CURRICULUM - 2023

C -23

DIPLOMA IN

APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING

STATE BOARD OF TECHNICAL EDUCATION & TRAINING

ANDHRA PRADESH

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
CURRICULUM- 2023 (C-23)

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PREAMBLE

Technical Education is a key driver of economic development and plays a crucial role in providing individuals with the skills and knowledge necessary to thrive in the workplace. As technological advancements continue to reshape industries and create new opportunities, it is critical that technical education curricula remain relevant and up-to-date.

The curriculum has been designed with this in mind, with a focus on practical skills, critical thinking, and problem-solving. We believe that these skills are essential for success in both academic and professional spheres. The revamping of the technical education curriculum is made with collaborative effort from educators, industry experts, policymakers, and students.

At the heart of the curriculum, is the belief that the technical education should be **student-centered**, empowering learners to take ownership of their learning and pursue their passions. We aim to create a learning environment that is safe, supportive, and nurturing, where every student has the opportunity to reach their fullest potential. We acknowledge that learning is a lifelong journey, and our curriculum is designed to provide a solid foundation for continued growth and development. We hope that our students will not only leave with a diploma but with employability and passion for learning.

The State Board of Technical Education and Training, (SBTET) AP, has been offering Diploma programmes to meet the above said aspirations of the stake holders: industries, students, academia, parents and the society at large. **The Curriculum should be flexible, adaptable, and responsive to the changing needs of the industry and society.** As such, it has been the practice of SBTET, A.P., to keep the curriculum abreast with the advances in technology through systematic and scientific analysis of current curriculum and bring out an updated revised version at regular intervals.

The design of Curriculum C-23 was started in the month of January - 2023. Feedback was collected from all stake holders: Students, Lecturers, Senior Lecturers, Head of Sections and Principals for all programmes for this purpose. Accordingly, a workshop was convened on 15th February 2023 by Smt. C. Naga Rani, I.A.S, Director of Technical Education & Chairperson, SBTET, AP to discuss on revamping of C-20 curriculum to meet the needs of industries and for improvement of placements.

The meeting was attended by Sri. Saurab Gaur, I.A.S, Principal Secretary, Skill Development & Training, Smt. Lavanya Veni, I.A.S, Director, Employment & Training. Thirteen Representatives from Industries and Fourteen Academicians from Higher Level Institutions and officials of ITI, Skill Development, CTE & SBTET attended the workshop.

Smt. C Naga Rani, I.A.S., Commissioner of Technical Education while addressing in the workshop, emphasized the necessity of industrial training and on-hand experience, that the students need to undergo to support the industries and the Gaps in the Curriculum need to be fixed to make the students passionate to work in the industry in order to support economy of the country.

The committees of each branch consisting of experts from Industries, Higher Level Institutions and Faculty of Polytechnics are informed to study the possibility of incorporating the following aspects while preparation of the curriculum so as to improve employability.

- **To bring out industry oriented Diploma Engineers.**
- **Internet of Things (IoT) for all branches**
- **Theoretical & Practical subjects 50: 50 Ratio**
- **Industry 4.0 concepts.**
- **5G Technology.**
- **Critical Thinking (Quantitative Aptitude, Data Interpretation, Quantitative reasoning etc) to face the written tests conducted by the industries during placements.**
- **Dynamic, Student centric to suit the needs of the industry.**

In continuation, series of workshops with subject experts followed in the subsequent weeks for thorough perusal for preparation of draft curriculum. Also, the suggestions received from representatives from various industries, academic experts from higher level institutions, subject experts from Polytechnics, have been recorded, validated for incorporation into the **Curriculum C-23.** Finally, the draft curriculum was sent to academicians of higher-level institutions, industrial experts for Vetting.

The design of new Curricula C-23 for different diploma programmes has thus been finalised with the active participation of the members of the faculty teaching in the Polytechnics of Andhra Pradesh, and duly reviewed by Expert Committee constituted of academicians and representatives from industries. Thus, the primary objective of the curriculum change is to produce employable diploma holders in the country by correlating the growing needs of the industries with relevant academic input.

The outcome-based approach as given by NBA guidelines has been followed throughout the design of this curriculum and designed to meet the requirements of NBA Accreditation, too.

The Revised Curriculum i.e., Curriculum–2023 (C-23) is approved by 45th Academic Committee of SBTET, A.P for its implementation with effect from Academic Year 2023-24. Also, the SBTET, A.P under the aegis of the Department of Technical Education, Andhra Pradesh in it's 62nd Board Meeting held on 13-07-2023 (vide item no: 17) Approved to update the Polytechnic Curriculum C-23 with effect from the academic year 2023-2024 onwards after revamping the present C-20 curriculum, to meet the latest industrial technological developments including Industry 4.0 concepts.

2. HIGHLIGHTS OF CURRICULUM C-23

The following Courses/ Topics are incorporated in this curriculum C-23 as per the suggestions received from Industrial Experts, Faculty of Higher Level Institutions and Polytechnics to improve the Employability Skills of the Polytechnic Students.

1. Duration of course for regular Diploma is 3 years.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year wise pattern.
3. 6 Months Industrial training has been introduced for 3 years Diploma Courses in VI semester.
4. Updated subjects/topics relevant to the industry are introduced in all courses at appropriate places.
5. The policy decisions taken at the State and Central level with regard to environmental science are implemented by including relevant topics in Chemistry. This is also in accordance with the Supreme Court guidelines issued in Sri Mehta's case.
6. Keeping in view the increased need of communication skills which is playing a major role in the success of Diploma Level students in the industries, emphasis is given for learning and acquiring listening, speaking, reading and writing skills in English. Further as emphasized in the meetings, Communication Skills lab and Life Skills lab are continuing for all the branches.
7. Upon reviewing the existing C-20 curriculum, it is found that the theory content is found to have more weight age than the Practical content. In C-23 curriculum, more emphasis is given to the practical content in Laboratories and Workshops, thus strengthening the practical skills. The ratio of Theory & Practicals is 50:50.
8. With increased emphasis for the student to acquire Practical skills, the course content in all the subjects is thoroughly reviewed and structured as outcome based than the conventional procedure based.
9. Curriculum of Laboratory and Workshops have been thoroughly revised based on the suggestions received from the industry and faculty, for better utilization of the equipment available in the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to confirm to the field requirements of industry.
10. The theory and practical subjects are restructured to find room for new theory and practical subjects to meet the present the industrial needs.
11. To make the students effective and efficient in all aspects, three periods per week are allotted in every year/semester for STUDENT CENTRIC ACTIVITY in which student will be trained for placements or make use of library or participate in sports & games/clean & green etc.

SPECIFIC CHANGES INCORPORATED IN CURRICULUM C-23 BRANCH:
All the Subjects in earlier curriculum are reviewed and the following specific changes are discussed and incorporated.

(i) In course AEI-305- Sensors and Transducers, as suggested by the experts form academic and industry miscellaneous measurements and smart sensors topics are incorporated.
(ii) As suggested by the experts from the academic and industry the following subjects are incorporated.
a. AEI-306 - Algorithm design using C with data structures is incorporated in III semester.
b. AEI-401 - Data Communication and computer networks is incorporated in IV semester.
c. AEI-502 - Internet of Things and Industry 4.0 is incorporated in V semester.
d. AEI-503 - ARM Microcontroller is incorporated in V semester.
e. AEI-506 - Internet of Things and Industry 4.0 Lab is incorporated in V semester.
f. AEI-507 - ARM Microcontroller LAB is incorporated in V semester.
(iii) In course AEI-501- Industrial Management & Entrepreneurship, as suggested by the experts from academic and industry Industrial Safety, Quality control topics are incorporated.

3. ACKNOWLEDGEMENTS

The Members of the working group are grateful to Smt C. Naga Rani I.A.S., Commissioner of Technical Education & Chairman of SBTET, for continuous guidance and valuable inputs during process of revising, modifying and updating the Curriculum C-20 to Curriculum C-23.

We are grateful to Sri. S. Suresh Kumar, I.A.S, Principal Secretary, Skills Development & Training for his valuable suggestions to bring the revamped curriculum C-23 in to a final form to meet latest Industry 4.0 concepts.

We are grateful to Sri. Saurab Gaur, I.A.S, former Principal Secretary, Skills Development & Training who actively participated in the Industry-Academia workshop conducted on 15th February, 2023 and offered valuable suggestions and insights into the learning needs and preferences so that the curriculum is engaging, inclusive, and effective.

It is pertinent to acknowledge the support of the following in the making of Curriculum C-23. A series of workshops in different phases were conducted by SBTET, AP, Guntur involving faculty from Polytechnics, Premier Engineering Colleges & representatives from various Industries and Dr. C. R. Nagendra Rao, Professor & Head, NITTTR-ECV to analyse the Previous C-20 Curriculum and in designing of C-23 Curriculum, is highly appreciated and gratefully acknowledged.

We also extend our sincere thanks to Sri. V. Padma Rao, Joint Director of Technical Education, Sri K.V. Ramana Babu, Secretary, SBTE&T, Andhra Pradesh, Sri K. Vijaya Bhaskar, Deputy Director (Academic) , Andhra Pradesh, officials of Directorate of Technical Education and the State Board of Technical Education, Andhra Pradesh and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

4. RULES AND REGULATIONS OF C-23 CURRICULUM

4.1 Duration and pattern of the courses

All the Diploma programs run at various institutions are of AICTE approved 3 years or 3½ years duration of academic instruction. All the Diploma courses are run on year wise

pattern in the first year, and the remaining two or two & half years are run in the semester pattern. In respect of few courses like Diploma in Bio-Medical course, the training will be in the seventh semester. **Run-through system is adopted for all the Diploma Courses, subject to eligibility conditions.**

4.2 Procedure for Admission into the Diploma Courses:

Selection of candidates is governed by the Rules and Regulations laid down in this regard from time to time.

a) Candidates who wish to seek admission in any of the Diploma courses will have to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET) conducted by the State Board of Technical Education and Training, Andhra Pradesh, Vijayawada. Only the candidates satisfying the following requirements will be eligible to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET).
    a. The candidates seeking admission should have appeared for S.S.C examination, conducted by the Board of Secondary Education, Andhra Pradesh or equivalent examination thereto, at the time of applying for the Common Entrance Test for admissions into Polytechnics (POLYCET). In case of candidates whose results of their Qualifying Examinations is pending, their selection shall be subject to production of proof of their passing the qualifying examination in one attempt or compartmentally at the time of admission.
    b. Admissions are made based on the merit obtained in the Common Entrance Test (POLYCET) and the reservation rules stipulated by the Government of Andhra Pradesh from time to time.
    c. For admission into the following Diploma Courses for which entry qualification is 10+2, candidates need not appear for POLYCET. A separate notification will be issued for admission into these courses.
        i). D.HMCT ii).D. Pharmacy

4.3 Medium of Instruction

The medium of instruction and examination shall be English.

4.4 Permanent Identification Number (PIN)

A cumulative / academic record is to be maintained of the Marks secured in sessional work and end examination of each year for determining the eligibility for promotion etc., A Permanent Identification Number (PIN) will be allotted to each admitted candidate to maintain academic records.

4.5 Number of Working Days Per Semester / Year:

a) The Academic year for all the Courses shall be in accordance with the Academic Calendar.
b) The Working days in a week shall be from Monday to Saturday
c) There shall be 7 periods of 50 minutes duration each on all working days.
d) The minimum number of working days for each semester / year shall be 90 / 180 days excluding examination days. If this prescribed minimum is not achieved due

to any reason, special arrangements shall be made to conduct classes to complete the syllabus.

4.6 Eligibility (Attendance to Appear for the End Examination)

a) A candidate shall be permitted to appear for the end examination in all subjects, if he or she has attended a minimum of 75% of working days during the year/Semester.
b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or 1st year may be granted on medical grounds.
c) A stipulated fee shall be payable towards condonation for shortage of attendance.
d) Candidates having less than 65% attendance shall be detained.
e) Students whose shortage of attendance is not condoned in any semester / 1st year and not paid the condonation fee in time are not eligible to take their end examination of that class and their admissions shall stand cancelled. They may seek re-admission for that semester / 1st year when offered in the next subsequent academic semester/year.

For INDUSTRIAL TRAINING:
i) During Industrial Training the candidate shall put in a minimum of 90% attendance.
ii) If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training at his own expenses.

4.7 Readmission

Readmission shall be granted to eligible candidates by the respective Principal/ Regional Joint Director.

a) (i) Within 15 days after commencement of class work in any semester (Except Industrial Training).
   (ii) For Industrial Training: before commencement of the Industrial training.
b) Within 30 days after commencement of class work in any year (including D. Pharmacy course or first year course in Engineering and Non-Engineering Diploma streams). Otherwise, such cases shall not be considered for readmission for that semester / year and are advised to seek readmission in the next subsequent eligible academic year.
c) The percentage of attendance of the readmitted candidates shall be calculated from the first day of beginning of the regular class work for that year / Semester, as officially announced by CTE/SBTET but not from the day on which he/she has actually reported to the class work.

4.8 Scheme of Evaluation

a) First Year

Theory Courses: Each Course carries Maximum marks of 80 with an end examination of 3 hours duration, along with internal assessment for Maximum of

20 marks. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

Laboratory Courses: There shall be 40/20 Marks for internal assessment i.e. sessional marks for each practical Course with an end examination of 3 hours duration carrying 60/30 marks. However, there are no minimum marks prescribed for sessional.

b) III, IV, V, VI and VII Semesters:

Theory Courses: End semester evaluation shall be of 3 hours duration and for a maximum of 80 marks.

Laboratory Courses: Each Course carry 60/30 marks of 3 hours duration 40/20 sessional marks.

4.9 Internal Assessment Scheme

a) Theory Courses: Internal assessment shall be conducted for awarding Sessional marks on the dates specified. **Three-unit tests shall be conducted for I year students and two Unit Tests for semesters. The details are presented below.**

S. No.	Type of Assessment	Weightage Assigned
(i)	Testing of knowledge through mid-examination for year/sem as (Mid-1+Mid-2+Mid3) or (Mid-1 + Mid-2)	40
(ii)	Assignments	5
(iii)	*Dynamic Learning activities : Project Work/ Seminar/Tech-fest/Group Discussion, Quizzes etc./Extra-curricular activities/NSS/NCC/ IPSGM/Cleaning & Greening of Campus etc.*	*5*
	T O T A L	50

Internal Assessment shall be of 90 minutes duration and for a maximum of 40 marks for each test.

At least one assignment should be completed for each unit which carries 10 marks. The total assignment marks should be reduced to 5.

The dynamic learning activity is to be conducted which carries 10 marks. The total marks should be reduced to 5.

The total 50 marks assigned to internal assignment is to be scaled down to 20 marks.

b) Practical Courses:

(i) **Drawing Courses:**

The award of Sessional marks for internal Assessment shall be as given in the following table:

Distribution of Marks for the Internal Assessment Marks	
First Year (Total:40 Marks)	**Semesters (Total:40 Marks)**

Max:20 Marks	Max:20 Marks	Max:20 Marks	Max:20 Marks
From the Average of THREE Unit Tests.	From the Average of Assessment of Regular Class work Exercises.	From the Average of TWO Unit Tests.	From the Average of Assessment of Regular Class work Exercises.

- For first year engineering drawing each unit test will be conducted for a duration of 2 hours with maximum marks of 40.

- (Part - A: 4 questions x 5 marks = 20 Marks; Part –B: 2 questions x 10 marks = 20 marks).

- For the semester drawing examinations, Two Unit tests shall be conducted as per the Board End Examination Question Paper Pattern.

- All Drawing exercises are to be filed in serial order and secured for further scrutiny by a competent authority

(ii) Laboratory Courses:

(a) Student's performance in Laboratories / Workshop shall be assessed during the year/ semester of study for 40 marks in each practical Course.

(b) Evaluation for Laboratory Courses, other than Drawing courses:

i. Instruction (teaching) in laboratory courses (except for the course on Drawing) here after shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in SBTET website.
ii. Internal assessment for Laboratory shall be done on the basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in AP, SBTET website.
iii. Question paper for End semester Evaluation shall also be task/s based and shall be prepared and distributed by SBTET as done in case of theory courses be prepared as per SBTET rules in vogue.

c) Internal assessment in Labs / workshops / Survey field work etc., during the course of study shall be done and sessional marks shall be awarded by the concerned Teacher.

d) For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective Head of Section preferably choosing a qualified person from in the order of preference.

i) Nearby Industry

ii) Govt / Semi Govt organization like R & B, PWD, PR, Railways, BSNL, APSRTC, APSEB etc.

iii) Govt / University Engg College.

iv) HoD / Senior Lecture (Selection Grade-II) from the Govt. Polytechnic

Internal examiner shall be the person concerned with internal assessment as in (c) above. The end examination shall be held along with all theory papers in respect of drawing.

e) Question Paper for Practicals: Question paper should cover (the experiments / exercise prescribed to test various) skills like handling, manipulating, testing, trouble shooting, repair, assembling and dismantling etc., from more than one experiment / exercise

f) Records pertaining to internal assessment marks of both theory and practical Courses are to be maintained for official inspection.

g) In case of Diploma programs having Industrial Training, Internal Assessment and Summative Evaluation, shall be done as illustrated in the following table:

Assessment no	**Upon completion of**	**By**	**Based on**	**Max Marks**
1	12 weeks	1.The faculty concerned (Guide) and 2. Training in charge (Mentor) of the industry	Learning outcomes as given in the scheme of assessment ,for Industrial Training	120
2	22 weeks			120
3. Final summative Evaluation	24 week	1.The faculty member concerned, 2.HoD concerned and 3.An external examiner	1.Demonstration of any one of the skills listed in learning outcomes	30
			2.Training Report	20
			3.Viva Voce	10
			TOTAL	**300**

h) Each staff member including Head of Section shall be assigned a batch of students 10 to 15 for making assessment during industrial training.

4.10 Minimum Pass Marks

a) Theory Examination:

For passing a theory Course, a candidate has to secure a minimum of 35% in end examination and a combined minimum of 35% of both Sessional and end examination marks put together.

b) Practical Examination:

For passing a practical Course, a candidate has to secure a minimum of 50% in end examination and a combined minimum of 50% of both sessional and practical end examination marks put together. In case of D.C.C.P., the pass mark for typewriting and short hand is 45% in the end examination. There are no sessional marks for typewriting and Shorthand Courses of D.C.C.P course.

C) Industrial Training:

I. Monitoring: Similar to project work each teacher may be assigned a batch of 10-15 students irrespective of the placement of the students to facilitate effective monitoring of students learning during industrial training.

II. Assessment: The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks. And also student has to secure 50% marks in final summative assessment at institution level.

III. In-Plant Industrial Training for 3-Year Diploma (C-23) Courses is scheduled as per the Academic Calendar of the SBTET every year.

4.11. Provision for Improvement

Improvement is allowed only after he / she has completed all the Courses from First Year to Final semester of the Diploma.

a) Improvement is allowed in any 4 (Four) Courses of the Diploma.
b) The student can avail of this improvement chance **ONLY ONCE**, that too within the succeeding two examinations after the completion of Diploma. However, the duration including Improvement examination shall not exceed **FIVE** years from the year of first admission.
c) No improvement is allowed in Practical / Lab Courses or Project work or Industrial Training assessment. However, improvement in drawing Course(s) is allowed.
d) If improvement is not achieved, the marks obtained in previous Examinations hold good.
e) Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
f) Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
g) All the candidates who wish to appear for improvement of performance shall deposit the original Marks Memos of all the years / Semesters and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised Memorandum of marks and Original Diploma Certificate will be issued, else the submitted originals will be returned.

4.12. Rules of Promotion From 1ST YEAR TO 3rd, 4th, 5th, 6th and 7th Semesters:

A) For Diploma Courses of 3 Years duration

i). A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds up to 10%) and pay the examination fee.

ii) A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training, AP from time to time before commencement of 3rd semester.

A candidate is eligible to appear for the 3rd semester examination if he/she puts the required percentage of attendance in the 3rd semester and pays the examination fee.

iii) A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training AP from time to time before commencement of 4th semester. A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester and pays the examination fee.

iv) A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester examination if he/she puts the required percentage of attendance in the 5th semester and pays the examination fee.

v) A candidate shall be sent to Industrial training / VI semester provided he/she puts in the required percentage of attendance in the 5th semester and pay the examination fee/ promotion fee as prescribed by SBTET.
A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-voce) puts the required percentage of attendance, i.e., 90% in 6th semester Industrial Training.

For IVC & ITI Lateral Entry students:

i.) A candidate shall be permitted to appear for Third Semester examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds up to 10%) and pay the examination fee for Third semester.

ii) A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training AP from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester and pays the examination fee.

ii) A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester examination if he/she puts the required percentage of attendance in the 5th semester and pays the examination fee.

iii) A candidate shall be sent to Industrial training / VI semester provided he/she puts in the required percentage of attendance in the 5th semester and pay the examination fee/ promotion fee as prescribed by SBTET.

A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-voce) puts the required percentage of attendance, i.e., 90% in 6th semester Industrial Training and pays the examination fee.

B) For Diploma Courses of 3 ½ Years duration (MET/ CH/ CHPP/ CHPC/ CHOT/ TT):

i. A candidate shall be permitted to appear for 1st year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the 1st year and pays the examination fee. A candidate who could not pay the 1st year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester exam if he/she puts the required percentage of attendance in the 4th semester

For IVC & ITI Lateral Entry students:

a) Puts the required percentage of attendance in the 4th semester

iv. A candidate shall be promoted to 5th semester industrial training provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

v. Promotion from 5th to 6th semester is automatic (i.e., from 1st spell of Industrial Training to 2nd spell) provided he/she puts the required percentage of attendance, which in this case ie.,90 % of attendance and attends for the VIVA-VOCE examination at the end of training.

vi. A candidate shall be promoted to 7th semester provided he / she puts the required percentage of attendance in the 6th semester and pays the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 7th semester.

vii. A candidate shall be promoted to 7th semester of the course provided he/she has successfully completed both the spells of Industrial Training.

