thermal & Solar PV.

Text Books:

1. *Non-Conventional Energy Sources* /G.D. Rai, Khanna Publishers
2. *Non-Conventional Energy Sources* – B.H.Khan- TMH Publications- Second Edition
3. Sukhatme and Nayak, *Solar Energy*: *Principles of Thermal Collection & Storage*, Tata McGraw-Hill, 3rd Edition, 2008.
4. CS Solanki: Solar Photovotaics – *Fundamentals, Technologies and Applications*, PHI Learning Pvt. Ltd., 2011.

References:

1. Rai, G.D., *Solar Energy Utilization*, Khanna Publishers, N. Delhi, 2010.
2. HP Garg and J Prakash: *Solar Energy: Fundamentals and Applications*, Tata McGraw-Hill, 3rd Edition, 2010.
3. VVN Kishore*, Renewable Energy Engineering and Technology* – A Knowledge Compendium, TERI Press, 2008.
4. *Renewable energy sources and emerging technologies* by D.P.Kothari, K.C.Singhal, P.H.I.
5. Jayarama Reddy, *Solar Power Generation: Technology*, New Concepts & Policy, CRC Press, 2012.
6. *Rakosh Das Begamudre, Energy Conversion Systems*, New Age International, 2007.
7. *Tom P. Hough, Solar Energy*: New Research, Nova Publishers, 2006.
8. *Stefan C. W. Krauter, Solar Electric Power Generation* – Photovoltaic Energy Systems: *Modeling of optical & thermal performance, electrical yield, energy balance*, *effect on reduction of greenhouse gas emissions*, Springer, 2006.

66458

FUNDAMENTALS OF BIOMEDICAL INSTRUMENTATION

(Open Elective-II: Common to all branches except EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the biomedical instrumentation system and their characteristics.
2. To understand different medical transducers.
3. To learn different bio potential electrodes and working principle of Blood Pressure measurement.
4. To learn working principle of ECG instruments.
5. To understand the concepts of EEG and EMG.

UNIT I - Introduction to Medical Instrumentation System

Components of Medical Instrumentation System: Static and dynamic characteristics of medical instruments, Problems encountered with measurements from human beings. Organization of Cell, Generation of action potential and refractory periods, Propagation methods of action potentials.

UNIT II

Medical Applications: Flow transducers - Electromagnetic and ultrasonic type, Pressure transducers - Piezo electric and Strain Gauge Type and Temperature transducers - Thermistor and RTD type.

UNIT III

Bio potential electrodes – Types, electrode-tissue interface, Silver-Silver chloride electrode. Blood pressure measurement: Introduction to blood pressure, Blood pressure measurement methods - Invasive and Non-Invasive.

UNIT IV

Electrocardiography (ECG): Electrical conduction system of the heart, electrodes and their placement, Standard 12 – lead configurations, Interpretation of ECG waveform with respect to events of cardiac cycle.

UNIT V - EEG and EMG

EEG block diagram, electrodes and their placement, EMG block diagram, electrode and their placement, study of neuromuscular junction, nerve conduction velocity using EMG.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the basic components of medical instrumentation system.
CO 2	:	Obtain basic knowledge on medical transducers.
CO 3	:	Develop skill in analyzing the Blood pressure measurement.
CO 4	:	Obtain basic knowledge on ECG and their Interpretation.
CO 5	:	Understand the significance of EEG and EMG.

Text Books:

1. John G. Webster, "*Medical Instrumentation-Application and Design*", John Wiley and sons Inc, 3rd Edition, 2003.
2. Khandpur R.S, "*Hand Book of Biomedical Instrumentation*", Tata McGraw-Hill, 1994.

References:

1. Joseph J. Carr and John M. Brown, "*Introduction to Biomedical Equipment Technology*", Pearson Education, 2001.
2. Bronzino Joseph D," *Hand Book of Biomedical Engineering*", CRC Press, 1995.

66459

FUNDAMENTALS OF INDUSTRIAL AUTOMATION

(Open Elective-II: Common to all branches except EIE)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Evaluation	:	70 Marks
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To know the basics of Automation and its details.
2. To learn about various field devices, operations and usages.
3. To understand PLC and its functionalities.
4. To identify the significance of SCADA and know its features.
5. To study about the DCS systems in industries

Unit I - Introduction to automation

Automation – Overview, History, Architecture, Features, Tools, Types, Principles & Strategies, Applications.