A candidate is eligible to appear for 7th semester examination if he/she

a) Puts in the required percentage of attendance in the 7th semester

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in the 7th semester.

C) For Diploma Courses of 3 ½ Years duration (BM):

The same rules which are applicable for conventional courses also apply for this course. The industrial training in respect of this course is restricted to one semester (6 months) after the 6th semester (3 years) of the course.

i. A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate who could not pay the 3rd semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester examination if he/she

a) Puts in the required percentage of attendance in the 4th semester

For IVC & ITI Lateral Entry Students:

A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester

iv. A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester exam if he/she

a) Puts in the required percentage of attendance in the 5th semester.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in the 5th semester.

v. A candidate shall be promoted to 6th semester provided he/she puts in the required percentage of attendance in the 5th semester and pays the examination fee.

A candidate who could not pay the 5th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 6th semester.

A candidate is eligible to appear for 6th semester examination

a) Puts in the required percentage of attendance in 6th semester

IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in 6th semester.

vi. A candidate shall be promoted to 7th semester provided he/she puts in the required percentage of attendance in 6th semester and pay the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee prescribed by SBTET from time to time before commencement of the 7th semester (Industrial Training).

A candidate is eligible to appear for 7th semester Industrial Training assessment (Seminar/Viva-voce) if he/she

a) Puts in the required percentage of attendance, ie., 90% in 7th semester Industrial Training.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance, i.e., 90% in 7th semester Industrial Training.

4.13. Students Performance Evaluation

Successful candidates shall be awarded the Diploma under the following divisions of pass.

a) First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.
b) First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.
c) Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.
   i. The Weightage of marks for various year/Semesters which are taken for computing overall aggregate shall be 25% of I year marks + 100% of 3rd and subsequent Semesters.
   ii. In respect IVC & ITI Lateral Entry candidates who are admitted directly into diploma course at the 3rd semester (i.e., second year) level the aggregate of (100%) marks secured at the 3rd and subsequent semesters of study shall be taken into consideration for determining the overall percentage of marks secured by the candidates for award of class/division.
d) Second Class shall be awarded to all students, who fail to complete the Diploma in the regular 3 years/ 3 ½ years and four subsequent examinations from the year of first admission.

4.14. EXAMINATION FEE SCHEDULE:

The examination fee should be as per the notification issued by State Board of Technical Education and Training, AP from time to time.

4.15. Structure of Examination Question Paper:

I. Formative assessment (Internal examination)

a) For theory Courses:

Three-unit tests for first year and two-unit tests for semesters shall be conducted with a duration of 90 minutes for each test for maximum marks of 40. It consists of part A and Part B.

Part A contains five questions and carries 16 marks. Among these five questions first question consists of four objective items like one word or phrase answer/filling-in the blanks/true or false etc with one mark for each question. The other four questions are short answer questions and carry three marks each.

Part B carries 24 marks and consists of three questions with internal choice ie., Either/Or type , and each question carries 8 marks.

The sum of marks of 3 tests for I year and 2 tests for semesters including assignments and Dynamic learning activities (50 marks) shall be reduced to 20 marks in each Course for arriving at final sessional marks.

b) For drawing Courses:

For I year:

Three-unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted for first year. It consists of part A and Part B.

Part A consists four questions for maximum marks of 16 and each question carries four marks (4×4 marks=16 marks).

Part B carries maximum marks of 24 and consists of five questions while the student shall answer any three questions out of these five questions. Each question in this part carries a maximum mark of 8, (3×8 marks=24 marks).

The sum of marks obtained in 3-unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20 marks are awarded by the Course teacher based on the student's performance during regular class exercise.

For semester: Two-unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted. The sum of marks obtained in 2-unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20 marks are awarded by the Course teacher based on the student's performance during regular class exercise.

c) For Laboratory /workshop: 50% of total marks for the Course shall be awarded based on continuous assessment of the student in laboratory/workshop classes and the remaining 50% shall be based on the sum of the marks obtained by the students in two tests.

II. Summative assessment (End examination)

The question paper for theory examination is patterned in such a manner that the Weightage of periods/marks allotted for each of the topics for a particular Course be considered. End Examination paper is of 3 hours duration.

a) **Each theory paper consists of Section 'A' and 'B'**

Section 'A' with Max marks of 30, contains 10 short answer questions. All questions are to be answered and each carry 3 marks, i.e., 10 x 3 = 30.

Section 'B' with Max marks of 50 contains 8 essay type questions. Only 5 questions are to be answered and each carry 10 marks, i.e., Max. Marks: 5 x 10 = 50.
Thus, the total marks for theory examination shall be: 80.

b) **For Engineering Drawing Course (107) consist of section 'A' and section 'B'**.

Section 'A' with max marks of 20, contains four (4) questions. All questions in section 'A' are to be answered to the scale and each carries 5 marks, ie. 4 x 5=20.

Section 'B' with max marks of 40, contains six (6) questions. The student shall answer any four (4) questions out of the above six questions and each question carries 10 Marks, i.e., 4 x 10 = 40.

c) **Practical Examinations**
For Workshop practice and Laboratory Examinations, Each student has to pick up a question paper distributed by Lottery System.

Max. Marks for an experiment / exercise	:	50
Max. Marks for VIVA-VOCE	:	10
Total Max. Marks	:	60

In case of practical examinations with 50 marks, the marks shall be distributed as

Max. Marks for an experiment / exercise	:	25
Max. Marks for VIVA-VOCE	:	05
Total Max. Marks	:	30

In case of any change in the pattern of question paper, the same shall be informed sufficiently in advance to the candidates.

d) **Note: Evaluation for Laboratory Courses, other than Drawing courses**:

I. Instruction (teaching) in laboratory courses (except for the course on Drawing) hereafter shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP and posted in its website.
II. Internal assessment for Laboratory shall be done on basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP and posted in its website.
III. Question paper for End semester Evaluation shall be prepared as per SBTET rules in vogue.

4.16. ISSUE OF MEMORONDUM OF MARKS
All candidates who appear for the end examination will be issued memorandum of marks without any payment of fee. However candidates who lose the original memorandum of marks have to pay the prescribed fee to the Secretary, State Board of Technical Education and Training, A.P. for each duplicate memo from time to time.

4.17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA PROGRAMMES:
Maximum period for completion of the diploma courses is twice the duration of the course from the date of First admission (includes the period of detention and discontinuation of studies by student etc) failing which they will have to forfeit the claim for qualifying for the award of Diploma (They will not be permitted to appear

for examinations after that date). This rule applies for all Diploma courses of 3 years and 3 ½ years of engineering and non-engineering courses.

4.18. ELIGIBILITY FOR AWARD OF DIPLOMA

A candidate is eligible for award of Diploma Certificate if he / she fulfil the following academic regulations.

i. He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.
ii. He / she have completed all the Courses.
Students who fail to fulfil all the academic requirements for the award of the Diploma within 6 / 7 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

For IVC & ITI Lateral Entry students

i. He / She pursued a course of study for not less than 2 / 2 ½ academic years & not more than 4 / 5 academic years.
ii. He / she has completed all the Courses.
Students who fail to fulfil all the academic requirements for the award of the Diploma within 4 / 5 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

4.19. ISSUE OF PHOTO COPY OF VALUED ANSWER SCRIPT, RECOUNTING& REVERIFICATION:

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

I. A candidate desirous of applying for Photo copy of valued answer script/s should apply within prescribed date from the date of the declaration of the result.
II. Photo copies of valued answer scripts will be issued to all theory Courses and Drawing Course (s).
III. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.
IV. No application can be entertained from third parties.

B) FOR RE-COUNTING (RC) and RE-VERIFICATION (RV) OF THE VALUED ANSWER SCRIPT

i. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.
ii. Re-verification of valued answer script shall be done for all theory Courses' and Drawing Course(s).
iii. The Re-verification committee constituted by the Secretary, SBTETAP with Course experts shall re-verify the answer scripts.

I. **RE-COUNTING**

The Officer of SBTET will verify the marks posted and recount them in the already valued answer script. The variations if any will be recorded separately, without making any changes on the already valued answer script. The marks awarded in the original answer script are maintained (hidden).

II. RE-VERIFICATION

(i) The Committee has to verify the intactness and genuineness of the answer script(s) placed for Re-verification.

(ii) Initially single member shall carry out the re-verification.

(iii) On re-verification by single member, if the variation is less than 12% of maximum marks, and if there is no change in the STATUS in the result of the candidate, such cases will not be referred to the next level ie., for 2-Tier evaluation.

(iv) On re-verification by a single member, if the variation is more than 12% of maximum marks, it will be referred to 2-Tier evaluation.

(v) If the 2-Tier evaluation confirms variation in marks as more than 12% of maximum marks, the variation is considered as follows:
a) If the candidate has already passed and obtains more than 12% of the maximum marks on Re-verification, then the variation is considered.
b) If the candidate is failed and obtains more than 12% of the maximum marks on Re-verification and secured pass marks on re-verification, then the status of the candidate changes to PASS.
c) If a candidate is failed and obtains more than 12% of the maximum marks on Re-verification and if the marks secured on re-verification are still less than the minimum pass marks, the status of the candidate remain FAIL only.

(vii) After Re-verification of valued answer script the same or change if any therein on Re-verification, will be communicated to the candidate.

(viii) On Re-verification of Valued Answer Script if the candidate's marks are revised, the fee paid by the candidate will be refunded or else the candidate has to forfeit the fee amount.

Note: No request for Photo copies/ Recounting /Re-verification of valued answer script would be entertained from a candidate who is reported to have resorted to Malpractice in that examination.

4.20. Mal Practice Cases:

If any candidate resorts to Mal Practice during examinations, he / she shall be booked and the Punishment shall be awarded as per SBTETAP rules and regulations in vogue.

4.21. Discrepancies/ Pleas:

Any Discrepancy /Pleas regarding results etc., shall be represented to the SBTETAP within one month from the date of issue of results. Thereafter, no such cases shall be entertained in any manner.

4.22. Issue of Duplicate Diploma

If a candidate loses his/her original Diploma Certificate and desires a duplicate to be issued he/she should produce written evidence to this effect. He / she may obtain a duplicate from the Secretary, State Board of Technical Education and Training, A.P., on payment of prescribed fee and on production of an affidavit signed before a First Class Magistrate (Judicial) and non-traceable certificate from the Department of Police. In case of damage of original Diploma Certificate, he / she may obtain a duplicate certificate by surrendering the original damaged certificate on payment of prescribed fee to the State Board of Technical Education and Training, A.P.

In case the candidate cannot collect the original Diploma within 1 year from the date of issue of the certificate, the candidate has to pay the penalty prescribed by the SBTET AP from time to time.

4.23. Issue of Migration Certificate and Transcripts:

The Board on payment of prescribed fee will issue these certificates for the candidates who intend to prosecute Higher Studies in India or Abroad.

4.24. General

i. The Board may change or amend the academic rules and regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students, for whom it is intended, with effect from the dates notified by the competent authority.
ii. All legal matters pertaining to the State Board of Technical Education and Training, AP are within the jurisdiction of Mangalagiri.
iii. In case of any ambiguity in the interpretation of the above rules, the decision of the Secretary, SBTET, A.P is final.

VISION

To constantly strive to make this department a universal level Polytechnic in Applied Electronics and Instrumentation Engineering.

MISSION

M1	To provide high quality education which inspire the students to realize their aspiration and potential.
M2	To enhance knowledge, create passion for learning, foster innovation and nurture talents towards serving the society and the country.
M3	To encourage faculty members to update their knowledge and carryout advanced study in cutting edge technologies.
M4	To provide a competitive learning environment, through a need based curriculum designed in collaboration with industry, conducive for high quality education emphasising on transfer of knowledge and skill development essential for the profession and the society as well.

Programme Educational Objectives (PEOs)

The major objectives of the Diploma in Applied Electronics and Instrumentation Engineering are, to prepare students

PEO1	For employment in the core industrial/manufacturing sector.
PEO2	For employment in research and development organizations.
PEO3	For graduate studies in engineering and management.
PEO4	For entrepreneurship in the long run.

PROGRAMME OUTCOMES (POs)

The students, after undergoing the Diploma in Applied Electronics and Instrumentation Engineering,

PO1.Basic and discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

PO2.Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods

PO3.Design/Development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs

PO4.Engineering tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5.Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO6.Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well defined engineering activities.

PO7.Life-long learning: Ability to analyse individual needs and engaging updating in the context of technological changes.

Program Specific Outcomes (PSOs):

The students of Applied Electronics and Instrumentation Engineering (AEIE) will be able to:

PSO1: Apply the fundamentals of electrical, electronic, computer, mathematics, science and engineering knowledge to identify, design, develop and investigate complex problems of electrical and electronic circuits, electronic process instrumentation, measurement and process control field.

PSO2: Apply appropriate technique and modern engineering hardware and software tools to design, develop, measure and control the electronic and instrumentation system to engage in life-long learning and work efficiently as an individual and in a multidisciplinary team.

PSO3: Understand the impact of professional behaviour and ethics and effective communication with engineering community and the society.

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
FIRST YEAR

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / year	Scheme of Examination			
		Theory	Practical / Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
AEI-101	English	3	-	90	3	20	80	100
AEI-102	Mathematics - I	5	-	150	3	20	80	100
AEI-103	Engineering Physics	4	-	120	3	20	80	100
AEI-104	Engineering Chemistry & Environmental Studies	4	-	120	3	20	80	100
AEI-105	Electronic components and devices	4	-	120	3	20	80	100
AEI-106	Basic Electrical Engineering	4	-	120	3	20	80	100
PRACTICAL								
AEI-107	Engineering Drawing	-	3	90	3	40	60	100
AEI-108	Electrical Wiring, Electronic components & Devices Lab	-	6	180	3	40	60	100
AEI-109	Physics Lab	-	1.5	45	3 (1.5+1.5)	20	30	100 (50+50)
AEI-110	Chemistry Lab		1.5	45		20	30	
AEI-111	Computer Fundamentals Lab	-	3	90	3	40	60	100
	Activities		3	90	3			
	TOTAL	24	18	1260	-	280	720	1000

AEI- 101, 102, 103, 104, 107, 109, 110 and 111 are common with all branches.

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
III SEMESTER

Subject Code	Name of the Subject	Instruction periods / week		Total Periods /Semester	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
AEI-301	Mathematics – II	4	-	60	3	20	80	100
AEI-302	Electronic circuits	3	-	45	3	20	80	100
AEI-303	Digital Electronics	4	-	60	3	20	80	100
AEI-304	Electronic Measuring Instruments	4	-	60	3	20	80	100
AEI-305	Sensors and Transducers	6	-	90	3	20	80	100
AEI-306	Algorithm design using C with data structures	5	-	75	3	20	80	100
PRACTICAL								
AEI-307	Electronic circuits Lab	-	3	45	3	40	60	100
AEI-308	Prog in C and MATLAB	-	3	45	3	40	60	100
AEI-309	Digital Electronics Lab	-	3	45	3	40	60	100
AEI-310	Electronic Measuring Instruments Lab	-	3	45	3	40	60	100
AEI-311	Sensors and Transducers Lab	-	3	45	3	40	60	100
	Activities	-	1	15	3			
	TOTAL	26	16	630	-	320	780	1100

AEI-301 common with all branches

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
IV SEMESTER

Subject Code	Name of the Subject	Instruction periods / week		Total Periods /semester	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
AEI-401	Data Communication and computer networks	3	-	45	3	20	80	100
AEI-402	Linear Integrated Circuits	3	-	45	3	20	80	100
AEI-403	Analytical and Biomedical Instrumentation	6	-	90	3	20	80	100
AEI-404	Process control	5	-	75	3	20	80	100
AEI-405	Industrial Electronics and control systems	5	-	75	3	20	80	100
PRACTICAL								
AEI-406	Linear IC Applications and e-CAD Lab	-	3	45	3	40	60	100
AEI-407	Biomedical instrumentation lab	-	3	45	3	40	60	100
AEI-408	Communication Skills	-	3	45	3	40	60	100
AEI-409	Analytical Instrumentation Lab	-	3	45	3	40	60	100
AEI-410	Process control Lab	-	3	45	3	40	60	100
	Activities		5	75	3			
	TOTAL	22	20	630	-	300	700	1000

AEI-408 common with all branches.

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
V SEMESTER

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / semester	Scheme of Examination			
		Theory	Practical / Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
AEI-501	Industrial Management & Entrepreneurship	4	-	60	3	20	80	100
AEI-502	Internet of Things and Industry 4.0	6	-	90	3	20	80	100
AEI-503	ARM Microcontrollers	5	-	75	3	20	80	100
AEI-504	Industrial Automation	5	-	75	3	20	80	100
AEI-505	Instrumentation in Process Industries	4	-	60	3	20	80	100
PRACTICAL								
AEI-506	Internet of Things and Industry 4.0 Lab	-	3	45	3	40	60	100
AEI-507	ARM Microcontrollers LAB	-	3	45	3	40	60	100
AEI-508	Life skills	-	3	45	3	40	60	100
AEI-509	Industrial Automation Lab	-	3	45	3	40	60	100
AEI-510	Project Work	-	3	45	3	40	60	100
	Activities	-	3	45	3			
TOTAL		24	18	630	-	300	700	1000

AEI-508 common with all branches.

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
VI SEMESTER
Scheme of evaluation

SI. No.	Subject	Duration	Scheme of evaluation		
			Item	Nature	Max. Marks
1	Industrial Training	6 months	1.First Assessment at Industry (After 12 Weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			2.Second Assessment at the Industry (After 20 weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			Final Summative assessment at institution level	Training Report	20
				Demonstration of any one of the skills listed in learning outcomes	30
				Viva Voce	10
TOTAL MARKS					300

GUIDELINES FOR INDUSTRIAL TRAINING OF DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING PROGRAMME

- Duration of the training: 6 months.
- Eligibility: As per SBTET norms
- Training Area: Students can be trained in Industry certification
- The Industrial Training shall carry maximum 300 marks
- Pass marks is 50% in assessment at industry (first and second assessment put together) and also 50% in final summative assessment at institution level.
- Formative assessment at industry level shall be carried out by the representative of the industry, where the student is undergoing training and the faculty from the concerned section in the institution.
- If the student fails to secure 50% marks in assessment at industry (first and second assessment put together), the student should reappear for 6 months industrial training at his/her own expenses.
- If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.
- Final Summative assessment at institution level is done by both internal, external examiners and faculty members who assessed the students during Industrial Training.
- During Industrial Training the candidate shall put a minimum of 90% attendance.
  If the student fails to secure 90% attendance during industrial training, the student should reappear for 6 months industrial training at his/her own expense

FIRST YEAR

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
FIRST YEAR

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / Semester	Scheme of Examination			
		Theory	Practical / Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
AEI-101	English	3	-	90	3	20	80	100
AEI-102	Mathematics - I	5	-	150	3	20	80	100
AEI-103	Engineering Physics	4	-	120	3	20	80	100
AEI-104	Engineering Chemistry & Environmental Studies	4	-	120	3	20	80	100
AEI-105	Electronic components and devices	4	-	120	3	20	80	100
AEI-106	Basic Electrical Engineering	4	-	120	3	20	80	100
PRACTICAL								
AEI-107	Engineering Drawing	-	3	90	3	40	60	100
AEI-108	Electrical Wiring, Electronic components & Devices Lab	-	6	180	3	40	60	100
AEI-109	Physics Lab	-	1.5	45	3 (1.5+1.5)	20	30	100 (50+50)
AEI-110	Chemistry Lab		1.5	45		20	30	
AEI-111	Computer Fundamentals Lab	-	3	90	3	40	60	100
	Activities		3	90	3			
	TOTAL	24	18	1260	-	280	720	1000

AEI- 101, 102, 103, 104,109, 110 and 111 are common with all branches.

English

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for FA	Marks for SA
AEI-101	English	3	90	20	80

S. No.	Title of the Unit	No of Periods	COs Mapped
1	English for Employability	8	CO1, CO2, CO3, CO4,CO5
2	Living in Harmony	8	CO1, CO2, CO3, CO4,CO5
3	Connect with Care	8	CO1, CO2, CO3, CO4, CO5
4	Humour for Happiness	8	CO1, CO2, CO3, CO4, CO5
5	Never Ever Give Up!	8	CO1, CO2, CO3, CO4, CO5
6	Preserve or Perish	9	CO1, CO2, CO3, CO4, CO5
7	The Rainbow of Diversity	8	CO1, CO2, CO3, CO4, CO5
8	New Challenges- Newer Ideas	8	CO1, CO2, CO3, CO4, CO5
9	The End Point First	8	CO1, CO2, CO3, CO4, CO5
10	The Equal Halves	8	CO1, CO2, CO3, CO4, CO5
11	Dealing with Disaster	9	CO1, CO2, CO3, CO4, CO5
Total Periods		**90**	

Course Objectives	- To improve grammatical knowledge and enrich vocabulary.
	- To develop effective reading, writing and speaking skills.
	- To comprehend themes related to Personality, Society, Environment to exhibit Universal Human Values.

CO No.	Course Outcomes
CO1	Learn and apply various grammatical concepts to communicate in academic, professional and everyday situations
CO2	Use appropriate vocabulary in various contexts
CO3	Read and comprehend different forms of academic, professional and general reading material
CO4	Communicate effectively in speaking and writing in academic, professional and everyday situations.
CO5	Display human values by applying the knowledge of themes related to Self, Society, Environment, Science and Technology for holistic development and harmonious living through communication.

CO-PO Matrix

AEI-101	**Course Title: English** **Number of Course Outcomes: 5**				**No. of Periods: 90**
POs	Mapped CO No.	CO Periods Addressing PO in Column 1		Level of Mapping (1,2,3)	Remarks
		Number	Percentage		
PO1		Not directly Applicable for English course, however, the language activities make use of the content from Science and Technology relevant to the programme to enhance English communication skills.			
PO2					
PO3					
PO4					
PO5	CO5	16	18%	Level 1	Up to 20%: Level 1 21%-50%: Level 2 >50%: Level 3
PO6	CO1, CO2, CO3, CO4,	52	58%	Level 3	
PO7	CO1, CO2, CO3, CO4,CO5	22	24%	Level 2	

Level 3 – Strongly Mapped, Level 2- Moderately Mapped; Level 1- Slightly Mapped

Learning Outcomes

1. English for Employability

1.1. Perceive the need for improving communication in English for employability
1.2. Use adjectives and articles effectively while speaking and in writing
1.3. Write simple sentences

2. Living in Harmony

2.1. Develop positive self-esteem for harmonious relationships
2.2. Use affixation to form new words
2.3. Use prepositions and use a few phrasal verbs contextually

3. Connect with Care

3.1. Use social media with discretion
3.2. Speak about abilities and possibilities
3.3. Make requests and express obligations
3.4. Use modal verbs and main verbs in appropriate form
3.5. Write short dialogues about everyday situations

4. Humour for Happiness

4.1. Realize the importance of humour for a healthy living
4.2. Improve vocabulary related to the theme
4.3. Inculcate reading and speaking skills
4.4. Frame sentences with proper Subject – Verb agreement
4.5. Understand the features of a good paragraph and learn how to gather ideas as a preliminary step for writing a good paragraph.

5. Never Ever Give Up!

5.1. Learn to deal with failures in life
5.2. Use the present tense form for various every day communicative functions such as speaking and writing about routines, professions, scientific descriptions and sports commentary
5.3. Write paragraphs with coherence and other necessary skills

6. Preserve or Perish

6.1. Understand the ecological challenges that we face today and act to save the environment.
6.2. Narrate / Report past events and talk about future actions
6.3. Develop vocabulary related to environment
6.4. Write e-mails

7. The Rainbow of Diversity

7.1. Appraise and value other cultures for a happy living in multi-cultural workspace
7.2. Understand the usage of different types of sentences
7.3. Ask for or give directions, information, instructions
7.4. Use language to express emotions in various situations
7.5. Write letters in various real life situations

8. New Challenges – Newer Ideas
8.1. Understand the functional difference between Active Voice and Passive Voice
8.2. Use Passive Voice to speak and write in various contexts
8.3. Understand the major parts and salient features of an essay
8.4. Learn about latest innovations and get motivated

9. The End Point First!
9.1. Understand the importance of setting goals in life
9.2. Report about what others have said both in speaking and writing
9.3. Write an essay following the structure in a cohesive and comprehensive manner
9.4. Apply the words related to Goal Setting in conversations and in life

10. The Equal Halves
10.1. Value the other genders and develop a gender-balanced view towards life
10.2. Identify the use of different conjunctions in synthesising sentences
10.3. Write various types of sentences to compare and contrast the ideas
10.4. Apply the knowledge of sentence synthesis in revising and rewriting short essays
10.5. Develop discourses in speech and writing

11. Dealing with Disasters
11.1. be aware of different kinds of disasters and the concept of disaster management
11.2. Generate vocabulary relevant to disaster management and use it in sentences
11.3. Analyze an error in a sentence and correct it
11.4. Learn and write different kinds of reports

Textbook: **'INTERACT'** (A Text book of English for I Year Engineering Diploma Courses) - by SBTET, AP

Reference Books:

Martin Hewings: *Advanced Grammar in Use,* Cambridge University Press
Murphy, Raymond : *English Grammar in Use,* Cambridge University Press
Sidney Greenbaum : *Oxford English Grammar*, Oxford University Press

Wren and Martin (Revised by N.D.V. Prasad Rao) : *English Grammar and Composition*, Blackie ELT Books, S. Chand and Co.
Sarah Freeman: *Strengthen Your Writing*, Macmillan

	End Exam (80 Marks)	**1,2,3 Unit Tests (20 Marks each)**
Part A	10 Question @ 3 Marks	5 Questions @ (1Q X4M) + (4Q X3M =12)
	Total = 30 Marks	Total = 16 Marks
Part B	5 Questions (+ 3 Choice) @10 Marks	3 Questions (with internal choice) @ 8 Marks
	Total = 50 Marks	Total = 24 marks
Grand Total	**80 Marks**	**40 Marks**

Time Schedule : AEI- 101 : ENGLISH

S.no.	Title of the Unit	Periods allotted	Weightage of Marks	No. of Short answer questions	No. of Long Answer questions	Mapping of COs
1	English for Employability	8	16	2	1	CO1, CO2, CO3, CO4, CO5
2	Living in Harmony	8			2	CO1, CO2, CO3, CO4, CO5
3	Connect with Care	8	26	2		CO1, CO2, CO3, CO4, CO5
4	Humour for Happiness	8				CO1, CO2, CO3, CO4, CO5
5	Never Ever Give Up!	8	10	1	1	CO1, CO2, CO3, CO4, CO5
6	Preserve or Perish	9	23		2	CO1, CO2, CO3, CO4, CO5
7	The Rainbow of Diversity	8		2		CO1, CO2, CO3, CO4, CO5
8	New Challenges - Newer Ideas	8	19		1	CO1, CO2, CO3, CO4, CO5

9	The End Point First	8		1		CO1, CO2, CO3, CO4, CO5
10	The Equal Halves	8	16	1	1	CO1, CO2, CO3, CO4, CO5
11	Dealing with Disaster	9		1		CO1, CO2, CO3, CO4, CO5
	Total	**90**	**110**	**30**	**80**	

ENGINEERING MATHEMATICS-I

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
AEI-102	Engineering Mathematics-I	5	150	20	80

S.No.	Unit Title	No. of periods	COs mapped
1	Algebra	31	CO1
2	Trigonometry	44	CO2
3	Co-ordinate Geometry	23	CO3
4	Differential Calculus	34	CO4
5	Applications of Derivatives	18	CO5
Total Periods		**150**	

Course Objectives	(i) To apply the principles of Algebra, Trigonometry and Co-ordinate Geometry to real-time problems in engineering. (ii) To comprehend and apply the concept of Differential Calculus in engineering applications.

Course Outcomes	CO1	Identify functions as special relations, resolve partial fractions and solve problems on matrices and determinants.
	CO2	Solve problems using the concept of trigonometric functions, their inverses and complex numbers.
	CO3	Find the equations and properties of straight lines, circles and conic sections in coordinate system.
	CO4	Evaluate the limits and derivatives of various functions.
	CO5	Find solutions for engineering problems using differentiation.

Learning Outcomes:

UNIT - I

C.O. 1 Identify functions resolve partial fractions and solve problems on matrices and determinants.

L.O. 1.1 Define Set, Ordered pair and Cartesian product of two sets - examples.

1.2 Explain Relations and Functions – examples

1.3 Find Domain & Range of functions – simple examples.

1.4 Define one-one and onto functions.

1.5 Find the inverse of a function – simple examples.

1.6 Define rational, proper and improper fractions of polynomials.

1.7 Explain the procedure of resolving proper fractions of the types mentioned below into partial fractions

i) $\frac{f(x)}{(ax+b)(cx+d)}$ *ii)* $\frac{f(x)}{(ax+b)^2(cx+d)}$

1.8 Define a matrix and order of a matrix.

1.9 State various types of matrices with examples (emphasis on 3rd order square matrices).

1.10 Compute sum, difference, scalar multiplication and product of matrices. Illustrate the properties of these operations such as commutative, associative and distributive properties with examples and counter examples.

1.11 Define the transpose of a matrix and state its properties – examples.

1.12 Define symmetric and skew-symmetric matrices with examples. Resolve a square matrix into a sum of symmetric and skew-symmetric matrices and provide examples.

1.13 Define determinant of a square matrix; minor, co-factor of an element of a 3x3 square matrix with examples. Expand the determinant of a 3 x 3 matrix using Laplace expansion formula. State and apply the properties of determinants to solve problems.

1.14 Distinguish singular and non-singular matrices. Define multiplicative inverse of a matrix and list properties of adjoint and inverse. Compute adjoint and multiplicative inverse of a square matrix.

1.15 Solve a system of 3 linear equations in 3 unknowns using Cramer's rule and matrix inversion method.

UNIT - II

C.O. 2 Solve problems using the concept of trigonometric functions, their inverses and complex numbers.

L.O. 2.1 Define trigonometric ratios of any angle - List the values of trigonometric ratios at specified values.

2.2 Draw graphs of trigonometric functions - Explain periodicity of trigonometric functions.

2.3 Define compound angles and state the formulae of sin(A±B), cos(A±B), tan(A±B) and cot(A±B).

2.4 Give simple examples on compound angles to derive the values of $\sin 15^0$, $\cos 15^0$, $\sin 75^0$, $\cos 75^0$, $\tan 15^0$, $\tan 75^0$ etc.

2.5 Derive identities like $\sin(A+B)\sin(A-B) = \sin^2 A - \sin^2 B$ etc.

2.6 Solve simple problems on compound angles.

2.7 Derive the formulae of multiple angles 2A, 3A etc and sub multiple angle A/2 in terms of angle A of trigonometric functions.

2.8 Derive useful allied formulae like $\sin^2 A = (1 - \cos 2A)/2$ etc.

2.9 Solve simple problems using the multiple and submultiple formulae.

Syllabus for Unit test-I completed

2.10 Derive the formulae on transforming sum or difference of two trigonometric ratios in to a product and vice versa - examples on these formulae.

2.11 Solve problems by applying these formulae to sum or difference or product of two terms.

2.12 Explain the concept of the inverse of a trigonometric function by selecting an appropriate domain and range.

2.13 Define inverses of six trigonometric functions along with their domains and ranges.

2.14 Derive relations between inverse trigonometric functions so that the given inverse trigonometric function can be expressed in terms of other inverse trigonometric functions with examples.

2.15 State various properties of inverse trigonometric functions and identities like $\sin^{-1}x+\cos^{-1} x = \frac{\pi}{2}$, etc.

2.16 Apply formulae like $\tan^{-1} x + \tan^{-1} y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$, *where* $x \geq 0, y \geq 0, xy < 1$ etc., to solve Simple problems.

2.17 Explain what is meant by solution of trigonometric equations and find the general solutions of sin x=k, cos x =k and tan x=k with appropriate examples.

2.18 Solve models of the type $a \sin^2 x + b \sin x + c=0$ and $a \sin x + b \cos x=c$.

2.19 State sine rule, cosine rule, tangent rule and projection rule and solve a triangle using these formulae.

2.20 List various formulae for the area of a triangle with examples.

2.21 Define a complex number, its modulus, conjugate, amplitude and list their properties.

2.22 Define arithmetic operations on complex numbers with examples.

2.23 Represent the complex number in various forms like modulus-amplitude (polar) form, Exponential (Euler) form with examples.

UNIT - III

Coordinate Geometry

C.O. 3 Find the equations and properties of straight lines, circles and conic sections in coordinate system.

L.O. 3.1 Write different forms of a straight line – general form, point-slope form, slope-intercept form, two-point form, intercept form and normal form (or perpendicular form).

3.2 Find distance of a point from a line, acute angle between two lines, intersection of two non-parallel lines and distance between two parallel lines.

3.3 Define locus of a point and circle.

3.4 Write the general equation of a circle and find its centre and radius.

3.5 Find the equation of a circle, given (i) centre and radius, (ii)two ends of the diameter (iii) three non collinear points of type (0,0) (a,0), (0, b).

3.6 Define a conic section - Explain the terms focus, directrix, eccentricity, axes and latus-rectum of a conic with illustrations.

3.7 Find the equation of a conic when focus, directrix and eccentricity are given.

3.8 Describe the properties of Parabola, Ellipse and Hyperbola in standard forms whose axes are along the co-ordinate axes and solve simple examples on these conics.

Syllabus for Unit test-II completed

C.O.4Evaluate the limits and derivatives of various functions.

L.O. 4.1 Explain the concept of limit and meaning of $\lim_{x\to a} f(x)=l$ and state the properties of limits.

4.2 Evaluate the limits of the type $\lim_{x\to a}\frac{f(x)}{g(x)}$ and $\lim_{x\to\infty}\frac{f(x)}{g(x)}$

4.3 State the Standard limits $\lim_{x\to a}\frac{x^n-a^n}{x-a}$, $\lim_{x\to 0}\frac{\sin x}{x}$, $\lim_{x\to 0}\frac{\tan x}{x}$, $\lim_{x\to 0}\frac{a^x-1}{x}$, $\lim_{x\to 0}\frac{e^x-1}{x}$, $\lim_{x\to 0}(1+x)^{\frac{1}{x}}$, $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^x$ (without proof) and solve simple problems using these standard limits.

4.4 Explain the concept of continuity of a function at a point and on an interval

4.5 State the concept of derivative of a function y = f(x) – definition, first principle as $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ and also provide standard notations to denote the derivative of a function.

4.6 Explain the significance of derivative in scientific and engineering applications.

4.7 Find the derivative of standard algebraic, logarithmic, exponential and trigonometric functions using the first principle.

4.8 Find the derivatives of inverse trigonometric, hyperbolic and inverse hyperbolic functions.

4.9 State the rules of differentiation of sum, difference, scalar multiplication, product and quotient of functions with simple illustrative examples.

4.10 Explain the method of differentiation of a function of a function (Chain rule) with illustrative examples.

4.11 Explain the method of differentiation of parametric functions with examples.

4.12 Explain the procedure for finding the derivatives of implicit functions with examples.

4.13 Explain the need of taking logarithms for differentiating some functions of $[f(x)]^{g(x)}$ type – examples on logarithmic differentiation.

4.14 Explain the concept of finding the second order derivatives with examples.

4.15 Explain the concept of functions of several variables, finding partial derivatives and difference between the ordinary and partial derivatives with simple examples.

4.16 Explain the concept of finding second order partial derivatives with simple problems.

C.O. 5 Evaluate solutions for engineering problems using differentiation

L.O. 5.1 State the geometrical meaning of the derivative - Explain the concept of derivative to find the slopes of tangent and normal to a given curve at any point on it with examples.

5.2 Find the equations of tangent and normal to to a given curve at any point on it – simple problems.

5.3 Explain the derivative as a rate of change in distance-time relations to find the velocity and acceleration of a moving particle with examples.

5.4 Explain the derivative as a rate measurer in the problems where the quantities like areas, volumes vary with respect to time- illustrative examples.

5.5 Define the concept of increasing and decreasing functions - Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.

5.6 Explain the procedure to find the extreme values (maxima or minima) of a function of single variable- simple problems for quadratic and cubic polynomials.

5.7 Apply the concept of derivatives to find the errors and approximations - simple problems.

Syllabus for Unit test-III completed

CO/PO – Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3				3	2	2
CO2	3	3	2	2				3	2	2
CO3	3	3	2	2				3	2	2
CO4	3	3	3	3				3	3	3
CO5	3	3	3	3				3	3	3
Avg.	3	2.8	2.4	2.6				3	2.4	2.4

3 = Strongly mapped (High), **2 =**moderately mapped (Medium), **1 =**slightly mapped (Low)

Note: The gaps in CO/PO mapping can be met with appropriate activities as follows:

For PO5: Appropriate quiz programmes may be conducted at intervals and duration as decided by concerned faculty.

For PO6: Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

For PO7: Plan activities in such a way that students can visit the Library to refer standard books on Mathematics and access the latest updates in reputed national and international journals. Additionally, encourage them to attend seminars and learn mathematical software tools.

PO- CO – Mapping strength

PO No	**Mapped with CO no**	**CO periods addressing PO in column I**		**Level (1,2 or 3)**	**Remarks**
		No	**%**		
1	CO1, CO2, CO3, CO4, CO5	150 (31+44+23+34+18)	100%	3	>40% Level 3 Highly addressed
2	CO1, CO2, CO3, CO4, CO5	80 (8+23+12+22+15)	53.3%	3	

3	CO1, CO2, CO3, CO4, CO5	61 (9+14+9+14+15)	40.6%	3	25% to 40% Level 2 Moderately addressed 5% to 25% Level 1 Low addressed <5% Not addressed
4	CO1, CO2, CO3, CO4, CO5	61 (14+9+9+14+15)	40.6%	3	
PSO 1	CO1, CO2, CO3, CO4, CO5	150 (31+44+23+34+18)	100%	3	
PSO 2	CO1, CO2, CO3, CO4, CO5	62 (10+14+9+14+15)	41.3%	3	
PSO 3	CO1, CO2, CO3, CO4, CO5	62 (10+14+9+14+15)	41.3%	3	

COURSE CONTENT

Unit-I
Algebra

1. **Functions**:

   Definitions of Set, Ordered pair, Cartesian product of two sets, Relations, Functions, Domain & Range of functions – One-one and onto functions, inverse of a function.

2. **Partial Fractions:**

   Definitions of rational, proper and improper fractions of polynomials. Resolve rational fractions (proper fractions) into partial fractions covering the types mentioned below.

   $i)\quad \frac{f(x)}{(ax+b)(cx+d)}$ $\qquad ii)\quad \frac{f(x)}{(ax+b)^2(cx+d)}$

3. **Matrices:**
   Definition of a matrix, types of matrices - Algebra of matrices, equality of two matrices, sum, difference, scalar multiplication and product of matrices. Transpose of a matrix, Symmetric, skew-symmetric matrices - Determinant of a square matrix, minor and cofactor of an element, Laplace's expansion, properties of determinants - Singular and non-singular matrices, Adjoint and multiplicative inverse of a square matrix-System of linear equations in 3 variables-Solutions by Cramer's rule and Matrix inversion method.

Unit-II
Trigonometry

4. **Trigonometric ratios:**
   Definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.
5. **Compound angles:**
   Formulas of sin(A±B), cos(A±B), tan(A±B), cot(A±B), and related identities.
6. **Multiple and sub multiple angles:**
   Formulae for trigonometric ratios of multiple angles 2A, 3A and sub multiple angle A/2.

7. **Transformations:**
   Transformations of products into sums or differences and vice versa.
8. **Inverse trigonometric functions:**
   Definition, domains and ranges-basic properties.
9. **Trigonometric equations:**
   Concept of a solution, principal value and general solution of trigonometric equations: Sinx =k, cosx= k, tanx =k, where k is a constant. Solutions of simple quadratic equations and equations of type a sin x + b cos x=c.
10. **Properties of triangles:**
    Relations between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle.
11. **Complex Numbers:**
    Definition of a complex number, modulus, conjugate and amplitude of a complex number - Arithmetic operations on complex numbers - Modulus-Amplitude (polar) form,
    Exponential form (Euler form) of a complex number.

UNIT-III

Coordinate geometry

12 **Straight lines:** Various forms of a straight line - Angle between two lines, perpendicular distance from a point, intersection of non-parallel lines and distance between parallel lines.

13. **Circle:** Locus of a point, Circle definition - Circle equation given (i) centre and radius, (ii)
    two ends of a diameter (iii) three non-collinear points of type (0,0), (a,0), (0, b) - General equation of a circle –its centre and radius.
14. Definition of a conic section - Equation of a conic when focus, directrix and eccentricity are given - Properties of parabola, ellipse and hyperbola in standard forms.

UNIT-IV

Differential Calculus

15. **Concept of Limit-** Definition and Properties of Limits and Standard Limits - Continuity of a function at a point.
16. **Concept of derivative-** Definition (first principle)- different notations - Derivatives of standard algebraic, logarithmic, exponential, trigonometric, inverse trigonometric, hyperbolic and inverse hyperbolic functions - Derivatives of sum, difference, scalar multiplication, product, quotient of functions - Chain rule, derivatives of parametric functions, derivatives of implicit functions, logarithmic differentiation - Second order derivatives - Functions of several variables, first and second order partial derivatives.

UNIT-V

Applications of Derivatives

17. Geometrical meaning of the derivative, equations of tangent and normal to a curve at any point.
18. Physical applications of derivatives – Velocity, acceleration, derivative as a rate measurer.
19. Applications of the derivative to find the extreme values – Increasing and decreasing functions, maxima and minima for quadratic and cubic polynomials.
20. Absolute, relative and percentage errors - Approximate values due to errors in measurements.

Textbook:

Engineering Mathematics-I, a textbook for first year diploma courses, prepared & prescribed by SBTET, AP.

Reference Books:

1. Shanti Narayan, A Textbook of matrices, S.Chand&Co.
2. Robert E. Moyer & Frank Ayers Jr., Schaum's Outline of Trigonometry, 4th Edition, Schaum's Series.
3. G.B.Thomas, R.L.Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
4. Frank Ayers & Elliott Mendelson, Schaum's Outline of Calculus, Schaum's Series.
5. M.Vygodsky, Mathematical Handbook, Mir Publishers, Moscow.