Unit II - Industrial field devices

Analog and Digital Sensors, Relays, Actuators- Electronic, Hydraulic & Pneumatic, I/P Converter & P/I Converter.

Unit III - Programmable logic controllers

History, Types, Input and output modules, PLC programming - Ladder diagram, Timers and Counters, Athematic Operations and Application of PLC to process industries.

Unit IV - SCADA systems

Introduction, Definition and History, SCADA System - Architecture, Communication Requirements, Desirable properties, Features and Applications of SCADA.

Unit V - Distributed control systems

Overview of DCS, S/W Configuration and Communication features of DCS, Advantages of DCS and Applications.

Course Outcomes: At the end of the course, student should be able to

CO 1 : Provide insight into the basics of Industrial Automation and its Components.

CO 2 : Make students understand the application of Tools for Automation in Industries.

CO 3 : Know the basic structures of PLC's, and their usage in Process Industries.

CO 4 : Study the architecture SCADA and its significance in industries.

CO 5 : Understand DCS and its significance in Industrial Automation.

Text Books:

1. John W Webb, Ronald A Reis, "*Programmable Logic Controllers: Principles and Application*", PHI Learning, New Delhi, 5th Edition.
2. Jitender Singh, Monika Deswal, "*PLC and SCADA*", Laxmi Publications, 2016.

References:

1. Gary Dunning, "*Introduction to Programmable Logic Controllers*", Thomson, 2nd Edition.
2. Stuart A Boyer, "*SCADA Supervisory Control and Data Acquisition*", ISA, 4th revised edition.
3. Programmable Logic Controllers, Frank D. Petruzella, Second edition, McGraw-Hill, Newyork, 2010.

67457

PROGRAMMING USING PYTHON

(Open Elective-II: Common to all branches except IT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite: NIL

Course Objectives:

1. To understand the syntax of Python and learn the language basics such as Strings, Numbers, Variables, Lists, Dictionaries, Functions, Decisions and Arrays.
2. To learn advanced Python programming features to develop the GUI applications, accessing databases, work with XML, and network programming.

Unit I

Python Programming Basics: Strings, Numbers and Operators, Variables, Lists and Dictionaries, built-in functions for Strings, Lists and Dictionaries, Decisions, Functions.

Unit II

Classes and Objects, Modules, Packages, Files and Directories, Exceptions, Other features of the language - Lambda and Filter, Map, Decisions within Lists, Generating Iterators for Loops, Special String Substitution Using Dictionaries, Getopt.

Unit III

Text Processing, Complex Numbers, Arrays and built-in functions, built-in Math Functions, Modules, creating modules, Sys module, OS module. string module.

Unit IV

GUI with Python - GUI Programming Toolkits for Python, Creating GUI Widgets with Tkinter, Accessing Databases - Working with DBM Persistent Dictionaries, Working with Relational Databases, Using the Python Database APIs.

Unit V

Advanced Python Programming: Using Python for XML **-** XML Libraries for Python, SAX and DOM Parsers Available for Python, Network Programming - Understanding Protocols, MIME Messages*,* Socket Programming, and the Python Chat Server.

Course Outcomes: At the end of the course, the student will be able to

CO 1	:	Write Python programs for Strings, Lists, and Dictionaries.
CO 2	:	Write Python programs for Files and Directories.
CO 3	:	Write functions and create modules
CO 4	:	Work with GUI features. Work with data from databases
CO 5	:	Use Python advanced libraries for XML. Use Python advanced libraries for Network Programming.

Text Book:

1. James Payne, Beginning Python Using Python 2.6 and Python 3.1, Wrox Publications.

References:

1. Magnus Lie Hetland, Beginning Python from Novice to Professional, A press Publications.
2. Steve Holden and David Beazley, Python web programming, New Riders Publications**.**
3. Mark Lutz, Programming Python, O'Reilly Media, Inc.

67458

BASICS OF IoT

(Open Elective-II: Common to all branches except IT)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Prerequisite: NIL

Course Objectives:

1. The students must be able to understand the basic characteristics of an IoT Based system, IoT protocols and logical design of IoT.
2. The students must develop an understanding of the IoT enabling technologies and the domain areas in which IoT can be used.
3. The students should develop knowledge on various kinds of IoT devices and their interfacing.
4. The students should develop thorough understanding of the life cycle approach for building an IoT based system.
5. The students must develop the skills to use an implementation language like python to build an IoT based system.

Unit I

IoT Introduction: History, definition and characteristics of IoT, Physical design of IoT: "Things" of IoT, IoT Protocols.

Logical design of IoT: IoT Functional Blocks, IoT Communication Models, IoT Communication APIs.

Unit II

IoT Enabling Technologies: WSN, Cloud Computing - PaaS, IaaS, SaaS Principles, Communication Protocols, Embedded Systems.

Domain Specific IoTs: Home Automation, Smart cities, Retail, Logistics, Agriculture, Health, Energy, Industry.

Unit III

IOT Physical Devices and END Points: Basic building blocks of an IoT device, Raspberry Pi, Arduino, other IoT devices.

Interfacing: Examples of Raspberry Pi interfaces.

Unit IV

Developing Internet of Things: Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification, Operational View Specification, Device and Component Integration, Application Development. A Case Study. IoT levels and Deployment templates.

Unit V

IoT System Logical Design using Python: Introduction to python, Installing python, python data types and data structures, control flow, functions, modules, packages file input/output, date /time operations, classes. Programming Raspberry Pi with Python.

Course outcomes: At the end of the course, the student will be able to

CO 1 : The student will have the ability to understand the characteristics, protocols and communication models required for logical design of IoT.

CO 2 : The student will have thorough knowledge of IoT enabling technologies and domain areas of application.

CO 3 : The student will have a good understanding of the hardware platforms for implementing an IoT. The student will have the ability to interface the IoT based Board with different peripheral devices such as keyboard, display device and serial communication devices.

CO 4 : The student will have a good understanding of the details of requirements gathering and specification of an IoT based system. The student will have the ability to integrate devices and develop an application.

CO 5 : The student will have the ability to implement an IoT based system using python language.

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands –On Approach*, University Press.
2. Adrian Mcewen, Hakin Cassimally, *Designing the Internet of Things*, Wiley.
3. Getting Started With Internet of Things, CunoPfisher, O'Reilly.

References:

1. Kimmo Karvinen, TeroKarvenien, *Shroff Getting Started with Sensors: Measure the World with Electronics*, Arduino, and Raspberry, O'Reilly, First edition, 2014.
2. Massimo Banzi, *Getting Started with Arduino: The Open Source,* Shroff Publishers & Distributors Private Ltd.
3. Richardson Matt, *Getting Started with Raspberry Pi*, Shroff Publishers & Distributers Private Limited. Brock Craft, Arduino Projects for Dummies, Wiley.

63456

ELEMENTS OF MECHANICAL ENGINEERING

(Open Elective – II: Common to all branches except ME)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam duration	:	3 Hours

Course Objectives:

1. To understand the concepts of thermodynamics and IC engines.
2. To understand the concept of heat transfer and types of heat exchangers.
3. To understand the concepts of refrigeration.
4. To understand basic manufacturing and machining processes.
5. To understand types of gears and drives.

Unit I

Thermodynamics: Concept of system, process and properties, laws of thermodynamics, concept of entropy and Clausius inequality, steady flow energy equation for an open system.

IC Engines: Working of four stroke and two stroke petrol and diesel engine with p-V diagrams, valve timing diagram, calculation of indicated power, brake power, specific fuel consumption, mechanical and thermal efficiencies.

Reciprocating Air compressors: work done, efficiency of multistage compressors, effect of clearance volume.

Unit II

Heat transfer: Basic modes of heat transfer, Fourier's law of conduction, Newton's law of cooling, Stefan-Boltzamn law of radiation and one dimensional steady state conduction heat transfer through plane walls without heat generation.

Heat exchangers: Classification and application of heat exchangers in industry, derivation of LMTD in parallel and counter-flow heat exchangers and problems.

Unit III

Refrigeration: Types of refrigeration systems- Air refrigeration system, vapor compression system, ammonia-water absorption refrigeration system ,thermoelectric refrigeration system, COP and representation of cycle on T-S and H-S diagrams, Types and properties of refrigerants, eco-friendly refrigerants., Introduction to psychometry and psychometry processes.

Unit IV

Basic Manufacturing Processes: Welding, brazing, soldering, brief description of process and parameters, associated principles of gas welding, arc welding.