TIME SCHEDULE

S.No.	Chapter	No. of Periods	Marks Allotted	Short type	Essay type	COs mapped
Unit - I: Algebra						
1	Functions	6	3	1	0	CO1
2	Partial Fractions	5	3	1	0	CO1
3	Matrices and Determinants	20	16	2	1	CO1
Unit - II: Trigonometry						
4	Trigonometric Ratios	2	0	0	0	CO2
5	Compound Angles	5	3	1	0	CO2
6	Multiple and Submultiple angles	8	3	1	0	CO2
7	Transformations	6	5	0	1/2	CO2
8	Inverse Trigonometric Functions	6	5	0	1/2	CO2
9	Trigonometric Equations	6	5	0	1/2	CO2
10	Properties of triangles	5	5	0	1/2	CO2
11	Complex Numbers	6	3	1	0	CO2
Unit III: Co-ordinate Geometry						
12	Straight Lines	5	3	1	0	CO3
13	Circles	6	5	0	1/2	CO3
14	Conic Sections	12	5	0	1/2	CO3
Unit – IV: Differential Calculus						
15	Limits and Continuity	6	3	1	0	CO4
16	Differentiation	28	23	1	2	CO4
Unit – V: Applications of Derivatives						
17	Geometrical Applications	4	5	0	1/2	CO5
18	Physical Applications	6	5	0	1/2	CO5
19	Maxima and Minima	4	5	0	1/2	CO5
20	Errors and Approximations	4	5	0	1/2	CO5
	Total	150	110	10	8	
			Marks	30	80	

ENGINEERING PHYSICS

Course code	Course title	No. of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-103	Engineering Physics	03	90	20	80

TIME SCHEDULE

S.No	Major topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs mapped
1.	Units and measurements	09	03	1	-	CO1
2.	Statics	11	13	1	1	
3.	Gravitation	12	20	-	2	
4.	Concepts of energy	10	13	1	1	CO2
5.	Thermal physics	10	13	1	1	
6.	Sound	12	16	2	1	CO3
7.	Electricity &Magnetism	13	16	2	1	
8.	Modern physics	13	16	2	1	CO4
	Total:	**90**	110	**10**	**8**	

Course title : Engineering Physics	
Course objectives	(1) To understand the basic concepts of physics for various Engineering applications as required for industries. (2) To equip the students with the scientific advances in technology and make the student suitable for any industrial or scientific organization.

MATRIX SHOWING MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES

COURSE OUTCOMES	CO1	Familiarize with various physical quantities, their SI units and errors in measurements; understand the concepts of vectors and various forces in statics.
	CO2	Understand the concepts of gravitation with reference to applications in satellites, provide the knowledge of various forms of energy and their working principles.
	CO3	Familiarize with the knowledge of transmission of heat and gas laws; provide the knowledge on musical sound and noise as pollution and also the concepts of echo and

		reverberation.
	CO4	Provide basic knowledge of electricity and concepts of magnetism and magnetic materials; familiarize with the advances in Physics such as photoelectric ell, optical fibers, semiconductors, superconductors and nanotechnology.

Matrix showing mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1			2	2		2
CO2	3	2	2	2	2		2	1		2
CO3	2		1		2		1		1	1
CO4	3	2	3	2	2		3	2		2

CO-PO Mapping Strength

AEI -103	**Engineering Physics** **No of Course Objectives : 4**				**No of periods 90**
POs	Mapped with CO No	CO periods addressing PO in Col 1 NO	%	Level 1,2,3	remarks
PO1	CO1,CO2,CO3,CO4	44	48.9 %	3	>40% level 3 (highly addressed) 25% to 40% level 2 (moderately addressed) 5% to 25% level 1 (Low addressed) < 5% (not addressed)
PO2	CO1,CO2, CO4	11	12.2%	1	
PO3	CO1, CO2,CO3, CO4	10	11.1%	1	
PO4	CO1, CO2,CO4	8	8.9%	1	
PO5	CO2,CO3, CO4	8	8.9%	1	
PO6					
PO7	CO1, CO2, CO3, CO4	9	10.0%	1	

3 = strongly mapped, 2 = moderately mapped, 1 = slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following.

(i) Seminars (ii) Tutorials (iii) Guest Lecturers (iv) Assignments
(v) Quiz competitions (vi) Industrial visits (vii) Tech fest
(viii) Mini project
(ix) Group discussions (x) Virtual classes (xi) Library visit for e-book

Learning outcomes

Upon completion of the course the student shall be able to

1.0 Understand the concept of units and measurements

1.1 Explain the concept of units
1.2 Define the terms
a) Physical quantity, b) Fundamental physical quantities and
c) Derived physical quantities
1.3 Define unit
1.4 Define fundamental units and derived units
1.5 State SI units with symbols for fundamental and some derived quantities
1.6 State Multiples and Submultiples in SI system
1.7 State rules of writing S.I units
1.8 State advantages of SI units
1.9 What are direct and indirect measurements?
1.10 Define accuracy and least count
1.11 Define error in measurement
1.12 Define absolute, relative and percentage errors with their formulae
1.13 Solve simple problems on absolute, relative and percentage errors

2.0 Understand the concepts of statics

2.1 Explain the concept of Vectors
2.2 Define scalar and vector quantities with examples
2.3 Represent vectors geometrically
2.4 Define the types of vectors (equal, negative, unit, co-initial, co-planar, position vector)
2.5 Resolve the vector into rectangular components
2.6 State and explain triangle law of addition of vectors
2.7 Define concurrent forces, co-planar forces and equilibrant.
2.8 State and explain Lami's theorem
2.9 State the parallelogram law of addition of forces with diagram.
2.10 Write the expressions for magnitude and direction of resultant (no derivation)
2.11 Illustrate parallelogram law with examples (i) flying of bird and (ii) working of sling.
2.12 Define moment of force and couple.
2.13 Write the formulae and S.I units of moment of force and couple.
2.14 Solve simple problems on (i)Resolution of force and
(ii) Parallelogram law of forces (finding R,α and θ).

3.0 Understand the concepts of Gravitation

3.1 State and explain Newton's universal law of gravitation.
3.2 Define G and mention its value.
3.3 Explain the acceleration due to gravity (g)
3.4 Explain the factors affecting the value of g
3.5 Derive the relationship between g and G.
3.6. State and explain the Kepler's laws of planetary motion
3.7 Define a satellite.
3.8 What are natural and artificial satellites? Give examples.
3.9 Define orbital velocity and write its formula.
3.10 Define escape velocity and write its formula.
3.11 Write a brief note on Polar satellites.
3.12 Write a brief note on Geo-stationary satellites.
3.13 Mention the applications of artificial satellites.

3.14 Solve simple problems on (i) Newton's law of gravitation and (ii) calculation of orbital and escape velocities.

4.0 Understand the concepts of Energy.

4.1 Define work done and energy. Mention their SI units.
4.2 List various types of energy.
4.3 Define P.E with examples. Write its equation.
4.4 Define K.E with examples. Write its equation.
4.5 Derive relationship between K.E and momentum.
4.6 State the law of conservation of energy. Give various examples.
4.7 Write a brief note on solar energy.
4.8 Explain the principle of solar thermal conversion.
4.9 Explain the principle of photo voltaic effect
4.10 Solve simple problems on (i) work done (ii) P.E & K.E and (iii) Relation between K.E & momentum.

5.0 Understand the concepts of thermal physics

5.1 Define the concepts of heat and temperature
5.2 State different modes of transmission of heat
5.3 Explain conduction, convection and radiation with two examples each.
5.4 State and explain Boyle's law
5.5 Define absolute zero temperature
5.6 Explain absolute scale of temperature
5.7 State the relationship between degree Celsius, Kelvin and Fahrenheit temperatures
5.8 State Charle's law and write its equation
5.9 State Gay-Lussac's law and write its equation
5.10 Define ideal gas
5.11 Derive ideal gas equation
5.12 Explain why universal gas constant (R) is same for all gases
5.13 Calculate the value of R for 1 gram mole of gas.
5.14 Solve simple problems on (i) Inter conversion of temperatures between °C, K and F (ii) Gas laws and (iii) Ideal gas equation.

6.0 Understand the concepts of Sound

6.1 Define the term sound
6.2 Define longitudinal and transverse waves with one example each
6.3 Explain the factors which affect the velocity of sound in air
6.4 Distinguish between musical sound and noise
6.5 Explain noise pollution and state SI unit for intensity of sound
6.6 Explain sources of noise pollution
6.7 Explain effects of noise pollution
6.8 Explain methods of minimizing noise pollution
6.9 Define Doppler effect.
6.10 List the Applications of Doppler effect
6.11 Define reverberation and reverberation time
6.12 Write Sabine's formula and name the physical quantities in it.
6.13 Define echoes and explain the condition to hear an echo.
6.14 Mention the methods of reducing an echo
6.15 Mention the applications of an echo
6.16 What are ultra sonics
6.17 Mention the applications of ultra sonics, SONAR
6.18 Solve simple problems on echo

7.0 Understand the concepts of Electricity and Magnetism

7.1 Explain the concept of P.D and EMF
7.2 State Ohm's law and write the formula
7.3 Explain Ohm's law
7.4 Define resistance and specific resistance. Write their S.I units.
7.5 State and explain Kichoff's first law.
7.6 State and explain Kirchoff's second law.
7.7 Describe Wheatstone bridge with legible sketch.
7.8 Derive an expression for balancing condition of Wheatstone bridge.
7.9 Describe Meter Bridge experiment with necessary circuit diagram.
7.10 Write the formulae to find resistance and specific resistance in meter bridge
7.11 Explain the concept of magnetism
7.12 What are natural and artificial magnets (mention some types)
7.13 Define magnetic field and magnetic lines of force.
7.14 Write the properties of magnetic lines of force
7.15 State and explain the Coulomb's inverse square law of magnetism
7.16 Define magnetic permeability
7.17 Define para, dia, ferro magnetic materials with examples
7.18 Solve simple problems on (i) Ohm's law (ii) Kirchoff's first law (iii) Wheatstone bridge (iv) meter bridge and (v) Coulomb's inverse square law

8.0 Understand the concepts of Modern physics

8.1 State and explain Photo-electric effect.
8.2 Write Einstein's Photo electric equation and name the physical quantities in it.
8.3 State laws of photo electric effect
8.4 Explain the Working of photo electric cell
8.5 List the Applications of photoelectric effect
8.6 Recapitulate refraction of light and its laws
8.7 Define critical angle
8.8 Explain the Total Internal Reflection
8.9 Explain the principle and working of Optical Fiber
8.10 List the applications of Optical Fiber
8.11 Explain the energy gap based on band structure
8.12 Distinguish between conductors, semiconductors and insulators based on energy gap
8.13 Define doping
8.14 Explain the concept of hole
8.15 Explain the types of semiconductors : Intrinsic and extrinsic
8.16 Explain n-type and p-type semiconductors
8.17 Mention the applications of semiconductors
8.18 Define superconductor and superconductivity
8.19 List the applications of superconductors
8.20 Nanotechnology definition, nano materials and applications

COURSECONTENT

1. Units and measurements

Introduction – Physical quantity – Fundamental and Derived quantities – Fundamental and derived units - SI units – Multiples and Sub multiples – Rules for writing S.I. units-Advantages of SI units – Direct and indirect measurements – Accuracy and least count – Errors : Absolute, relative and percentage errors –Problems.

2. Statics

Scalars and Vectors– Representation of a vector - Types of vectors - Resolution of vector into rectangular components – Triangle law of vectors – Concurrent forces - Lami's theorem - Parallelogram law of forces : Statement, equations for magnitude and direction of resultant, examples – Moment of force and couple – Problems.

3. Gravitation

Newton's law of gravitation and G – Concept of acceleration due to gravity (g) – Factors affecting the value of g – Relation between g and G- Kepler's laws – Satellites : Natural and artificial – Orbital velocity and escape velocity – Polar and geostationary satellites – Applications of artificial satellites – Problems.

4. Concepts of energy

Work done & Energy-Definition and types of energy - potential energy - kinetic energy- - K.E and momentum relation – Law of Conservation of energy, examples - Solar energy, principles of thermal and photo conversion – Problems.

5. Thermal physics

Modes of transmission of heat – Expansion of Gases - Boyle's law – Absolute scale of temperature - Thermometric scales and their inter conversion - Charle's law - Gay-Lussac's law - Ideal gas equation - Universal gas constant (R) - Problems.

6. Sound

Sound - Nature of sound - Types of wave motion, Longitudinal and transverse – Factors affecting the velocity of sound in air - musical sound and noise - Noise pollution – Causes & effects - Methods of reducing noise pollution - Doppler effect - Echo-Reverberation -Reverberation time-Sabine 's formula – Ultrasonics & applications – SONAR - Problems.

7. Electricity & Magnetism

Concept of P.D and EMF - Ohm's law and explanation-Specific resistance - Kirchoff's laws – Wheat stone's bridge - Meter bridge.

Natural and artificial magnets – magnetic field and magnetic lines of force – Coulomb's inverse square law – Permeability – Magnetic materials – Para, dia, ferro – Examples – Problems.

8. Modern Physics

Photoelectric effect – laws of photoelectric effect – photoelectric cell – Applications of photoelectric cell - Total internal reflection - Fiber optics - Principle and working of an optical fiber - Applications of optical fibers – Semiconductors : Based on Energy gap – Doping – Hole - Intrinsic and extrinsic semiconductors (n-type & p-type) – Applications of semiconductors – Superconductivity – applications – Nanotechnology definition, nano materials, applications.

REFERENCES

1. Intermediate physics - Volume - I & 2 — Telugu Academy (English version)
2. Unified physics Volume 1, 2, 3 and 4 — Dr. S.L Guptha and Sanjeev Guptha
3. Concepts of Physics, Vol 1 & 2 — H.C. Verma
4. Text book of physics Volume I & 2 — Resnick & Halliday
5. Fundamentals of physics — Brijlal & Subramanyam
6. Text book of applied physics — Dhanpath Roy
7. NCERT Text Books of physics — Class XI & XII Standard
8. e-books/e-tools/websites/Learning Physics software/eLMS

Table showing the scope of syllabus to be covered for unit tests

Unit test	Learning outcomes to be covered
Unit test - 1	From 1.1 to 3.14
Unit test - 2	From 4.1 to 6.18
Unit test - 3	From 7.1 to 8.20

Engineering Chemistry and Environmental Studies

Course code	Course Title	No. of Periods per week	Total No. of Periods	Marks for FA	Marks for SA
AEI-104	Engineering Chemistry and Environmental Studies	3	90	20	80

TIME SCHEDULE

S.No	Unit Title/Chapter	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Fundamentals of Chemistry	14	21	2	1.5	CO1
2	Solutions, Acids and Bases	16	21	2	1.5	CO1
3	Electrochemistry	12	13	1	1	CO2
4	Corrosion	8	13	1	1	CO2
5	Water Treatment	8	13	1	1	CO3
6	Polymers& Engineering Materials	12	13	1	1	CO4
7	Fuels	6	3	1	-	CO4
8	Environmental Studies	14	13	1	1	CO5
	Total	90	110	10	8	

Course Objectives

Course Title: Engineering Chemistry & Environmental Studies	
Course Objectives	1. To familiarize with the concepts of chemistry involved in the process of various Engineering Industrial Applications. 2. To know the various natural and man-made environmental issues and concerns with an interdisciplinary approach that include physical, chemical, biological and socio cultural aspects of environment. 3. to reinforce theoretical concepts by conducting relevant experiments/exercises

Course outcomes

Course Outcomes	CO1	Explain Bohr`s atomic model, chemical bonding, mole concept, acids and bases, P^H and Buffer solutions.
	CO2	Explain electrolysis, Galvanic cell, batteries and corrosion
	CO3	Explain the chemistry involved in the treatment of hardness in water.
	CO4	Explain the methods of preparation and applications of Polymers and

		Elastomers, chemical composition and applications of Alloys, Composite Materials, Liquid Crystals , Nano Materials and Fuels.
	CO5	Explain Global impacts due to air pollution, causes , effects and controlling methods of water pollution and understand the environment, forest resources, e-Pollution and Green Chemistry Principles.

EE-104	Engineering. Chemistry and Environmental studies No of Course Outcomes:5				No Of periods 90
POs	Mapped with CO No	CO periods addressing PO in Col NO. 1	%	Level 1,2,3	remarks
PO1	CO1,CO2,CO3	42	46.7 %	3	>40% level 3 (highly addressed) 25% to 40% level 2(moderately addressed) 5% to 25% level 1 (Low addressed) < 5%(not addressed)
PO2	CO2,CO3	16	17.8%	1	
PO3	CO4	12	13.3%	1	
PO4	CO4	6	6.7%	1	
PO5	CO5	14	15.5%	1	
PO6	-	-	-	-	
PO7	-	-	-	-	

COs-POs mapping strength (as per given table)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-
CO4	-	-	1	1	-	-	-	-	-	-
CO5	-	-	-	-	1	-	-	-	-	-
Average	3	1	1	1	1		-	-	-	-

3=strongly mapped 2= moderately mapped 1= slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

i) Seminars ii) Tutorials iii) Guest Lectures iv) Assignments v) Quiz competitions vi) Industrial visit vii) Tech Fest viii) Mini project ix) Group discussions x) Virtual classes xi) Library visit for e-books

***One question of 10 marks should be given with 50% weightage from unit title 1and 2**

Upon completion of the course, the student shall be able to learn out

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

1.0 Atomic structure

1.1 Explain the charge, mass of fundamental particles of an atom (electron, proton and neutron) and the concept of atomic number and mass number.

1.2 State the Postulates of Bohr's atomic theory and its limitations.

1.3 Explain the significance of four Quantum numbers and draw the atomic

structures of Silicon and Germanium.

1.4 Define Orbital of an atom and draw the shapes of s,p and d-orbitals.

1.5 Explain 1.Aufbau principle, 2.Pauli's exclusion principle 3. Hund's principle.

1.6 Write the electronic configuration of elements up to atomic number 30.

1.7 Explain the significance of chemical bonding.

1.8 Explain the Postulates of Electronic theory of valency.

1.9 Define and explain Ionic and Covalent bonds with examples of NaCl , *H_2,*O_2 and *N_2.(* Lewis dot method).

1.10 List out the Properties of Ionic compounds and covalent compounds and distinguish between their properties.

2.0 Solutions, Acids and Bases

2.1 Define the terms 1. Solution, 2. Solute and 3. Solvent.

2.2 Classify solutions based on solubility.

2.3 Define the terms 1. Atomic weight, 2. Molecular weight and 3. Equivalent weight. Calculate Molecular weight and Equivalent weight of the given acids (HCl, H_2SO_4, H_3PO_4) Bases (NaOH, $Ca(OH)_2$, $Al(OH)_3$ and Salts (NaCl, Na_2CO_3, $CaCO_3$).

2.4 Define mole and solve numerical problems on mole concept.

2.5 Define molarity, normality and solve numerical problems on molarity and normality.

a) Calculate the Molarity or Normality, if weight of solute and volume of solution are given.

b) Calculate the weight of solute, if Molarity or Normality with volume of solution are given.

c) Problems on dilution to convert high concentrated solutions to low concentrated solutions.

2.6 Explain Arrhenius theory f Acids and Bases and give its limitations.

2.7 Define ionic product of water, pH and solve numerical problems on pH (Strong Acids and Bases).

2.8 Define buffer solution and classify buffer solutions with examples. Give its applications.

3.0 Electrochemistry

3.1 Define the terms 1. Conductor 2. Semiconductor 3. Insulator, 4. Electrolyte 5. Non–electrolyte. Give two examples each.

3.2 Distinguish between Metallic conduction and Electrolytic conduction.

3.3 Explain electrolysis by taking an example of used NaCl and list out the applications of electrolysis.

3.4 Define Galvanic cell. Explain the construction and working of Galvanic cell.

3.5 Distinguish between electrolytic cell and galvanic cell.

3.6 Define battery and list the types of batteries with examples.

3.7 Explain the construction, working and applications of i) Dry cell (Leclanche cell), ii) Lead storage battery, iii) Lithium-Ion battery and iv) Hydrogen-Oxygen fuel cell.

4.0 Corrosion

4.1 Define the term corrosion.

4.2 state the Factors influencing the rate of corrosion.

4.3 Describe the formation of (a)composition cell (b) stress cell (c)concentration cell during corrosion.

4.4 Define rusting of iron and explain the mechanism of rusting of iron.

4.5 Explain the methods of prevention of corrosion by
(a)Protective coatings (anodic and cathodic coatings).
(b) Cathodic protection (Sacrificial anode process and Impressed–voltage process).

5. 0 Water Treatment

5.1 Define soft water and hard water with respect to soap action.
5.2 Define and classify the hardness of water.
5.3 List out the salts that causing hardness of water (with Formulae).
5.4 State the disadvantages of using hard water in industries.
5.5 Define Degree of hardness and units of hardness (mg/L and ppm).
5.6 Solve numerical problems on hardness.
5.7 Explain the methods of softening of hard water by (i) Ion-exchange process and (ii) Reverse Osmosis process.

6.0 Polymers & Engineering materials.

A) Polymers

6.1 Explain the concept of polymerization.
6.2 Describe the methods of polymerization (a) addition polymerization of ethylene (b) condensation polymerization of Bakelite (Only flowchart).
6.3 Define plastic. Explain a method of preparation and uses of the following plastics: 1. PVC 2. Teflon 3. Polystyrene 4. Nylon 6,6.
6.4 Define elastomers. Explain a method of preparation and applications of the following: 1. Buna- S 2. Neoprene.

B) Engineering Materials

6.5 Define an alloy. Write the composition and applications of the following: 1.Nichrome 2. Duralumin 3.Stainless Steel.
6.6 Define Composite Materials and give any two examples. State their Properties and applications.
6.7 Define Liquid Crystals and give any two examples. State their Properties and applications.
6.8 Define Nano Materials and give any two examples. State their Properties and applications.

7.0 Fuels

7.1 Define the term fuel.
7.2 Classify the fuels based on occurrence.
7.3 Write the composition and uses of the following:
1. LPG 2. CNG 3.Biogas 4.Power alcohol
7.4 Write the commercial production of Hydrogen as future fuel. Give its advantages and disadvantages.

8.0 ENVIRONMENTAL STUDIES

8.1 Explain the scope and importance of environmental studies.
8.2 Define environment. Explain the different segments of environment. 1.Lithosphere 2. Hydrosphere 3. Atmosphere 4. Biosphere
8.3 Define the following terms:
1. Pollutant 2.Pollution 3.Contaminant 4. Receptor 5. Sink 6. Particulates 7. Dissolved oxygen (DO) 8. Threshold Limit Value (TLV) 9. BOD 10.COD 11. Eco system 12. Producers 13. Consumers 14. Decomposers with examples.
8.4 State the renewable and non- renewable energy sources with examples.
8.5 State the uses of forest resources.
8.6 Explain the causes and effects of deforestation.
8.7 Define air pollution and explain its Global impacts 1. Greenhouse effect, 2. Ozone layer depletion and 3. Acid rain.
8.8 Define Water pollution. Explain the causes, effects and controlling methods of Water pollution.