Casting: Sand casting, die casting, and principles and application
Forming: Basic concepts of forming processes: Extrusion, rod/wire drawing, Forging and Rolling.

Principles and Applications of basic Machining Processes: Turing, milling and grinding.

Unit V

Definition of kinematic link and pair, mechanism and machine.
Gears: Classifications of gears, nomenclature.
Gear Trains: Simple, compound, inverted and epi-cyclc gear trains.

Belt and Rope drives: Open and cross belt drives, length of belt, ratio of tensions of flat belt, condition for maximum power transmission for flat belt.

Course Outcomes: After the completion of the course, the student will be able to

CO 1	:	Understand the concepts of thermodynamics, IC engines and compressors.
CO 2	:	Explain the concept of heat transfer and various heat exchangers.
CO 3	:	Explain the concepts of refrigeration.
CO 4	:	Understand manufacturing and machining processes.
CO 5	:	Explain gears, gear trains, belt and rope drives.

Text Books:

1. R.K. Rajput, *Thermal Engineering,* Laxmi Publications, 2005.
2. C. Sachdeva, *Fundamentals of Engineering Heat and Mass transfer,* Wiley Eastern Ltd, 2004.

References:

1. P.N. Rao, *Manufacturing Technology, Vol. 1 & 2,* Tata McGraw-Hill Publications, 2010.
2. Thomas Bevan, *Theory of Machines,* 3rd edition, C B S Publishers, 2005.

63457

RAPID PROTOTYPING

(Open Elective – II: Common to all branches except ME)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam duration	:	3 Hours

Course Objectives:

1. To learn the fundamental concepts of Rapid Prototyping) .
2. To understand the Liquid-based Rapid Prototyping Systems.
3. To understand powder based technologies like SGC and LOM
4. To understand used deposition modeling and selective laser sintering.
5. To understand 3D printing and rapid tooling

Unit I

Introduction: Rapid prototyping fundamentals, Historical development, classification, Advantages and Limitations.

Unit II

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, Layering technology, Applications, Advantages and Disadvantages.

Unit III

Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Unit IV

Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

UNIT V

Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages,.

Course Outcomes: After completion of the course, the student will be able to

CO 1: Explain the need of Rapid prototyping
CO 2: Describe the Liquid-based Rapid Prototyping Systems.
CO 3: Describe SGC and LOM processes.
CO 4: Explain SLS and FDM technologies.
CO 5: Describe 3 D printing and Rapid tooling.

Introduction to Rapid tooling

Text Books:

1. Pandey P C and Shan H S, *Modern Machining Process,* Tata McGraw-Hill Publications, 1980.
2. Bhattacharya A, *New Technology*, the Institution of Engineers, India, 1984.

References:

1. Davies and Austin, *Developments in High Speed Metal Forming,* the Machinery Publishing Co. Ltd., 1985.
2. Mikell. P. Groover, *Fundamentals of Modern Manufacturing*, Prentice Hall.

68451

POLITY AND POLITICS IN INDIA

(Open Elective-II: Common to all branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives: This course exposes the students to

1. The constitutional design of state structures and institutions
2. The basic philosophy behind the Indian constitution like LIBERTY, JUSTICE, DEMOCRACY & a strong union.
3. State institutions, in their mutual interaction with the larger extra constitutional requirement.
4. Different Commissions and the rights to exercise them
5. The electoral system, party system and its challenges in India

UNIT I - Historical and Ideological Basis

Colonialism- Nature, Impact and Legacies, Ideological and Philosophical Basis of Indian Polity-Liberalism, Socialism, Secularism and Republicanism, Basic features of Indian Constitution-Parliamentary Democracy, Fundamental Rights and Directive Principles, Federal System-Nature, Structure and Asymmetries.

UNIT II - Union: Institutions of Governance Executive

President, Prime Minister and Council of Ministers, Legislature- Composition, Powers and Functions of Parliament, Judiciary-composition, Jurisdiction and Functions of Supreme Court, NitiAyog - Inter- State Council, National Development Council: Organization and Role

UNIT III - State: Institutions of Governance Executive

Governor, Chief Minister and Council of Ministers, Legislature: Composition, Powers and Functions, Judiciary: Supreme Court, High court- Structure: Jurisdiction and Functions, Local Self Governments: Panchayati Raj Institutions and Urban Local Bodies.

UNIT IV - Inclusionary Commissions

National Commission of Schedule Castes, National Commission of Schedule Tribes, National Commission of Backward Classes, National Commission of Women National commission of Minorities, National Human Rights Commission.

UNIT V - Democracy, Participation and Assertion

Electoral System: Nature, Trends and Challenges, Party System in India: Single Party to Multiparty System, Regional Parties and Emerging Trends, Politics of Identity: Caste, Ethnicity and Religion: Social Movements: Gender, Sustainable Development, Ecology, Peasants and Workers.

Course outcomes: At the end of the course Students will

CO 1: Develop an understanding about the ideological and philosophical basis of Indian Polity.
CO 2: Have awareness about the principles of equality, liberty and democracy that are enshrined in the constitution.
CO 3: Have an understanding of multiparty system existing in the country
CO 4: Develop an understanding about the inclusionary commissions and other bodies like, NITI Ayog.
CO 5: Develop an understanding about the political system existing in India

Suggested Reading:

1. Austin Granville, *the Indian Constitution: Cornerstone of a Nation*, 1999.O.U.P
2. Aloysisus G *Nationalism without a Nation in India*, OUP, 1997
3. Katharine Adeney and Lawrence Saez, *Coalition Politics and Hindu Nationalism*, Volume 2 of Routledge advances in South Asian Studies, Psychology Press, 2005.
4. Lawrence Saez and Brass Paul, *Ethnicity and Nationalism: Theory and Comparison*, Sage, 1991.
5. Brass Paul, *the Politics of India since Independence*, Cambridge University Press, 1990
6. Chandra Bipan, *India after Independence 1947 to 2000*, Penguin India, 2000
7. Partha Chaterjee, *State and Politics in India*: Oxford University Press, 1999
8. Chandra Kanchan, *Why Ethnic Parties Succeed: Patronages and Ethnic Head Counts in India*, Cambridge University Press, Cambridge, 2004.
9. De Souza Peter, *India's Political Parties*, Sage, New Delhi, 2006
10. Ronald & E Sridharan Hasan Zoya Ed., *Politics and the State in India*, Sage, 2000
11. Hasan Zoya Ed., *Parties and Party Politics in India*, Oxford University Press, New Delhi, 2001.
12. Kothari, Rajni (ed) *Caste in Indian Politics*, Orient Longman, 1970
13. Atul Kohli, *Centralization and Powerlessness: India's Democracy in a Comprehensive Perspective,* Joe Midgal, Atul Kohli and Vivenne Shue (eds), *State Power and Social Forces,* Cambridge University Press, 1994.
14. Oommen T.K, *State and Society in India Studies in National Building*, Sage, 2000
15. Sharma S.L &(ed.), *National and National Identity in South Asia*, Orient BlackSwan/Sangam Books Ltd, 2001.
16. Satyamurthy T.V, *State and Nation in the Context of Social Change,* Oxford University Press, 1997.
17. Chaube S.K , Singh M.P and Rekha Saxena, *India at the Polls: Parliamentary Elections in a Federal Phase* Orient Longman, Delhi, 2003.

68452

APPRECIATION OF CONTEMPORARY ENGLISH LITERATURE

(Open Elective-II: Common to all Branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To appreciate contemporary English literature
2. To imbibe inherent values of contemporary English literature
3. To acquire holistic language skills
4. To enable analyzing the text critically
5. To become global citizens by being familiar with the contemporary trends in English literature.

Unit I – Essay

1. Jet Lag – Pico Iyer
2. Indian Crowds – Nirad.C. Chaudhuri

Unit II – Poetry

1. Caged Bird – Maya Angelou
2. Walking Around – Pablo Neruda

Unit III – Novella

1. *Night* – Elie Wiesel

Unit IV – Short Story

1. The Luncheon – W. Somerset Maugham
2. The Umbrella Man – Roald Dahl

Unit V – Play

1. Boiled Beans on Toast – Girish Karnad

Course Outcomes

The course will enable Students to develop:

CO 1 : Nuanced view of English language and literature
CO 2 : Aesthetics and enriched vocabulary
CO 3 : Mastery in Reading and Writing skills
CO 4 : Critical appreciation and aesthetic skills
CO 5 : Skills to meet the global challenges

Text Books:

1. Elie Weisel, *Night*, Hill & Wang, 1960.
2. Girish Karnad, *Boiled Beans on Toast,* Oxford University Press, 2014.
3. Compiled text book of the prescribed Essays, Poetry and Short stories, prepared inhouse, Ms. Vanitha Singireddy and Ms. Bhawani Balasubramanyam.