8.9 Define e-Pollution, State the sources of e-waste. Explain its health effects and control methods.

8.10 Define Green Chemistry. Write the Principles and benefits of Green Chemistry.

COURSE CONTENT

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

1. **Fundamentals of Chemistry**

   Atomic Structure: Introduction - Fundamental particles – Bohr's theory – Quantum numbers – Atomic structure of Silicon and Germanium - Orbitals, shapes of s, p and d orbitals - Aufbau's principle - Hund's rule - Pauli's exclusion Principle -Electronic configuration of elements.

   Chemical Bonding: significance–Electronic theory of valency- Types of chemical bonds – Ionic and covalent bond with examples–Properties of Ionic and Covalent compounds.

2. **Solutions, Acids and Bases**

   Solutions: Types of solutions - Mole concept – Numerical problems on mole concept - Methods of expressing concentration of a solution – Molarity and Normality – Numerical problems on molarity and normality.

   Acids and Bases: Arrhenius theory of acids and bases – Ionic product of water- pH– Numerical problems on pH–Buffer solutions – Classification- applications.

3. **Electrochemistry**

   Conductors, semiconductors, insulators, electrolytes and non-electrolytes – Electrolysis of fused NaCl–Applications of electrolysis - Galvanic cell – Battery-Types- Dry Cell (Leclanche Cell), Lead- Storage battery- Lithium-Ion battery -Hydrogen-Oxygen Fuel cell.

4. **Corrosion**

   Introduction - Factors influencing corrosion - Composition, Stress and Concentration Cells– Rusting of iron and its mechanism – Prevention of corrosion by Protective Coating methods, Cathodic Protection methods.

5. **Water treatment**

   Introduction– Soft and Hard water– Causes of hardness– Types of hardness– Disadvantages of hard water – Degree of hardness (ppm and mg/lit) – Numerical problems on hardness - Softening methods – Ion-Exchange process– Reverse Osmosis process.

6. **Polymers & Engineering materials**

   Polymers:

   Concept of polymerization – Types of polymerization – Addition, condensation with examples – Plastics - Preparation and uses of i).PVC ii) Teflon iii) Polystyrene and iv) Nylon 6,6.

   Elastomers: Preparation and application of i)Buna-s and ii) Neoprene.

   Engineering Materials:

   Alloys- Composition and applications of i) Nichrome, ii) Duralumin and iii) Stainless Steel.

   Composite Materials- Properties and applications.

   Liquid Crystals- Properties and applications.

   Nano Materials- Properties and applications.

7. **Fuels**

   Definition and classification of fuels – Composition and uses of i) LPG ii) CNG iii) Biogas and iv) Power alcohol – Hydrogen as a future fuel-production- advantages and disadvantages.

8. ENVIRONMENTAL STUDIES

Scope and importance of environmental studies – Environment - Important terms related to environment–Renewable and non-renewable energy sources–Forest resources – Deforestation –Air pollution–Global impacts on environment –Water pollution – causes – effects – control measures- e-Pollution –Sources of e-waste - Health effects - Control methods - Green Chemistry- Principles -Benefits.

Table specifying the scope of syllabus to be covered for Unit Test- 1, Unit Test- 2 and Unit Test -3

Unit Test	**Learning outcomes to be covered**
Unit Test – 1	**From 1.1 to 2.8**
Unit Test – 2	**From 3.1 to 5.7**
Unit Test – 3	**From 6.1 to 8.10**

REFERENCE BOOKS

1. Telugu Academy — Intermediate chemistry Vol. 1&2
2. Jain & Jain — Engineering Chemistry
3. O.P. Agarwal, Hi-Tech. — Engineering Chemistry
4. D.K.Sharma — Engineering Chemistry
5. A.K. De — Engineering Chemistry

ELECTRONIC COMPONENTS AND DEVICES

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-105	Electronic components and devices	4	120	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Resistors	15	16	2	1	CO1
2	Capacitors	13	13	1	1	CO1
3	Inductors	12	13	1	1	CO1
4	Switches and Relays	13	13	1	1	CO2
5	Microphones & Loud Speakers	15	13	1	1	CO3
6	Semiconductor Diode and Its applications	15	13	**1**	**1**	CO4
7	Transistors	15	13	1	1	CO5
8	Power supplies and Batteries	12	13	1	1	CO6
9	PCBs	10	3	1	0	CO7
	TOTAL	120	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i)	Familiarise with passive components, switches, relays, microphones and loud speakers.	
	(ii)	Understand formation of semiconductor materials.	
	(iii)	Analyze the working of PN junction Diode in forward and reverse bias, Transistor and its configurations	
	(iv)	Describe rectifier circuits, DC power supplies, PCB materials and their fabrication	
Course outcomes	CO1	**AEI-105.1**	Familiarize with different passive components and their use.
	CO2	**AEI-105.2**	Familiarize with different switches , relays and their use.
	CO3	**AEI-105.3**	Familiarize with different microphones, loud speakers and their use.
	CO4	**AEI-105.4**	Analyze the working of semiconductor diodes.
	CO5	**AEI-105.5**	Analyze the working of Transistor and its configurations.
	CO6	**AEI-105.6**	Describe rectifier circuits and DC power supplies.
	CO7	**AEI-105.7**	Describe PCB materials and their fabrication.
Learning Outcomes	**1.0 Resistors.** 1.1 Define the term resistance. 1.2 Classify types of resistors. 1.3 Derive the relation $R=\rho l/a$ 1.4 List the specifications of a resistor, and state their importance. 1.5 Explain the Colour Code of a Resistor. 1.6 Find the value of Resistance by using colour code. 1.7 Derive the equivalent resistance when two resistors are connected in series. 1.8 Derive the equivalent resistance when two resistors are connected in parallel. 1.9 Simple problems on series and parallel connected resistors. 1.10 Explain the effect of temperature on resistance. 1.11 Define temperature co-efficient of resistance and derive the relation $R_t=R_o(1+\alpha_o t)$. 1.12 Compare the features of carbon film, metal film and wire wound resistors with respect to size, power rating, tolerance, temperature coefficient and applications. 1.13 Describe constructional details and working of carbon and wire wound potentiometers. 1.14 Compare the features of carbon and wire wound potentiometers 1.15 Mention the need for tapering in potentiometers.		

	1.16 Describe constructional details and working of rheostat and list its applications. 1.17 List the common faults in resistors. **2.0 Capacitors** 2.1 Define the term capacitance. 2.2 Classify the types of capacitors. 2.3 List the specifications of a capacitor and state their importance. 2.4 State the factors affecting the capacitance of a capacitor. 2.5 List the properties of dielectric materials. 2.6 Define Di-electric constant, Di-electric strength and polarization of a material. 2.7 State the properties, range of values and applications of paper, mica, glass, ceramic and electrolytic capacitors. 2.8 List the types of variable capacitors and mention their applications. 2.9 List the losses in capacitors. 2.10 Derive the equivalent capacitance of Capacitors connected in i) series, and ii) parallel. 2.11 Simple problems on series and parallel connected capacitors. 2.12 List the common faults in capacitors. **3.0 Inductors** 3.1 Define self-inductance, mutual inductance and coefficient of coupling. 3.2 Draw the symbols of iron core, air core, and ferrite core inductors. 3.3 Simple problems on self inductance, mutual inductance and coefficient of coupling. 3.4 Classify inductors. 3.5 List the specifications of inductors. 3.6 List the various core materials used in the construction of inductors. 3.7 Derive the equivalent inductance when they are connected in series aiding and opposing. 3.8 Write the expressions of inductance when they are connected in parallel aiding and opposing (No derivation). 3.9 Describe the constructional features of A.F. and R.F chokes. 3.10 List the applications of A.F. and R.F chokes. **4.0 Switches and Relays** 4.1 Define a switch. 4.2 Classify switches according to poles and throws (SPST, SPDT, DPST, DPDT, Multipole multi-throw). 4.3 Sketch the I.S.I symbols of SPST, SPDT, DPST, DPDT, Multi-pole multi throw switches. 4.4 List the different types of switches. 4.5 Explain the working of toggle, rotary, slider switches and mention their applications. 4.6 State the need of fuse in electronic equipment. 4.7 Mention different types of fuses. 4.8 Mention the ratings of fuse. 4.9 State the necessity of connectors in electronic circuits. 4.10 List the different types of connectors. 4.11 Mention the use of MCB.

	4.12 Define a relay. 4.13 Classify different relays based on principle of operation, polarization and application. 4.14 Mention specifications and applications of relays. 4.15 Explain the construction & working of general-purpose electromagnetic relay. 4.16 List the contact materials used in relays and list their characteristics. **5.0 Microphones & Loud Speakers** 5.1 Define Microphone. 5.2 List the different types of microphones based on impedance, polar characteristics and principle of working. 5.3 Explain the working of carbon, Crystal and dynamic microphones. 5.4 Mention the specifications of microphones. 5.5 Define Loudspeaker. 5.6 Explain the constructional features and principle of operation of PMMC Loudspeaker. 5.7 Mention the necessity of Baffle for a Loudspeaker and list the types of Baffles (like open, infinite, bass reflex, acoustic labyrinth). 5.8 Mention the use of woofers and tweeters. 5.9 Give the need for a Horn loud speaker. 5.10 Mention the specifications of Loudspeaker. **6.0 Semiconductor Diode & its applications** 6.1 State the electrical properties of solid Semiconductor materials. 6.2 Sketch energy level diagrams for conductors, Semiconductors, Insulators. 6.3 Define Intrinsic and extrinsic Semiconductors. 6.4 Distinguish between Intrinsic and extrinsic Semiconductors. 6.5 Describe the formation of P- type and N-type materials and sketch the energy band diagrams. 6.6 Identify the Majority and Minority carriers in P and N Type materials. 6.7 Distinguish between Drift and Diffusion current. 6.8 Explain the formation of PN junction diode. 6.9 Describe the working of PN junction Diode with various biasing voltages. 6.10 Sketch the forward and Reverse Bias Voltage characteristics of diode. 6.11 List the specifications of a diode. 6.12 List the applications of a diode. 6.13 Draw and explain the working of basic clipper and clamper circuits using diodes. 6.14 Describe the formation and working of Zener diode. 6.15 Sketch the characteristics of Zener breakdown and Avalanche breakdown. 6.16 Distinguish between Zener breakdown and Avalanche breakdown. 6.17 Explain working principle and list applications of following a) Varactor diode b) Tunnel diode 6.18 Draw the symbols of PN junction diode, Zener diode, Varactor diode, and Tunnel diode.

	7.0 Transistors 7.1 State the formation of a transistor. 7.2 Draw the symbols and explain the working of PNP and NPN Transistors. 7.3 List transistor configurations. 7.4 Describe the working of transistor as amplifier in CE configuration. 7.5 Draw and explain the different transistor configurations (CB, CC). 7.6 Define cut off, saturation and active regions. 7.7 Sketch the input/output characteristics of CB, CC and CE configurations. 7.8 Define alpha, beta and gamma Factors. 7.9 Obtain relation between alpha, beta and gamma Factors. 7.10 Write collector current expression in CB and CE modes of transistors. 7.11 Compare the performance characteristics of transistor in CB, CE and CC configurations. **8.0 Power supplies and Batteries.** 8.1 State the necessity of D.C. power supply for Electronic circuits. 8.2 Define cycle, Frequency, Time Period, Maximum Value, Average value, RMS value, Form Factor, peak factor for sinusoidal AC quantities. 8.3 Describe the working of HW, FW and Bridge Rectifier circuits with wave forms. 8.4 Define PIV, Ripple factor and Efficiency and write their expressions for the above circuits. 8.5 Compare HW, FW and Bridge Rectifiers 8.6 Define Voltage Regulation. 8.7 Define a filter circuit. 8.8 State the need for a filter circuit in power supplies. 8.9 List the types of filter circuits. 8.10 State the need for a regulated power supply and list its specifications. 8.11 List the types of storage batteries. 8.12 List the uses of storage batteries. 8.13 Explain about maintenance free battery and list their applications. 8.14 State the need of inverters. 8.15 State the principle of operation of inverter. 8.16 Classify inverters. 8.17 List the applications of inverters. 8.18 Explain the working of SMPS with block diagram. 8.19 Classify UPS. 8.20 Explain the working of Off Line UPS and Online UPS. **9.0 PCBs** 9.1 State the need of PCB in electronic equipment. 9.2 Classify PCBs. 9.3 List the standard PCB specifications. 9.4 List the types of laminates used in PCBs. 9.5 Explain the following in PCB Layout planning. a) Layout Scale b) Grid system. c) Spacing specifications for component holes and conductor widths. 9.6 List the methods of transferring layout on the copper clad sheet. 9.7 List the steps involved in screen-printing for making PCBs.

	9.8 List the materials used in screen-printing. 9.9 Describe the photo processing technique for PCB preparation. 9.10 Explain the methods of etching, cleaning and drilling of PCB. 9.11 List the steps involved in making double-sided PCB. 9.12 Define soldering. 9.13 State the need of flux in soldering. 9.14 List the materials used in soldering. 9.15 List the soldering methods of PCBs.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-105.1	*2*	*2*			*2*			*3*	*2*	*1*
AEI-105.2	*1*	*1*			*1*			*3*	*2*	*1*
AEI-105.3	*1*	*1*			*1*			*3*	*2*	*1*
AEI-105.4	*1*	*1*						*3*	*2*	*1*
AEI-105.5	*1*	*1*						*3*	*2*	*1*
AEI-105.6	*1*	*1*						*3*	*2*	*1*
AEI-105.7	*1*	*1*						*3*	*2*	*1*
Average	*1.14*	*1.14*			*1.34*			*3*	*2*	*1*

3= Strongly mapped
2= Moderately mapped
1= Slightly mapped

COURSE CONTENTS

1. **Resistors:** Classification of resistors, colour code, Specifications, Carbon film metal film, wire wound resistors. Constructional details of carbon and wire wound Potentiometers - tapering. Effect of temperature on resistance. Faults in resistors.
2. **Capacitors:** Classification, specifications of capacitors, dielectric constant, dielectric strength, properties and applications of paper, mica, ceramic ,glass and electrolytic capacitors. Variable capacitors and applications, capacitor connected in series and parallel.
3. **Inductors**: Self Inductance, mutual inductance, coefficient of coupling, A.F. and R.F. chokes.

4. **Switches, connectors and Relays**: Different types of switches and connectors used in Electronic circuits and their specifications. Fuses. Types of relays-Relay contacts - Electromagnetic Relay.
5. **Microphones and Loudspeakers:** Types of microphones – carbon, dynamic and crystal. Constructional features, principle of working, characteristics, construction of PMMC Loudspeakers, Baffles, need for horn loud speaker.
6. **Semiconductor Diode:** Electrical properties ofsemiconductor materials, Energy level diagrams of conductors, semiconductors and Insulators, Formation of P-type and N-type materials, PN junction diode with characteristics, Drift and Diffusion current, Diode clippers and clampers. Zenerdiode - Zener break down and Avalanche breakdown, Varactor diode, tunnel diode.

7. **Transistors:** Working of PNP and NPN transistors. Transistor configurations-CB,CE and CC, Input and Output characteristics, α, β, and γ factors, Relation between α, β, and γ- Comparisons of CB,CE and CC configurations
8. **Power supplies and Batteries:** Need of DC power supply, Rectifiers- Half wave rectifier, full wave rectifier, bridge rectifier, RMS value, DC value, Ripple factor and Efficiency, voltage regulation. Filters - Batteries-storage batteries. Inverters, SMPS and UPS
9. **PCBs:** Classification of PCBs, screen-printing of PCBs, photo processing, double sided PCBs, soldering methods of PCBs, standard PCB specifications.

Reference Books

1. Electronic devices and applications by B. Soma Nathan Nair, PHI.
2. Principles of Electronic Communications by Anok Singh (For speakers & Microphones)
3. Electronic components by Dr.K.Padmanabham.
4. Principles of Electronics by V.K.Mehatha, S Chand & Company Ltd.
5. Printed Circuit Boards Design and Technology by Walter C. Bosshart, TMH
6. Basic Electronics by Grob., TMH
7. Electronic devices & Circuits by Millman&Halkias, TMH
8. Electronic Components by F.J. Waters.

Table specifying syllabus to be covered for UNIT tests.

Unit Test	**Learning Outcomes to be covered**
Unit Test-I	From 1.1 to 3.10
Unit Test-II	From 4.1 to 6.18
Unit Test-III	From 7.1 to 9.15

BASIC ELECTRICAL ENGINEERING

Course code	Course title	No of periods/week	Total no. of periods	Marks for FA	Marks for SA
AEI-106	BASIC ELECTRICAL ENGINEERING	04	120	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	D.C Circuits and Network Theorems	25	26	2	2	CO1
2	Single phase A.C. circuits	30	26	2	2	CO2
3	Heating Effects of Electrical Current	15	13	1	1	CO3
4	Transformers	25	29	3	2	CO4
5	DC & AC Machines	25	16	2	1	CO5
	TOTAL	120	110	**10**	**8**	

	Upon completion of the course the student shall be able to		
Course Objectives	(i)		Familiarise with basic electrical circuits like D.C Circuits and Network Theorems, Single phase A.C. circuits, Heating Effects of Electrical Current, Transformers, DC & AC Machines.
Course outcomes	CO1	AEI-106.1	Understand the basics of D.C circuits and network theorems.
	CO2	AEI-106.2	Analyse the Single phase A.C circuits.
	CO3	AEI-106.3	Understand the Heating Effects of Electrical Current.
	CO4	AEI-106.4	Explain the Transformer principle and list its Applications.
	CO5	AEI-106.5	Understand the basic principle of D.C and A.C machines.

Learning Outcomes	**1.0 DC Circuits and Network Theorems**. 1.1Differentiate between active and passive circuits. 1.2 Define junction, branch and loop in a circuit. 1.3 State Kirchhoff's current law and voltage law. 1.4 Solve simple circuit problems by nodal method and loop current method based on Kirchhoff's laws. 1.5 Draw star and delta circuits. 1.6 Explain star/delta transformation along with derivations. 1.7 Solve simple problems on star- delta and delta– star transformations. 1.8 Define ideal voltage source & ideal current source. 1.9 Convert ideal voltage source to ideal current source. 1.10 Convert ideal current source to ideal voltage source. 1.11 State and explain super position theorem with one example. 1.12 Solve simple problems on superposition theorem. 1.13. State Thevenin's , Nortons , maximum power transfer theorems. (No Problems) **2.0 Single phase A.C. circuits** 2.1 Define the term phase and phase difference. 2.2 Derive the relationship between voltage and current in pure resistive, Inductive and capacitive circuits. 2.3 Draw the phasor diagrams and wave forms of pure resistive, inductive and capacitive circuits. 2.4 Write the equation for impedance, current, phase angle, power and Power factor in R-L, R-C, & R-L-C. Series circuits. 2.5 Draw the phasor diagrams and wave forms of R-L, R-C, & R-L-C Series circuits. 2.6 Solve simple Problems on Series Circuits. 2.7 Define Resonance in series circuits. 2.8 Derive the equation for resonant frequency in series R-L-C circuit. 2.9 Solve problems on parallel circuits by a) Vector method b) Admittance method and c) 'J' notation method. 2.10 Define resonance in parallel electric circuits. 2.11 Derive the equation for resonant frequency in parallel R-L-C circuit. 2.12 Differentiate between series resonant circuit and parallel resonant circuit. 2.13 Solve simple problems on resonance. 2.14 Define `Q'factor. Mention the importance of Q factor. **3.0 Heating effects of Electric Current** 3.1 State Mechanical equivalent of heat.

	3.2 State the heat produced due to flow of current. 3.3 List the practical applications of heat produced due to Electric current in Metal. 3.4 Explain the construction and working of following practical applications of heat produced due to Electric current in metal: a) Filament lamps b) Electric kettle c) Electric cooker d) Electric Iron e) Space heaters f) Geyser g) Infrared lamp. 3.5 Define Thermal efficiency. **4.0 Transformers** 4.1 Explain the working principle of a Transformer 4.2 Explain the construction of transformers (core type, shell type). 4.3. Differentiate between core type and shell type transformers. 4.4Give reasons for using laminations in transformer core. 4.5Derive the EMF equation of transformer. 4.6Solve simple problems on EMF equation of transformer. 4.7State the voltage transformation ratio. 4.8Define efficiency and regulation of transformer. 4.9State the losses in a transformer. 4.10Explain the working of Auto transformer and list their advantages. 4.11 Explain the working of Current transformer and Potential transformer with diagrams. 4.12 State the use of transformer as : a) Impedance matching transformer b) Isolation transformer 4.13 State the need for cooling in transformers. 4.14 List the cooling methods of a transformer. 4.15 List important specifications of a transformer. **5.0 DC machines & AC Machines** 5.1 Explain the working of simple loop generator. 5.2 State Fleming's right hand rule. 5.3 Explain the construction of D.C. Generator. 5.4 Write the expression for E.M.F. equation of a D.C.generator (no derivation). 5.5 Classify D.C. Machines with reference to excitation. 5.6 Define armature reaction and state their effects. 5.7 Define commutation and state the methods to improve commutation

	5.8 List different losses in D.C. Machines. 5.9 Draw and explain power flow diagram in a D.C. generator. 5.10 Define efficiency of a D.C. generator. 5.11 Solve simple problems on efficiency of a D.C. generator. 5.12 State Fleming's left hand rule. 5.13 Explain the working principle of D.C. Motors. 5.14 State the significance of back e.m.f. and give its formula in terms of supply voltage, Armature current and Resistance, and also in terms of ø, Z, N,P, A. 5.15 Write the expression for Torque Equation (No derivation) 5.16 Explain the principle of alternator. 5.17 Explain the constructional features of alternator. i) Salient pole ii) Non salient pole or smooth cylindrical type. 5.18 Write the EMF equation of an alternator (No – Derivation).

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-106.1	*1*	*1*						*3*	*2*	*1*
AEI-106.2	*1*	*1*			*1*			*3*	*2*	*1*
AEI-106.3	*1*	*1*						*3*	*2*	*1*
AEI-106.4	*1*	*1*						*3*	*2*	*1*
AEI-106.5	*1*	*1*						*3*	*2*	*1*
Average	*1*	*1*			*1*			*3*	*2*	*1*

3= Strongly mapped
2= Moderately mapped
1= Slightly mapped

COURSE CONTENTS

1. **DC Circuits and Network Theorems:**
   Junction, branch and loop in circuits- Kirchhoff's laws - Star - Delta configurations, Concept of transformation - Ideal Voltage , Ideal current source - Super position theorem, Thevenin's Theorem -Norton's Theorem, Maximum power transfer theorem with reference to D.C.

2. **Single phase A.C. Circuits:**
   Voltage and current relations in pure resistive,Inductive and capacitive circuits including wave forms and phasor diagrams - R-L, R-C ,R-L-C series circuits - Derivation

of relation between voltage, current, impedance, power including wave forms and phasor diagrams-Problems on series circuits – Problems on Parallel circuits by vector method, admittance method and by `J' notation method, problems - Resonant circuit - Definition of resonance – Series and parallel resonant circuit - -Resonant frequency - problems - `Q' factor of coil.

3. **Heating Effects of Electrical Current:**
   Mechanical Equivalent of Heat - Heat produced due to flow of current in metal: Filament lamps, Electric kettle, Electric cooker, Electric Iron, Space heaters, Geyser, Infrared lamp-Thermal efficiency.
4. **Transformers:**
   Principle of Transformer - Types and Constructional features of transformer- E.M.F equation of a transformer- Auto Transformer - Potential Transformer, Current transformer, Impedance matching transformer, Isolation transformer.

5. **DC & AC Machines:**
   D.C. machines: Simple loop generator-Flemings right hand rule-Construction of D.C generator, E.M.F equation, classification of D.C machines on the basis of excitation, Armature reaction and commutation, Losses and efficiency, Flemings left hand rule, principle of D.C. motor, significance of back E.M.F, torque equation.

   AC Machines: Principle and construction of alternator, types of alternator, e.m.f. equation of alternator.

REFERENCE BOOKS

1. Electrical Technology - Vol – I& Vol-II by B.L. Theraja
2. Introduction to Electrical Engg. By V.K.Mehtha
3. Electrical Technology by Hughes.
4. Problems in Electrical Engg. By Parker Smith

Table specifying syllabus to be covered for UNIT tests.

Unit Test	**Learning Outcomes to be covered**
Unit Test-I	From 1.1 to 2.3
Unit Test-II	From 2.4 to 4.6
Unit Test-III	From 4.7 to 5.18

ENGINEERING DRAWING

Course code	Course Title	No. of periods /week	Total No. of periods	Marks for FA	Marks for SA
AEI-107	ENGINEERING DRAWING	3	90	40	60

TIME SCHEDULE

S.No	Unit Title	No. of periods	Weightage of marks	Short Questions	Essay Questions	CO's Mapped
1	Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice	10	10	**2**	**-**	**CO1**
2	Principles of Geometric Constructions	15	15	**1**	**1**	**CO2**
3	Projections of points, lines, planes and solids	20	25	**1**	**2**	**CO3**
4	Sectional Views	20	10	**-**	**1**	**CO4**
5	Orthographic projection	25	20	**-**	**2**	**CO5**
	Total	**90**	**80**	**4**	**6**	

Course Objectives and Course Outcomes

Course Objectives	Upon completion of the course the student shall be able to understand the basic graphic skills and use them in preparation, reading and interpretation of engineering drawings.

	CO 1	AEI -107.1	Practice the use of engineering drawing instruments and Familiarise with the conventions to be followed in engineering drawing as per BIS

Course Outcomes	**CO 2**	AEI -107.2	Construct the i) basic geometrical constructions ii) engineering curves
	CO 3	AEI -107.3	Visualise and draw the projections of i) Points ii) Lines iii) Regular Planes iv) Regular Solids
	CO 4	AEI -107.4	Visualise and draw the sectional views of components
	CO 5	AEI -107.5	Visualise and draw the orthographic projections of components

LEARNING OUTCOMES

Upon completion of the course the student shall able to

1.0 Solids like Prisms, Pyramids, Cylinder, Cone (up to axis of **Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice**

1.1 State the importance of drawing as an engineering communication medium

1.2 Select the correct instruments to draw the different lines / curves.

1.3 Use correct grade of pencil and other instruments to draw different types of lines and for different purposes

1.4 Identify the steps to be taken to keep the drawing clean and tidy.

1.5 Write titles using vertical and slopping (inclined) lettering and numerals of 7mm, 10mm and 14mm height.

1.6 Acquaint with the conventions, notations, rules and methods of dimensioning in engineering drawing as per the B.I.S.

1.7 Dimension a given drawing using standard notations and desired system of dimensioning.

2.0 Principles of Geometric Constructions

2.1 Practice the basic geometric constructions like i) dividing a line into equal parts
i) Exterior and interior tangents to the given two circles
ii) Tangent arcs to two given lines and arcs

2.2 Draw any regular polygon using general method when i) side length is given
i) Inscribing circle radius is given ii) describing circle radius is given

2.3 Draw the engineering curves like i) involute ii) cycloid

3.0 Projections of points, lines, planes and solids (All in first quadrant only)

3.1 Explain the basic principles of the orthographic projections

3.2 Visualise and draw the projection of a point with respect to reference planes (HP & VP)

3.3 Visualise and draw the projections of straight lines with respect to two reference Planes (up to lines parallel to one plane and inclined to other plane)

3.4 Visualise and draw the projections of planes (up to planes perpendicular to one plane and
inclined to other plane)

3.5 Visualise and draw the projections of regular solids parallel to one plane and inclined to other plane)

4.0 Sectional Views

4.1 Identify the need to draw sectional views.

4.2 Draw sectional views of regular solids by applying the principles of hatching.

5.0 Orthographic projection

5.1 Draw the orthographic views of an object from its pictorial drawing.

5.2 Draw the minimum number of views needed to represent a given object fully.

Competencies and Key competencies to be achieved by the student

S.No	Major topic	Key Competency
1.	Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice	• Explain the linkages between Engineering drawing and other subjects of study in Diploma course.
		• Select the correct instruments to draw various entities in different orientation
		• Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)
		• Dimension a given drawing using standard notations and desired system of dimensioning
2.	Geometrical construction	• Dividing a line into equal parts, tangents to circles, Construct involute, cycloid from the given data.
3.	Projection of points, Lines, Planes & Solids	• Draw the projections of points, straight lines, planes & solids with respect to reference planes (HP& VP)
4.	Sectional Views	• Differentiate between true shape and apparent shape of section • Apply principles of hatching. • Draw simple sections of regular solids
5.	Orthographic Projection	• Draw the minimum number of views needed to represent a given object fully.

COURSE CONTENTS:

NOTES: 1. B.I.S Specification should invariably be followed in all the topics.

2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.

1.0 Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice

Explanation of the scope and objectives of the subject of Engineering Drawing . Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46 –1988 – Mention B.I.S - Role of drawing in -engineering education - Basic Tools, tools for drawing– Mentioning of names under each classification and their brief description -Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet,

Importance of lettering – Types of lettering -Guide Lines for Lettering Practicing of letters & numbers of given sizes (7mm, 10mm and 14mm)-Advantages of single stroke or simple style of lettering - Use of lettering stencils- Purpose of engineering Drawing, Need of B.I.S code in dimensioning -Shape description of an Engineering object -Definition of Dimensioning size description -Location of features, surface finish, fully dimensioned Drawing -Notations or tools of dimensioning, dimension line extension line, leader line, arrows, symbols, number and notes, rules to be observed in the use of above tools -Placing dimensions: Aligned system and unidirectional system (SP-46-1988)-Arrangement of dimensions Chain, parallel, combined progressive, and dimensioning by co-ordinate methods-The rules for dimensioning standard, features "Circles (holes) arcs, angles, tapers, chamfers, and dimension of narrow spaces.

2.0 Geometric Constructions

Division of a straight line into given number of equal parts –Drawing interior and exterior tangents to two circles of given radii and centre distance-Drawing tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles), Tangent arc of given radius touching a circle or an arc and a given line, Tangent arcs of radius R, touching two given circles internally and externally-Construction of any regular polygon by general method for given side length, inscribing circle radius and describing/superscripting circle radius - Involute, Cycloid, explanations as locus of a moving point, their engineering application, viz., Gear tooth profile, screw threads, springs etc. – their construction.

3.0 Projection of points, lines and planes and Solids (All in first quadrant only)

Classification of projections, Observer, Object, Projectors, Projection, Reference Planes, Reference Line, Various angles of projections –Differences between first angle and third angle projections

Projections of points -Projections of straight line –(a) Parallel to both the planes, (b)Perpendicular to one of the planes and (c) Inclined to one plane and parallel to other planes-Projections of regular planes-(a) Plane parallel to one of the reference planes, (b) Plane perpendicular to HP and inclined to VP and vice versa- Projections of regular solids- (a) Axis perpendicular to one of the planes, (b) Axis parallel to VP and inclined to HP and vice versa.

4.0 Sectional Views

Need for drawing sectional views – what is a sectional view - Hatching – Section of regular solids inclined to one plane and parallel to other plane

5.0 Orthographic Projections

Meaning of orthographic projection - Using a viewing box and a model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object -Concept of front view, top view, and side view sketching these views for a number of engineering objects - Explanation of first angle projection. – Positioning of three views in First angle projection -Projection of points as a means of locating the corners of the surfaces of an object – Use of meter line in drawing a third view when other two views are given -Method of representing hidden lines -Selection of minimum number of views to describe an object fully.

REFERENCE BOOKS

1 Engineering Graphics by P I Varghese – (McGraw-hill)
2 Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)
3 Engineering Drawing by N.D.Bhatt.
4 T.S.M. & S.S.M on " Technical Drawing" prepared by T.T.T.I., Madras.
5 SP-46-1998 – Bureau of Indian Standards.

PO-CO Mapping

AEI -107	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	3	2	2		1		1	2	3	1
CO2	3	2	2			2	1	2	3	1

CO3	3	2	2	1	1		1	2	3	1
CO4	3	2	2	1		2	1	2	3	1
CO5	3	2	2	1	1	2	1	2	3	1
CO6	3	2	2	1	1	2	1	2	3	1
AVERAGE	**3**	**3**	**3**	**1**	**1**	**2**	**1**	**2**	**3**	**1**

3: High, 2: Moderate,1: Low

Table specifying syllabus to be covered for UNIT TEST I, II and III.

Unit Test	**Learning Outcomes to be Covered**
Unit Test – I	From 1.1 to 2.3
Unit Test – II	From 3.1 to 3.5
Unit Test – III	From 4.1 to 5.2

ELECTRICAL WIRING AND ELECTRONIC COMPONENTS& DEVICES LAB

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-108	ELECTRICAL WIRING, ELECTRONIC COMPONENTS & DEVICES LABORATORY	6	180	40	60

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	COs Mapped
1	Wiring practice	35	CO1, CO6
2	Identification of components	30	CO2, CO6
3	Soldering Practice	40	CO3
4	Study and use of Electronic equipment	35	CO4, CO7
5	Testing of Electronic components, Devices and Rectifiers	40	CO5, CO7, CO8
	TOTAL	**180**	

Upon completion of the course the student shall be able to			
Course Objectives		(i) ii)	Familiarise with electrical wiring, Soldering and Identification of components and equipments. Familiarise with Study, Testing and use of different types of Electronic components and equipments.
Course outcomes	CO1	**AEI-108.1**	Familiarisation of various tools used in electrical wiring.
	CO2	**AEI-108.2**	Identification of components
	CO3	**AEI-108.3**	Practice on Soldering.
	CO4	**AEI-108.4**	Study and use of electronic equipment

	CO5	**AEI-108.5**	Testing of electronic components and Devices.
	CO6	**AEI-108.6**	Connection of tube light with function of choke, tube and starter, ceiling fan, microphones and loudspeaker.
	CO7	**AEI-108.7**	Measurement of the value of resistor, AC/DC Voltages and currents using voltmeters and current Meters, using analog and digital Multimeters.
	CO8	**AEI-108.8**	Draw forward and reverse bias characteristics of semiconductor diode, Zener diode, transistor in CB mode and in CE mode.
Learning Outcomes		**1.0. Wiring Practice:** 1.1. Familiarisation of various tools used in electrical wiring. 1.Wire stripper, 2. Insulation remover 3. Pocket knife 4.Electrical Tester 5.Phillips Head Screwdrivers 6. Mallet 7.Rawl plug jumper 8 .Standard wire Gauge 1.2. Identifying and working with Pliers a) Identify the various functions of cutting pliers, Nose pliers, Pipe pliers, Flush cutter,top cutting pliers, Electronics pliers, Insulated cutting pliers b) Perform the following operations: 1. Holding 2. Wire cutting 3. Component bending 4.Twisting the wire. 1.3. Identification of different wires and cables: a) Hook up wires a. PVC wire b. Teflon wires c.single strand d. Multi strand. b) Wires used for electrical wiring: i) Service wire ii) TRS wires / PVC Wires (Al &Cu), iii) .single strand iv) Multi strand v) twisted c) Flexible pair wires vi) Enamelled copper wire, Power cord. d) Cables: UTP cable, Co axial cables, Flat ribbon cable for antennas, Telephone cable, Ethernet cable, Ribbon cables, Optical fiber. 1.4. Wire joints practice: Perform the following wire joint operations: Twisting, Splicing, Insulating, Western union joint, Married joint, Britania (straight Joint), Tee joint, Joining running cables,	

		Pigtail or rat tail joint. 1.5. Identifying the Electrical accessories: a) SPST Switch ,SPDT switch ,DPST switch, b) Two pin and Three pin Sockets and plugs, c) Power Socket and Power plugs, Lamp holders, Ceiling rose, d) Mains Switch, MCB, Kitkat Fuse – Fuse wire ratings. e) Usage of Fuse and variac 1.6. Identifying the mains supply Phase ,Neutral ,Ground: a) Identification of Phase and Neutral, Terminals in mains supply, b) Understand the purpose of earthing, 2pin and 3pin Plug Connections. 1.7. Make simple switch connections using low voltage transformer a) Connecting a 6V lamp to a switch (toggle). b) 2 way switch connections. c) Series and parallel connection of lamps. 1.8. Simple staircase wiring – one lamp control with two switches. 1.9. Connection of tube light with function of choke, tube and starter. 1.10. Connection of ceiling fan and reversing the direction of ceiling fan. **2.0 Identification of components:** 2.1 Identify different types resistors with different wattage. 2.2 Identify different types of Inductors. 2.3 Identify colour coding of different resistors. 2.4 Find the value of a given Resistor using colour code. 2.5 Identify different types of switches and relays. 2.6 Identify microphones and loudspeaker connections. **3.0 Soldering** 3.1 Familiarisation of various soldering tools, Components & different cables.

		3.2 Assemble and disassemble components using soldering irons 3.3 Use different types of soldering irons. 3.4 Use solder squeezer on electronic PCBs. 3.5 Use instant soldering gun. 3.6 Solder on printed circuit boards using passive and active components. **4.0 Study and use of electronic equipment:** 4.1 Familiarise with the symbols of electronic circuit components by drawing. 4.2 Measurement of AC/DC Voltages and currents using voltmeters and current Meters. 4.3 Measurement of voltage, current and resistance using analog and digital Multi meters. 4.4 Perform the continuity test for different components and devices using analog and Digital multi meters. 4.5 Study and use of AF / RF signal generators. 4.6 Study and use of C.R.O. (single trace & Dual trace) for measuring frequency and amplitude. 4.7 Study and use of single channel and dual channel regulated power supply units. **5.0 Testing of electronic components, Devices and Rectifiers:** 5.1 Measure the value of resistor using ohmmeter / multi meter and compare with the colour code value. 5.2 Test and measure the value of capacitor using R.L.C. meter and compare with the marked / colour code value. 5.3 Test the given loud speaker and measure the voice coil resistance-using millimetre. 5.4 Test the working of different types of switches, relays. 5.5 Arrange the Public Address system and test the performance. 5.6 Identify leads and testing of different diodes (PN Junction Diode, Zener Diode) and transistors using Multimeter. 5.7 Study of data manuals/ application manuals for diodes and transistors. 5.8 Draw forward and reverse bias characteristics of semiconductor diode and calculate forward and reverse resistance of diode.

		5.9	Draw reverse bias characteristics of Zener diode and find out the zener voltage.
		5.10	Draw input and output characteristics of transistor in CB mode.
		5.11	Draw input and output characteristics of transistor in CE mode.
		5.12	Implement Half wave rectifier with and without filter.
		5.13	Implement Full wave rectifier with and without filter.
		5.14	Implement Bridge rectifier with and without filter.

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
AEI-108.1	1	1			1			3	2	1
AEI-108.2	1	1			1			3	2	1
AEI-108.3	1	1			1			3	2	1
AEI-108.4	1	1			1			3	2	1
AEI-108.5	1	1			1			3	2	1
AEI-108.6	1	1			1			3	2	1
AEI-108.7	1	1			1			3	2	1
AEI-108.8	1	1			1			3	2	1
Average	1	1			1			3	2	1

3= strongly mapped
2= moderately mapped
1= slightly mapped

Reference Lab Manual:

1. Electronic Devices and Circuits by David A Bell 4 Edition PHI

2. Hand soldering and circuit board repair by H.(Ted)Smith, Thomas Delmar.

3. Electronic instruments and systems – principles, maintenance and troubleshooting. by R.G. Gupta.

ENGINEERING PHYSICS LAB

SUBJECT	SUBJECT CODE	TOTAL PERIODS	NUMBER OF PERIODS PER WEEK
PHYSICS LAB	AEI-109	45	03

Course objectives	(1) To provide strong practical knowledge of Physics to serve as a tool for various device applications in Engineering. (2) To enhance scientific skills of the students by incorporating new experiments so as to enrich the technical expertise of the students as required for industries.

COURSE OUTCOMES	CO1	Improving accuracy in various measurements; understanding the nature of the forces keeping the body in equilibrium.
	CO2	Estimating the acceleration caused by the gravity of earth; Practical study of the concepts of refraction of light at curved/plane surface
	CO3	Understanding the pressure of the gas as function of its volume; study of the combined magnetic field of the earth and an artificial magnet to estimate its pole strength; Estimating the velocity of sound in air through resonance phenomenon.
	CO4	Applying Kirchoff's laws to evaluate the specific resistance of a wire; Study of exchange of heat from system to surrounding by graphical analysis; Conversion of light energy to micro currents as potential engineering application.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	2	2	1	2
CO2	3		1	1	1	1	1
CO3	3	2			1		
CO4	3	2	2			1	2

CO-PO Mapping Strength

Course code Common - 109	**Engineering Physics No of Course Objectives : 4**				**No of periods 45**
POs	Mapped with CO No	CO periods addressing PO in Col 1 NO	%	Level 1,2,3	remarks
PO1	CO1,CO2,CO3,CO4	15	33.3 %	2	>40% level 3 (highly addressed) 25% to 40% level 2 (moderately addressed) 5% to 25% level 1 (Low addressed) < 5% (not addressed)
PO2	CO1,CO3, CO4	8	17.8%	1	
PO3	CO1, CO2, CO4	6	13.3%	1	
PO4	CO1, CO2	3	6.7%	1	
PO5	CO1,CO2, CO3	5	11.1%	1	
PO6	CO1, CO2, CO4	3	6.7%	1	
PO7	CO1, CO2, CO4	5	11.1%	1	

3 = strongly mapped, 2 = moderately mapped, 1 = slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following.

(i) Seminars (ii) Viva-voce (iii) Assignments
(iv) Quiz competitions (v) Industrial visits (vi) Tech fest
(vii) Mini project
(viii) Group discussions (ix) Virtual labs (x) Library visit for e-books

ENGINEERING PHYSICS LAB

Subject Title : Engineering Physics Lab
Subject Code : AEI-109
Periods per week : 03
Total periods per year : 45

TIMESCHEDULE

S.No	List of experiments	No.of Periods
1.	Vernier calipers	03
2.	Micrometer (Screw gauge)	03
3.	Verification of Lami's theorem using concurrent forces	03
4.	Determination of 'g' using simple pendulum	03
5.	Focal length and focal power of convex lens	03
6.	Refractive index of solid using travelling microscope	03
7.	Verification of Boyle's law using Quill tube	03
8	Determination of pole strength of the bar magnet through magnetic field lines	03
9	Resonance apparatus – Determination of velocity of sound in air	03
	Experiments for demonstration	
10	Meter bridge – Determination of resistance and specific resistance of a wire	03
11	Verification of Newton's law of cooling	03
12	Photo electric cell – Study of its characteristics	03
	Revision	06
	Test	03
	Total:	**45**

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Practice with Vernier calipers to determine the volumes of cylinder and sphere.
2.0 Practice with Screw gauge to determine thickness of a glass plate and cross sectional area of a wire.
3.0 Verify the Lami's theorem using concurrent forces.
4.0 Determine the value of acceleration due to gravity (g) using Simple Pendulum. To

verify the result from $l\text{-}T^2$ graph.

5.0 Calculate the Focal length and focal power of convex lens using distant object method and U-V method. To verify the result from U-V graph and 1 / U – 1 / V graph methods.