References:

1. Pico Iyer, *the Global Soul: Jet Lag, Shopping Malls, and the Search for Home*, Vintage, 2001.
2. Nirad. C. Chaudhuri, *the Autobiography of an Unknown Indian*, Macmillan, 1951.
3. Roald Dahl, *the Umbrella Man and Other Stories*, Penguin, 2013.
4. W. Somerset Maugham, *Collected Short Stories,* Volume I, Penguin, 1992.

68453

FUNDAMENTALS OF HUMAN FOOD AND NUTRITION

(Open Elective-II: Common to all Branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To emphasize the importance of human food and nutrition.
2. To impart knowledge regarding macro nutrients and their deficiency disorders.
3. To impart knowledge regarding micro nutrients and their deficiency disorders.
4. Provide an overview of cooking methods and their impact on nutritive value.
5. To develop awareness on human diet.

UNIT I – Introduction to Nutrition

Concept – Definitions– Health (WHO), Nutrition, Nutrients, food, Classification of foods based on nutritive value and functions. ICMR Food groups, Food Pyramid, Definition and Importance of balanced diet, recommended dietary allowance.

UNIT I – Nutrients: Macro Nutrients

Nutrients - Classification, sources, functions and deficiency symptoms of Macro Nutrients – Carbohydrates, Fats and Proteins, Micro Nutrients - Vitamins - Fat Soluble Vitamins – Vitamin A, D, E and K.

UNIT III – Micro Nutrients

Functions, sources and deficiency symptoms of Water Soluble Vitamins– Vitamin C and B complex group (B_1, B_2, Niacin, Pyridoxine, Vitamin B_{12}, Folic Acid,). Minerals – Functions, sources and deficiency symptom's of Calcium, Iron, Iodine, Sodium, Potassium and Fluorine.

UNIT IV – Food Preparation and Nutritive Value

Methods of food preparation- Moist heat-Boiling, Steaming, pressure cooking, poaching and Braising, Dry heat – Baking, roasting, grilling, Frying- Sautéing, Shallow and deep frying, Advantages and disadvantages of food preparation methods, Effects of cooking on nutritive value of foods.

UNIT V – Dietetics

Normal Diet, Modification of normal diet and their applications, Based on consistency – Fluid diet (clear and full), soft diet, Based on nutrients –high protein and low protein, Modified foods – Nutraceuticals, PrebIoTics and probIoTics, Phytochemicals, Genetically modified foods(GM) and food laws and standards.

Course Outcomes: At the end of the course, the student should be able to

CO 1: Thoroughly understand the concept and importance of nutrition.
CO 2: Understand the sources and functions of macro nutrients.
CO 3: Understand the sources and functions of micro nutrients.
CO 4: Develop awareness on the basic food preparation terminology and cooking methods.
CO 5: Gain knowledge on nutritive value and importance of balanced diet.

Text Books:

1. *Food Science and Nutrition*, Sunetra Roday, 2nd Edition, Oxford University Press, 2012.
2. *Food Science*, B. Srilakshmi, 6th Edition, New Age International Publishers, 2015.

References:

1. *A Text Book of Foods, Nutrition and Dietetics*, M. Raheena Begum, 3rd Edition, Sterling Publishers Private Limited, 2008.
2. *Nutrition and Dietetics,* Shubhangini A Joshi, 4th Edition, McGraw-Hill Education (India) Private Limited, 2015.

68454

MANAGEMENT SCIENCE

(Open Elective-II: Common to all branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To learn various principles of Management and to make them effective business decision makers.
2. To make the students understand functional areas and potential problems of business for efficient utilization of resources.
3. To have an overview of Organizational structure, Organization culture and climate
4. To understand the basic elements involved in Leading and Motivation
5. To provide knowledge about various control systems

UNIT I - Introduction to Management

Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management;

Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioural approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT II - Planning and Decision Making

General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy.

Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making.

Project planning tools: Network diagrams, PERT & CPM Techniques, Project crashing (simple problems).

UNIT III - Organization and HRM

Principles of Organization, Organizational Design & Organizational Structures: Departmentalization, Delegation; Empowerment, Centralization, Decentralization; Organizational Culture; Organizational Climate and Organizational Change.

Human Resource Management-Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT IV - Leading and Motivation:

Leadership, Power and Authority, Leadership Styles; Behavioural Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.

Motivation - Content Motivational Theories - Needs Hierarchy Theory, Herzberg's Two Factor Theory, Theory X and Theory Y.

UNIT V - Controlling

Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non-Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency and Methods.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Make business decisions for effective business administration.
CO 2	:	Identify Business strategies for effective and efficient utilization of resources.
CO 3	:	Design the organization which can effectively work in dynamic business environment.
CO 4	:	Become better leaders and be self-motivated.
CO 5	:	Develop and implement the Control Systems in the organization.

Text Books:

1. Robert N Lussier, *Management Fundamentals* 5th Edition, Cengage Learning, 2013.
2. Stephen P. Robbins, *Fundamentals of Management,* Pearson Education, 2009.

References:

1. Koontz and Weihrich, *Essentials of Management*, McGraw-Hill.
2. Andrew DuBrin, *Management Essentials,* 9th Edition, Cengage Learning, 2012.

68455

SOCIAL PSYCHOLOGY

(Open Elective-II: Common to all branches)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30
Tutorial	:	-	Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To enhance the social skills among engineering students for better adjustment in the society.
2. To bring about awareness of social psychology in engineering students.
3. To understand social dynamics such as Motivation and Leadership
4. To understand group dynamics and communication
5. To evaluate environmental stress and its impact on behaviour

Unit I - Introduction to Psychology and Social Psychology

Definition, Nature and scope of Psychology, Social Psychology as branch of Psychology. Definition, Nature and scope of Social Psychology. Individual in a social milieu. Influence of society on individuals. Social Psychology in relation to Sociology and Social sciences - Anthropology and Economics. Methods in Social Psychology – survey method – questionnaire and interview, observation method, experimental method in social psychology.

Unit II - Attitudes and Social Process

Nature and definition of Attitudes, Need for Studying Attitudes, Formation and change of attitudes; Persistence and attitude change, Influence of attitudes on individual behaviour – Prejudice. Discrimination, Stereo typing. Impression Formation, Impression Management. Interpersonal Attraction, Aggression, Promoting Social Harmony – alleviating prejudice, reducing discrimination, managing anger.

Unit III - Motivation and Leadership

Definition and process of Motivation; Types of motives – primary and secondary motives. Influence of motivation on social behaviour. Leadership: Definition of Leadership; Types of Leadership; Characteristics of successful leader. Social power – source of power; Determination of social power. Difference between leader and manager.

Unit IV - Groups and Communication

Meaning and Dynamics, Nature of Social groups, Types of groups, Group cohesiveness; Group dynamics. Group interaction – Competitive and cooperative groups, determinants of cooperation and competition. Nature and purpose of communication, process of communication. Types of communication, Channels of communication, Barriers of communication. Techniques for effective communication.

Unit V - Environmental Influence on Social Behaviour

Nature and scope of environmental psychology; environmental stress and their influence on behaviour – Crowding, Noise, Pollutants – Water, Air, Agriculture products, Temperature, Climate. Enabling sustainable living through new technologies and reducing consumption.

Course Outcomes:

CO 1: The student will be acquainted with social psychology and society around him/her.
CO 2: He/she will be equipped with some of the social skills to deal with others as well as be a successful person.
CO 3: The students become self-motivated and better leaders
CO 4: Students develop group behavior and better communication skills
CO 5: Students strive for Sustainable Living

Text Books:

1. Baron, R.A., Byrne, D., and Branscombe, N.A, *Social Psychology*, Prentice Hall India, 2008.
2. Myers D.G., Sahajpal, P. and Behera P, *Social Psychology*, 10^{th} Edition, McGraw-Hill, 2012.
3. Singh, A.K., Social Psychology, Prentice Hall India, 2015.

References:

1. Fiske Susan, T., Gilbert Daniel T. and Lindzey Gardener, *Handbook of Social Psychology*, Vol. I & II, 5^{th} Edition, John Wiley Publications, 2010. (Relevant Chapters only).
2. Kuppu Swamy B, *an Introduction to Social Psychology*, Media Promoters and Publishers Pvt. Ltd., 1972.