6.0 Determine the refractive index of a solid using travelling microscope

7.0 Verify the Boyle's law using Quill tube. To draw a graph between P and 1/l.

8.0 Determination of magnetic pole strength of a bar magnet by drawing magnetic lines of force and locating null points (either N - N or N - S method)

9.0 Determine the velocity of sound in air at room temperature and its value at zero degree Centigrade using resonance apparatus.

10.0 Determine the resistance and specific resistance of material of a wire using Meter Bridge

11.0 To verify the Newton's law of cooling.

12..0 To study the characteristics of photo electric cell.

Course Outcomes

S.No	List of experiments	No.of Periods	COs
1.	Vernier calipers	03	CO1
2.	Micrometer (Screw gauge)	03	
3.	Verification of Lami's theorem using concurrent forces	03	
4.	Determination of g using simple pendulum	03	CO2
5.	Focal length and power of convex lens	03	
6.	Refractive index of solid using travelling microscope	03	
7.	Verification of Boyle's law using Quill tube	03	CO3
8	Determination of pole strength of the bar magnet through magnetic field lines	03	
9	Resonance apparatus – Determination of velocity of sound in air	03	
10	Meter bridge – Determination of resistance and specific resistance of a wire	03	CO4
11	Verification of Newton's law of cooling	03	
12	Photo electric cell – Study of its characteristics	03	

Competencies and Key competencies to be achieved by the student

Name of the Experiment	Competencies	Key competencies
1 . Practice on Vernier Callipers (03)	• Find the Least count • Fix the specimen in position • Read the scales • Calculate the physical quantities of given object	• Read the scales • Calculate the requisite physical quantities of given objects • Calculating volumes of the cylinder and sphere
2. Practice on Screw gauge(03)	• Find the Least count • Fix the specimen in position • Read the scales • Calculate thickness of glass plate and cross section of wire from radius	• Read the scales • Noting zero error • Calculate thickness of given glass plate • Calculate cross section of wire from radius
3. Verification of Lami's theorem forces(03)	• Making experimental set up • Fix suitable weights • Note the positions of threads on drawing sheet • Find the angles between the concurrent forces • Changing weights appropriately • Verify Lami's theorem	•Measuring angles between the forces • Marking the directions of forces on a paper • Verifying Lami's theorem from the weights and measured angles between the forces.
4. Simple pendulum(03)	• Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations (say 20) • Find the time period • Calculate the acceleration due to gravity • Draw l-T^2 graph	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Verify form l-T^2 graph

5. Focal length and Focal power of convex lens (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graphs	• Find focal length from distant object method. • Calculate the focal length and power of convex lens • Verify result from u-v and 1/u – 1/v graphs
6 Refractive index of solid using traveling microscope(03)	• Find the least count of Vernier on microscope • Place the graph paper below microscope • Read the scales	• Reading the scales on Microscope. • Fiding real and apparent thickness of the slab • Calculate the refractive
7 . Boyle's law verification (03)	• Note the atmospheric pressure • Fix the Quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated values of P x l	• Fixing Quill tube in various positions on retort stand. • Find the length of air column • Find the pressure of enclosed air • Find the values of Px l • Verify Boyle's law.
8. Mapping of magnet lines of force (03)	• Draw magnetic meridian • Place the bar magnet in N-N or N-S directions • Draw magnetic lines of force • Locate the neutral points	• Draw the pattern of magnetic lines of force • Locate the neutral points • Calculating pole strength of the bar magnet
9. Velocity of sound in air – Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound .	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound at room temperature and at 0^0 C

10. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance	• Making connections as per circuit diagram. • Find the balancing length • Calculate unknown resistance • Calculate the specific resistance of the given wire
11. Verification of Newton's law of Cooling (03)	• Heating liquid in a beaker using a heating element • Inserting thermometer in liquid in calorimeter • Stirring liquid • Measuring temperatures as a function of time using thermometer • Plotting a cooling curve	• Measuring temperature of a liquid as function of time. • Plotting a cooling curve. • Verifying Newton's law of cooling.
12. Photo electric cell – Study of its Characteristics (03)	• Experimental set up and making connections • Veryfying intensity of light by varying distances between light source and photocell. • Measuring Voltage and current values.	• Making connections for experimental set up. • Varying distances appropriately • Measuring Voltage and current values. • Study of V- I Characteristics Form graph.

Scheme of Valuation for End Practical Examination:

Activity	**Marks**
For writing, Apparatus, formulae, least count (if applicable)	5
Procedure & precautions	5
Drawing Tables	3
Readings, calculations, graph (if applicable), reporting the findings	12
Viva-voce	5
Total marks	**30**

CHEMISTRY LABORATORY

Subject t Title : Chemistry Laboratory
Subject Code : AEI -110
Periods per week : 03
Total periods per year : 45

CO1	Operate and practice volumetric apparatus and preparation of standard solution.
CO2	Evaluate and judge the neutralization point in acid base titration.
CO3	Evaluate the end point of reduction and oxidation reaction.
CO4	Judge the stable end point of complex formation, stable precipitation.
CO5	Judge operate, demonstrate, and perform precise operations with instrument for investigation of water pollution parameters.

PO- CO mapping

Course code Common-110	**Chemistry Laboratory No. of CO's:5**				**No. of periods : 45**
POs	Mapped with CO No.	CO periods addressing PO in Col. No. 1	%	Level 1,2,3	Remarks
PO1	CO1,CO2,CO3, CO4,CO5	12	26.66	2	>40% Level 3 (highly addressed) 25% to 40% Level 2 (moderately addressed) 5% to 25% Level1 (Low addressed) < 5%(not addressed)
PO2	CO1,CO2,CO3, CO4,CO5	9	20	1	
PO3					
PO4	CO1,CO2,CO3, CO4,CO5	12	26.66	2	
PO5	CO2,CO3, CO4,CO5	12	26.66	2	
PO6	-	-	-	-	
PO7	-	-	-	-	

COs-POs mapping strength (as per given table)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	-	2	-	-	-	-	-	-
CO2	2	1	-	2	2	-	-	-	-	-
CO3	2	1	-	2	2	-	-	-	-	-
CO4	2	1	-	2	2	-	-	-	-	-
CO5	2	1	-	2	2	-	-	-	-	-

3=strongly mapped 2= moderately mapped 1= slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities
from the following: i) Seminars ii) Tutorials iii) Guest Lectures iv) Assignments v) Quiz competitions vi) Industrial visit vii) Tech Fest viii) Mini project ix) Group discussions x) Virtual classes xi) Library visit for e-books

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods	Mapped with COs
1.	a) Recognition of chemical substances and solutions used in the laboratory by senses. b) Familiarization of methods for Volumetric analysis.	03	CO 1
2.	Preparation of Std.Na_2CO_3solution and making solutions of different	03	CO1
3.	Estimation of HCl solution using Std.Na_2CO_3solution.	03	CO2
4.	Estimation of NaOH using Std. HCl solution.	03	CO2
5.	Determination of acidity of water sample.	03	CO2
6.	Determination of alkalinity of water sample.	03	CO2
7.	Estimation of Mohr's Salt usingStd.$KMnO_4$. Solution.	03	CO3
8.	Estimation of Ferrous ion by using Std. $K_2Cr_2O_7$ solution.	03	CO3
9.	Determination of total hardness of water sample using Std. EDTA solution.	03	CO4
10.	Estimation of Chlorides present in water sample by using Std. $AgNO_3$ solution.	03	CO4
11.	Estimation of Dissolved Oxygen(D.O) in water sample by using Std. hypo solution.	03	CO5
12.	Determination of pH using pH meter..	03	CO 5
13.	Determination of conductivity of water and adjusting ionic strength	03	CO 5
14.	Determination of turbidity of water.	03	CO 5
15.	Estimation of total solids present in water sample.	03	CO 5
	Total:	**45**	

Objectives:

Upon completion of the course the student shall be able to

1.0 To identify the chemical compounds and solutions by senses.
Practice volumetric measurements (using pipettes, measuring jars, volumetric flask, burettes)
and gravimetric measurements (using different types of balances), making dilutions, etc.
2.0 Practice making standard solutions with pre weighed salts and to make solutions of desired dilutions using appropriate techniques.
3.0 Conduct titrations adopting standard procedures and using Std. Na_2CO_3 solution for estimation of HCl.
4.0 Conduct titrations adopting standard procedures and using Std. HCl solution for estimation of NaOH.

5.0 Conduct titrations adopting standard procedures to determine the acidity of given samples of water (One ground water and one surface / tap water, and rain water if available).
6.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water (One ground water and one surface / tap water).
7.0 Conduct titrations adopting standard procedures and using Std.$KMnO_4$ solution for estimation of Mohr'sSalt.
8.0 Conduct titrations adopting standard procedures and using Std.$K_2Cr_2O_7$ solution for estimation of Ferrous ion.
9.0 Conduct titrations adopting standard procedures to determine the total hardness of given samples of water (One ground water and one surface / tap water) using Std. EDTA solution.
10. Conduct titrations adopting standard procedures to determine the chlorides present in the given samples of water (One ground water and one surface / tap water) using Std. $AgNO_3$ solution.
11. Conduct the test using titrimetric / electrometric method to determine. Dissolved Oxygen (D.O) in the given water samples (One sample from closed container and one from open container / tap water) by Std. Hypo solution.
12. Conduct the test on given samples of water / solutions (like soft drinks, sewage, etc.) to determine their pH using standard pH meter.
13. Conduct the test on given samples of water / solutions.
    a) to determine conductivity.
    b) to adjust the ionic strength of the sample to the desired value.
14. Conduct the test on given samples of solutions (coloured and non-coloured) to determine their turbidity in NTU.
15. Determine the total solids present in given samples of water (One ground water and one surface / tap water).

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	**Competencies**	**Key competencies**
Recognition of chemical substances and solutions. Familiarization of methods for Volumetric analysis. (03)	-	--
Preparation of Std.Na_2CO_3 solution and making solutions of different dilutions. (03)	▪ Weighing the salt to the accuracy of .01 mg. ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette. ▪ Making appropriate dilutions.	▪ Weighing the salt to the accuracy of 0.01 mg. ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette. ▪ Making appropriate dilutions.

Estimation of HCl solution using Std. Na_2CO_3 solution. (03)	▪ Cleaning the glassware and rinsing with appropriate solutions. ▪ Making standard solutions. ▪ Measuring accurately the standard solutions and titrants. ▪ Filling the burette with titrant. ▪ Fixing the burette to the stand. ▪ Effectively controlling the flow of the titrant. ▪ Identifying the end. ▪ Making accurate observations. ▪ Calculating the results.	▪ Making standard solutions. ▪ Measuring accurately the standard solutions and titrants. ▪ Effectively controlling the flow of the titrant. ▪ Identifying the end point. ▪ Making accurate observations.
Estimation of NaOH using Std. HCl solution. (03)		
Determination of acidity of water sample. (03)		
Determination of alkalinity of water sample. (03)		
Estimation of Mohr's Salt using Std. $KMnO_4$ solution. (03)		
Estimation of Ferrous ion by using Std. $K_2Cr_2O_7$ solution (03)		
Determination of total hardness of water using Std. EDTA solution. (03)		
Estimation of Chlorides present in water sample using Std. $AgNO_3$ solution (03)		
Estimation of Dissolved Oxygen(D.O) in water sample (By titration method) (03)		
Determination of pH using pH meter. (03)	▪ Familiarize with instrument. ▪ Choose appropriate 'Mode' / 'Unit'. ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions. ▪ Plot the standard curve. ▪ Make measurements accurately. ▪ Follow Safety precautions.	▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions. ▪ Plot the standard curve. ▪ Make measurements accurately.
Determination of conductivity of water and adjusting ionic strength to required level. (03)		
Determination of turbidity of water. (03)		

Estimation of total solids present in water sample. (03)	▪ Measuring the accurate volume and weight of sample. ▪ Filtering and air drying without losing any filtrate. ▪ Accurately weighing the filter paper, crucible and filtrate. ▪ Drying the crucible in an	▪ Measuring the accurate volume and weight of sample. ▪ Filtering and air drying without losing any filtrate. ▪ Accurately weighing the filter paper, crucible and filtrate.

SCHEME OF VALUATION

A) Writing Chemicals, apparatus, principle and procedure. 5M

B) Demonstrated competencies. 20M
Making standard solutions.
Measuring accurately the standard solutions and titrants.
Effectively controlling the flow of the titrant.
Identifying the end point.
Making accurate observations.

C) Viva-voce. 5M

Total **30M**

COMPUTER FUNDAMENTALS LABORATORY

Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
AEI-111	Computer Fundamentals Lab	3	90	40	60

Time schedule:

S.No.	Chapter/Unit Title	No. of sessions each of 3 periods duration	No.of Periods
1.	Computer hardware Basics	2	6
2.	Windows Operating System	2	6
3.	MS Word	8	24
4.	MS Excel	7	21
5.	MS PowerPoint	5	15
6.	Adobe Photoshop	6	18
	Total periods	**30**	**90**

S.No.	Chapter/Unit Title	No.of Periods	CO's Mapped
1.	Computer hardware Basics	6	CO1
2.	Windows Operating System	6	CO1
3.	MS Word	24	CO2
4.	MS Excel	21	CO3
5.	MS PowerPoint	15	CO4
6	Adobe Photoshop	18	CO5
	Total periods	**90**	

Course Objectives	i)To know Hardware Basics ii)To familiarize operating systems iii)To use MS Office effectively to enable to students use these skills in future courses iv) To use Adobe Photoshop in image editing.

Course Outcomes	At the end of the course students will be able to		
	CO1	AEI-111.1	Identify hardware and software components
	CO2	AEI-111.2	Prepare documents with given specifications using word processing software
	CO3	AEI-111.3	Use Spread sheet software to make calculation and to draw various graphs / charts.
	CO4	AEI-111.4	Use Power point software to develop effective presentation for a given theme or topic.
	CO5	AEI-111.5	Edit digital or scanned images using Photoshop

CO-PO/PSO MATRIX

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
AEI-111.1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
AEI-111.2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
AEI-111.3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
AEI-111.4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
AEI-111.5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**

3=Strongly mapped , 2=moderately mapped, 1=slightly mapped

Learning Outcomes:

I. Computer Hardware Basics

1. a)To Familiarize with Computer system and hardware connections
   b)To Start and Shut down Computer correctly
   c)To check the software details of the computer
2. To check the hardware present in your computer

II. Windows's operating system

3. To Explore Windows Desktop
4. Working with Files and Folders
5. Windows Accessories: Calculator – Notepad – WordPad – MS Paint

III. Practice with MS-WORD

6. To familiarize with Ribbon layout of MS Word
   Home – Insert- Page layout – References – Review- View.
7. To practice Word Processing Basics
8. To practice Formatting techniques
9. To insert a table of required number of rows and columns
10. To insert Objects, Clipart and Hyperlinks
11. To use Mail Merge feature of MS Word
12. To use Equations and symbols features

IV. Practice with MS-EXCEL

13. To familiarize with MS-EXCEL layout
14. To access and enter data in the cells
15. To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
16. To use built in functions and Formatting Data
17. To create Excel Functions, Filling Cells
18. To enter a Formula for automatic calculations
19. To sort and filter data in table.
20. To present data using Excel Graphs and Charts.
21. To develop lab reports of respective discipline.
22. To format a Worksheet in Excel, Page Setup and Print

V. Practice with MS-POWERPOINT

23. To familiarize with Ribbon layout features of PowerPoint 2007.
24. To create a simple PowerPoint Presentation
25. To set up a Master Slide in PowerPoint
26. To insert Text and Objects
27. To insert a Flow Charts
28. To insert a Table

29. To insert a Charts/Graphs
30. To insert video and audio
31. To practice Animating text and objects
32. To Review presentation

VI. Practice with Adobe Photoshop

33. To familiarize with standard toolbox
34. To edit a photograph.
35. To insert Borders around photograph.
36. To change Background of a Photograph.
37. To change colors of Photograph.
38. To prepare a cover page for the book in your subject area.
39. To adjust the brightness and contrast of the picture so that it gives an elegant look.
40. To type a word and apply the shadow emboss effects.

Key competencies:

Expt No	Name of Experiment	Competencies	Key competencies
1 (a).	To familiarize with Computer system and hardware connections	a. Identify the parts of a Computer system: i). CPU ii). Mother Board iii) Monitor iv) CD/DVD Drive v) Power Switch vi) Start Button vii) Reset Button b. Identify and connect various peripherals c. Identify and connect the cables used with computer system d. Identify various ports on CPU and connect Keyboard & Mouse	Connect cables to external hardware and operate the computer
1 (b).	To Start and Shut down Computer correctly	a. Log in using the password b. Start and shut down the computer c. Use Mouse and Key Board	a. Login and logout as per the standard procedure b. Operate mouse &Key Board
1 (c).	To Explore Windows Desktop	a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support	a. Access application programs using Start menu b. Use taskbar and Task manager
2.	To check the software details of the computer	a. Find the details of Operating System being used b.Find the details of Service Pack installed	Access the properties of computer and find the details

3.	To check the hardware present in your computer	a. Find the CPU name and clock speed b. Find the details of RAM and Hard disk present c. Access Device manager using Control Panel and check the status of devices like mouse and key board d. Use My Computer to check the details of Hard drives and partitions e. Use the Taskbar	a. Access device manager and find the details b. Type /Navigate the correct path and Select icon related to the details required
4.	Working with Files and Folders	a. Create folders and organizing files in different folders b. Use copy / paste move commands to organize files and folders	a. Create files and folders Rename , arrange and search for the required folder/file
	Working with Files and Folders Continued....	c. Arrange icons – name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut to files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin	b. Restore deleted files from Recycle bin
5.	To use Windows Accessories: Calculator – Notepad – WordPad – MS Paint	a. Familiarize with the use of Calculator b. Access Calculator using Run command c. Create Text Files using Notepad and WordPad and observe the difference in file size d. Use MS paint and create .jpeg, .bmp files using MS Paint	a. Use windows accessories and select correct text editor based on the situation. b. Use MS pain to create /Edit pictures and save in the required format.
6.	To familiarize with Ribbon layout of MS word. – Home – Insert- page layout- References- Review-View	a. Create/Open a document b. Use Save and Save as features c. Work on two Word documents simultaneously d. Choose correct Paper size and Printing options	a. Create a Document and name appropriately and save b. Set paper size and print options

7.	To practice Word Processing Basics	a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS- word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar	a. Use key board and mouse to enter/edit text in the document. b. Use shortcuts c. Use spell check/ Grammar features for auto corrections.
8.	To practice Formatting techniques	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. The Styles of Word f. Insert bullets and numbers g. Themes and Templates h. Insert page numbers, header and footer	a. Format Text and paragraphs and use various text styles. b. Use bullets and numbers to create lists c. Use Templates /Themes d. Insert page numbers date, headers and footers
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table –marking borders. Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order	a. Insert table in the word document and edit b. Use sort option for arranging data.
10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and t Bookmarks. b. Create an organization	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts

		chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	a. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar-Title Bar- Ribbon-Worksheets- Formula Bar-Status Bar	a. Familiarize with excel layout and use b. Use various features available in toolbar
14.	To access and Enter data in the cells	a. Move Around a Worksheets-Quick access - Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	a. Access and select the required cells by various addressing methods b. Enter data and edit
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	a. Insert and Delete Columns and Rows-Create Borders-Merge and Centre b. Add Background Colour-Change the Font, Font Size, and Font Colour c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width	Format the excel sheet
16.	To use built in functions and Formatting Data	a. Perform Mathematical Calculations verify - AutoSum b. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	a. Enter formula b. Use Cell References in	Enter formula for

		Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help	automatic calculations
18.	To Create Excel Functions, Filling Cells	a. Use Reference Operators b. Work with sum, Sum if , Count and Count If Functions c. Fill Cells Automatically	a. Create Excel sheets involving cross references and equations b. Use the advanced functions for conditional calculations
19.	To sort and filter data in table	a. Sort data in multiple columns b. Sort data in a row c. Sort data using Custom order d. Filter data in work sheet	a. Refine the data in a worksheet and keep it organized b. Narrow a worksheet by selecting specific choice
20.	To Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce c. Excel Column Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
21.	To develop lab reports of respective discipline	Create Lab reports using MS Word and Excel	a. Insert Practical subject name in Header and page numbers in Footer
22.	To format a Worksheet in Excel, page setup and print	a. Shade alternate rows of data b. Add currency and percentage symbols c. Change height of a row and width of a column d. Change data alignment e. Insert Headers and Footers f. Set Print Options and Print	a. Format Excel sheet b. Insert headers &footers and print
23.	To familiarize with Ribbon layout &features of PowerPoint 2007.	Use various options in PowerPoint a. Home b. Insert c. Design d. Animation e. Slideshow f. View	Access required options in the tool bar

		g. Review	
24.	To create a simple PowerPoint Presentation	a. Insert a New Slide into PowerPoint b. Change the Title of a PowerPoint Slide c. PowerPoint Bullets d. Add an Image to a PowerPoint Slide e. Add a Textbox to a PowerPoint slide	a. Create simple PowerPoint presentation with photographs/Clip Art and text boxes b. Use bullets option
25.	To Set up a Master Slide in PowerPoint and add notes	a. Create a PowerPoint Design Template b. Modify themes c. Switch between Slide master view and Normal view d. Format a Design Template Master Slide e. Add a Title Slide to a Design Template f. The Slide Show Footer in PowerPoint g. Add Notes to a PowerPoint Presentation	a. Setup Master slide and format b. Add notes
26.	To Insert Text and Objects	a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and word art f. Use 3d features g. Arrange objects	Insert Text and Objects Use 3d features
27.	To insert a Flow Chart / Organizational Charts	a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art	Create organizational charts and flow charts using smart art
28.	To insert a Table	a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend	Insert tables and format
29.	To insert a Charts/Graphs	a. Create 3D Bar Graphs in PowerPoint b. Work with the PowerPoint Datasheet c. Format a PowerPoint Chart Axis d. Format the Bars of a Chart e. Create PowerPoint Pie Charts	Create charts and Bar graphs, Pie Charts and format.

		f. Use Pie Chart Segments g. Create 2D Bar Charts in PowerPoint h. Format the 2D Chart e. Format a Chart Background	
30.	To Insert audio & video, Hyperlinks in a slide Add narration to the slide	a. Insert sounds in the slide and hide the audio symbol b. Adjust the volume in the settings c. Insert video file in the format supported by PowerPoint in a slide d. Use automatic and on click options e. Add narration to the slide f. Insert Hyperlinks	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files
31.	To Practice Animation effects	a. Apply transitions to slides b. To explore and practice special animation effects like Entrance, Emphasis, Motion Paths &Exit	Add animation effects
32.	Reviewing presentation	a. Checking spelling and grammar b. Previewing presentation c. Set up slide show d. Set up resolution e. Exercise with Rehearse Timings feature in PowerPoint f. Use PowerPoint Pen Tool during slide show g. Saving h. Printing presentation (a) Slides (b) Hand-out	a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show
33	To familiarize with standard toolbox	a. Open Adobe Photoshop b. Use various tools such as i. The Layer Tool ii. The Colour& Swatches Tool iii. Custom Fonts & The Text Tool iv. Brush Tool v. The Select Tool vi. The Move Tool vii. The Zoom Tool viii. The Eraser ix. The Crop Tool x. The Fill Tool	Open a photograph and save it in Photoshop

34	To edit a photograph	a. Use the Crop tool b. Trim edges c. Change the shape and size of a photo d. Remove the part of photograph including graphics and text	a. Able to edit image by using corresponding tools.
35	To insert Borders around photograph	a. Start with a single background layer b. Bring the background forward c. Enlarge the canvas d. Create a border colour e. Send the border colour to the back f. Experiment with different colours	Able to create a border or frame around an image to add visual interest to a photo
36	To change Background of a Photograph	a. open the foreground and background image b. Use different selection tools to paint over the image c. Copy background image and paste it on the foreground. d. Resize and/or drag the background image to reposition. e. In the Layers panel, drag the background layer below the foreground image layer.	Able to swap background elements using the Select and Mask tool and layers.
37	To change colors of Photograph	a. Change colours using: i) Colour Replacement tool ii) **Hue/Saturation adjustment layer tool**	*Able to control colour saturation*
38	To prepare a cover page for the book in subject area	a. open a file with height 500 and width 400 for the cover page. b. apply two different colours to work area by dividing it into two parts using Rectangle tool. c. Copy any picture and place it on work area→ resize it using free transform tool. d. Type text and apply colour and style e. Apply effects using blended	*Able to prepare cover page for the book*

		options	
39	To adjust the brightness and contrast of picture to give an elegant look	a. open a file. b. Go to image→ adjustments→ Brightness/Contrast. c. adjust the brightness and contrast. d. Save the image.	*Able to control brightness/contrast.*
40	To type a word and apply the shadow emboss effects	a. open a file b. Select the text tool and type text. c. Select the typed text go to layer→ layer style→ blended option→ drop shadow, inner shadow, bevel and emboss→ contour→ satin→ gradient overlay d. Save the image.	Able to apply shadow emboss effects

Table specifying the scope of syllabus to be covered for unit tests

Unit Test	Learning outcomes to be covered
Unit test-1	From 1 to 8
Unit test-2	From 9 to 22
Unit test-3	From 23 to 40

THIRD SEMESTER

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
III SEMESTER

Subject Code	Name of the Subject	Instruction periods / week		Total Periods /Semester	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
AEI-301	Mathematics – II	4	-	60	3	20	80	100
AEI-302	Electronic circuits	3	-	45	3	20	80	100
AEI-303	Digital Electronics	4	-	60	3	20	80	100
AEI-304	Electronic Measuring Instruments	4	-	60	3	20	80	100
AEI-305	Sensors and Transducers	6	-	90	3	20	80	100
AEI-306	Algorithm design using C with data structures	5	-	75	3	20	80	100
PRACTICAL								
AEI-307	Electronic circuits Lab	-	3	45	3	40	60	100
AEI-308	Prog in C and MATLAB	-	3	45	3	40	60	100
AEI-309	Digital Electronics Lab	-	3	45	3	40	60	100
AEI-310	Electronic Measuring Instruments Lab	-	3	45	3	40	60	100
AEI-311	Sensors and Transducers Lab	-	3	45	3	40	60	100
	Activities	-	1	15	3			
	TOTAL	26	16	630	-	320	780	1100

AEI-301 common with all branches

ENGINEERING MATHEMATICS-II
(Common to AEI/BM/CH/CHOT/CHPP/CHPC/CHST/EC)

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
AEI-301	Engineering Mathematics-II	4	60	20	80

S.No.	Unit Title	No. of periods	COs mapped
1	Indefinite Integration	20	CO1
2	Definite Integration and its applications	10	CO2
3	Differential Equations	13	CO3
4	Laplace Transforms & Fourier series	17	CO4
	Total Periods	60	

Course Objectives	(i) To understand the concepts of indefinite integrals and definite integrals with applications to engineering problems. (ii) To understand the formation of differential equations and learn various methods of solving first order differential equations. (iii) To learn the principles of solving homogeneous differential equations of second order. (iv) To comprehend and understand the concepts of Laplace transformations and Fourier series.

Course Outcomes	CO1	Integrate various functions using different methods.
	CO2	Evaluate definite integrals and learn its applications.
	CO3	Obtain differential equations and solve differential equations of first order and first degree, and solve homogeneous differential equations of second order.
	CO4	Find Laplace Transforms of various functions and expand the given functions as Fourier series.

ENGINEERING MATHEMATICS – II
(Common to AEI/BM/CH/CHOT/CHPP/CHPC/CHST/EC)

Learning Outcomes

Unit-I

C.O. 1 Integrate various functions using different methods.

L.O.1.1. Explain the concept of Indefinite integral as an anti-derivative.

1.2. State the indefinite integral of standard functions and properties of $\int (u+v)\,dx$ and $\int k\,u\,dx$ where *u, v* are functions of *x* and *k* is constant.

1.3. Solve problems involving standard functions using these properties.

1.4. Evaluate integrals involving simple functions of the following type by the method of substitution.

i) $\int f(ax+b)\,dx$, *where f(x)* is in standard form.

ii) $\int (f(x))^n\, f'(x)\,dx,\ n \neq -1$

iii) $\int \dfrac{f'(x)}{f(x)}\,dx$

iv) $\int [f(g(x))]g'(x)dx$

1.5. Find the integrals of *tan x, cot x, sec x* and *cosec x* w.r.t. x.

1.6. Evaluate the Standard integrals of the functions of the type :

i) $\dfrac{1}{a^2+x^2}, \dfrac{1}{a^2-x^2}, \dfrac{1}{x^2-a^2}$

ii) $\dfrac{1}{\sqrt{a^2+x^2}}, \dfrac{1}{\sqrt{a^2-x^2}}, \dfrac{1}{\sqrt{x^2-a^2}}$

iii) $\sqrt{a^2+x^2}, \sqrt{a^2-x^2}, \sqrt{x^2-a^2}$

1.7. Evaluate integrals using decomposition method.

1.8. Solve problems using integration by parts.

1.9 Use Bernoulli's rule for evaluating the integrals of the form $\int u.v\,dx$.

1.10. Evaluate the integrals of the form $\int e^x[f(x)+f'(x)]dx$

Unit-II

C.O.2 Evaluate definite integrals with applications.

L.O.2.1. State the fundamental theorem of integral calculus

2.2. Explain the concept of definite integral.

2.3. Solve simple problems on definite integrals.

2.4. State various properties of definite integrals.

2.5. Evaluate simple problems on definite integrals using these properties.

2.6. Find the area bounded by a curve and axes.

2.7. Obtain the mean and R.M.S values of the simple functions.

Syllabus for Unit test-I completed

Unit -III

C.O. 3 Form differential equations and solve differential equations of first order and first degree and Solve homogeneous differential equation of second order.

L.O.3.1. Define a Differential equation, its order and degree

3.2 Find order and degree of a given differential equation.

3.3 Form a differential equation by eliminating arbitrary constants.

3.4 Solve the first order and first degree differential equations by variables separable method.

3.5 Solve linear differential equation of the form $\frac{dy}{dx} + Py = Q$, where P and Q are functions of x only or constants.

3.6 Solve Differential equations of the type $(aD^2 + bD + c)\, y = 0$ where $a(\neq 0)$, b, c are real numbers and provide examples.

Unit-IV

Laplace transforms & Fourier series

C.O. 4 Find Laplace Transforms of various functions and expand the given functions as Fourier series.

L.O. 4.1 Define Laplace Transform and explain the sufficient conditions for the existence of Laplace Transform.

4.2.Obtain Laplace transforms of elementary functions and solve simple problems.

4.3 State linearity property, first shifting theorem of Laplace transforms (without proof) and solve simple problems.

4.4 Define Inverse Laplace Transform.

4.5 Obtain Inverse Laplace Transforms for standard functions and solve simple problems.

4.6 State linearity property, first shifting theorem of Inverse Laplace transforms (without proof) and solve simple problems.

4.7 Define orthogonality of functions in an interval.

4.8 Define Fourier series of a function in the interval $(c,\ c+2\pi)$ and Euler's formulae for Fourier coefficients.

4.9 Write sufficient conditions for the existence of Fourier series expansion of a function in an interval.

4.10 Expand the functions f(x) = k (constant) and f(x) = x as Fourier series in the intervals (0 , 2π) and (-π , π)

Syllabus for Unit test-II completed

C-23 EC-301

Engineering Mathematics – II

(Common to AEI/BM/CH/CHOT/CHPP/CHPC/CHST/EC)

CO/PO – Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1				3	2	2
CO2	3	3	3	3				3	3	3
CO3	3	3	3	3				3	3	3
CO4	3	3	3	3				3	3	3
Avg.	3	2.75	2.75	2.5				3	2.75	2.75

Note: The gaps in CO/PO mapping can be met with appropriate activities as follows:

For PO5: Appropriate quiz programmes may be conducted at intervals and duration as decided by concerned faculty.

For PO6: Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

For PO7: Plan activities in such a way that students can visit the Library to refer standard books on Mathematics and access the latest updates in reputed national and international journals. Additionally, encourage them to attend seminars and learn mathematical software tools.

Engineering Mathematics – II
(Common to AEI/BM/CH/CHOT/CHPP/CHPC/CHST/EC)
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		Number	%		
1	CO1, CO2, CO3,CO4	60 (20+10+13+17)	100%	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately addressed 5% to 25% Level 1 Low addressed <5% Not addressed
2	CO1, CO2, CO3,CO4	29 (6+5+6+12)	48.3%	3	
3	CO1, CO2, CO3,C04	29 (6+5+6+12)	48.3%	3	
4	CO1, CO2, CO3,CO4	27 (4+5+6+12)	45%	3	
5					
6					
7					
PSO 1	CO1, CO2, CO3,CO4	60	100%	3	
PSO 2	CO1, CO2, CO3,CO4	29 (6+5+6+12)	48.3%	3	
PSO 3	CO1, CO2, CO3,CO4	29 (6+5+6+12)	48.3%	3	

ENGINEERING MATHEMATICS – II
(Common to AEI/BM/CH/CHOT/CHPP/CHPC/CHST/EC)

COURSE CONTENTS

Unit-I

Indefinite Integration:

1. Integration regarded as anti-derivative – Indefinite integrals of standard functions. Properties of indefinite integrals. Integration by substitution or change of variable. Integrals of tan x, cot x, sec x, cosec x.

Evaluation of integrals which are of the following forms:

$i)\ \frac{1}{a^2+x^2}, \frac{1}{a^2-x^2}, \frac{1}{x^2-a^2}$

$ii)\ \frac{1}{\sqrt{a^2+x^2}}, \frac{1}{\sqrt{a^2-x^2}}, \frac{1}{\sqrt{x^2-a^2}}$

$iii)\ \sqrt{a^2+x^2}, \sqrt{a^2-x^2}, \sqrt{x^2-a^2}$

Integration by decomposition of the integrand into simple rational, algebraic functions.

Integration by parts, Bernoulli's rule and integrals of the form $\int e^x [f(x) + f'(x)]\, dx$.

Unit-II

Definite Integral and its applications:

2. Definite integral, fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals - Area bounded by a curve and axes, Mean and RMS values of a function on a given interval.

Unit -III

Differential Equations:

3. Definition of a differential equation, order and degree of a differential equation, formation of differential equations - Solutions of differential equations of first order and first degree using variables separable method and linear differential equation of the type $\frac{dy}{dx} + Py = Q$ - Solutions of homogenous linear differential equations of second order with constant coefficients.

Unit IV:

Laplace transforms & Fourier series

4. Definition, sufficient conditions for the existence of Laplace transform, Laplace transforms of elementary functions, linearity property, state first shifting theorem with simple problems - Definition of inverse Laplace transform, Inverse Laplace transforms of elementary functions, linearity property, first shifting theorem.

5. Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval $(c\ ,\ c+2\pi)$, Euler's formulae, sufficient conditions for the existence of Fourier series expansion of a function, Fourier series expansion of basic functions limited to k (constant), x over the intervals $(0,\ 2\pi), (-\pi, \pi)$.

Textbook:

Engineering Mathematics-II, a textbook for second year third semester diploma courses, prepared & prescribed by SBTET, AP.

Reference Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Schaum's Outlines Differential Equations, Richard Bronson & Gabriel B. Costa
3. M. R. Spiegel, Schaum's Outline of Laplace Transforms, Schaums' Series.
4. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

Subject Title : **Engineering Mathematics – II**
Subject Code : **AEI/BM/CH/CHOT/CHPP/CHPC/CHST/EC-301**
Periods/Week : **04**
Periods/Semester : **60**

TIME SCHEDULE

S.No.	Chapter/Unit title	No. of Periods	Marks Allotted	Short Type	Essay Type	COs mapped
Unit – I: Indefinite integration						
1	Indefinite integration	20	32	4	2	CO1
Unit – II: Definite Integration and its applications						
2	Definite Integrals	5	11	2	1/2	CO2
3	Area of curves	2	3	1	0	CO2
4	Mean and RMS values	3	8	1	1/2	CO2
Unit – III: Differential Equations						
5	Introduction to Differential Equations	5	3	1	0	CO3
6	Solution of first order differential equations	4	10	0	1	CO3
7	Solution of second order homogeneous differential equations	4	10	0	1	CO3
Unit - IV Laplace transforms & Fourier series						
8	Laplace Transforms	5	10		1	CO4
9	Inverse Laplace Transforms	5	10		1	CO4
10	Fourier Series	7	13	1	1	CO4
	Total	60	110	10	8	
			Marks	30	80	

Engineering Mathematics – II
(Common to AEI/BM/CH/CHOT/CHPP/CHPC/CHST/EC)
Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O 1.1 to L.O 2.7
Unit Test-II	From L.O 3.1 to L.O 4.10

ELECTRONIC CIRCUITS

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
AEI-302	ELECTRONIC CIRCUITS	03	45	20	80

TIME SCHEDULE

S No	Chapter/ Unit Title	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	FET, MOSFET	07	16	**2**	1	**CO1**
2	Transistor biasing and stabilization	09	26	**2**	**2**	**CO2,CO3**
3	Small Signal Amplifiers	06	13	**1**	**1**	**CO4**
4	Feedback amplifiers& Power Amplifiers	08	16	**2**	**1**	**CO5,CO6**
5	Oscillators	07	26	**2**	**2**	**CO7**
6	Sweep circuits & Multi vibrators	08	13	**1**	**1**	**CO8**
	TOTAL	45	110	10	8	

Upon completion of the course the student will be able to:			
Course Objectives	1. Understand the operation of FET,MOSFET		
	2. Familiarize with various transistor biasing and stabilization circuits		
	3. Understand different small signal, large signal amplifiers		
	4. Explain different feedback amplifiers and oscillators		
	5. Understand different sweep circuits and multivibrators.		
Course Outcomes	**CO1**	AEI-302.1	Explain the working of FET and MOSFET
	CO2	AEI-302.2	Understand AC, DC load line, Q point and biasing circuits.

	CO3	AEI-302.3	Explain stabilization circuits and compensation techniques
	CO4	AEI-302.4	Explain the working of small signal amplifiers
	CO5	AEI-302.5	Analyze the importance of feedback
	CO6	AEI-302.6	Categorize feedback amplifiers and explain push pull power amplifier
	CO7	AEI-302.7	Explain various oscillator circuits
	CO8	AEI-302.8	Explain various sweep circuits and multivibrators

LEARNING OUTCOMES

1.0 **Understand the construction and working of FET,MOSFET's.**

1.1 Classify FETs.
1.2 List the advantages of JFET over BJT.
1.3 Draw the symbols of P-channel and N-channel JFET.
1.4 Explain the construction and working of N-channel JFET.
1.5 Draw the drain and transfer characteristics of N-channel JFET.
1.6 List the applications of FET.
1.7 List the types of MOSFETs.
1.8 Explain the construction and principle of operation of N- channel depletion and Enhancement type MOSFETs.
1.9 Explain the construction and principle of operation of CMOSFET.

2.0 Transistor biasing and stabilization

2.1 Explain the transistor as an amplifier in CB, CE and CC modes.
2.2 State, why CE Mode is widely used in amplifier circuits.
2.3 Define DC load line and AC load line.
2.4 Determine the Q- point (operating point) on the DC load line.
2.5 Define transistor biasing.
2.6 State the need for proper biasing in amplifier circuits.
2.7 List the types of biasing circuits.
2.8 Explain potential divider method of biasing.
2.9 Define the term stabilization.
2.10 State the need for stabilization in amplifier circuits.
2.11 Define stability factors S, S_V and S_β.
2.12 List the compensation techniques.
2.13 Explain Diode and Thermistor compensation techniques.

3.0 Small signal Amplifiers

3.1 Classify the amplifiers based on frequency, period of conduction, and coupling.
3.2 State the need of multistage amplifier (Cascading of amplifiers).
3.3 List the types of couplings used in amplifiers.

	3.4 Explain the principle of operation of two-stage RC coupled amplifier with circuit diagram and draw its frequency response. 3.5 Explain the principle of operation of two-stage transformer coupled amplifier with circuit diagram and draw its frequency response. 3.6 Draw and explain the circuit of Direct Coupled Amplifiers. 3.7 Compare RC coupling, transformer coupling and Direct Coupling schemes used in amplifiers. **4.0 Feedback Amplifiers and power amplifiers** 4.1 Compare Negative and Positive feedback. 4.2 Explain the principle of negative feedback in amplifiers. 4.3 Classify negative feedback amplifiers. 4.4 Draw and explain the following block diagram arrangements, of negative feedback amplifiers. (a)Voltage –Series (b) Voltage –Shunt (c) Current- Series (d) Current - Shunt 4.5 Explain the Emitter follower circuit and mention its advantages. 4.6 Explain the working of Darlington amplifier circuit. 4.7 Distinguish between voltage amplifiers and power amplifiers. 4.8 Classify power amplifier circuits on the basis of frequency, period of conduction, and configurations. 4.9 Draw and explain the circuit of Push Pull Amplifier. 4.10 List the advantages of push-pull amplifiers. 4.11 List the applications of power amplifier. 4.12 State the necessity of Heat sink for a power transistor and power I.C. device. 4.13 List the different types of heat sinks. **5.0 Oscillators** 5.1 List the Barkhausen Criterion conditions for an amplifier to work as an oscillator. 5.2 List the essentials of an oscillator. 5.3 Classify oscillator circuits. 5.4 Draw and explain the working of an RC phase shift and Wein bridge oscillator circuits. 5.5 State the conditions of sustained oscillations and give the expression for the frequency of oscillations of RC phase shift oscillator and Wein bridge oscillator circuits. 5.6 Draw and explain the working of Hartley, and Colpitts oscillator circuits. 5.7 Draw and explain the working of Crystal oscillator circuit. 5.8 Write the expressions for frequency of oscillation and mention the conditions for sustained oscillations of Hartley, Colpitts, and Crystal oscillator circuits. 5.9 List the advantages of crystal oscillators over other types. 5.10 State the reasons for instability in oscillator circuits. 5.11 Suggest the remedies for instability in oscillator.

	5.12 List the applications of oscillators. **6.0 Sweep circuits and Multivibrators** 6.1 Define Sweep Voltage. 6.2 State the fundamental consideration of sweep waveform. 6.3 Distinguish between voltage and current time-base generators. 6.4 Explain how transistor works as a switch, in CE mode. 6.5 Draw and explain the Bootstrap sweep circuit. 6.6 Draw and explain Miller's sweep circuit using transistor. 6.7 Draw current sweep circuit using transistor and explain its working with waveform. 6.8 Classify Multivibrators. 6.9 Draw and explain the working of Transistorized Astable, Bistable and Mono Stable multivibrators with waveforms. 6.10 Draw and explain the working of Schmitt trigger circuit using transistor with waveforms.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-302.1	*1*	*1*						*3*	*2*	
AEI-302.2	*1*	*1*	*1*	*1*				*3*	*2*	
AEI-302.3	*1*	*1*		*1*				*3*	*2*	
AEI-302.4	*1*	*1*		*1*				*3*	*2*	
AEI-302.5	*1*	*1*						*3*	*2*	
AEI-302.6	*1*	*1*						*3*	*2*	
AEI-302.7	*1*	*1*						*3*	*2*	
AEI-302.8	*1*	*1*			*1*			*3*	*2*	
Average	*1*	*1*	*1*	*1*	*1*			*3*	*2*	

3= Strongly mapped
2= Moderately mapped
1= Slightly mapped

COURSE CONTENT:

1.0 FET,MOSFET**:** FET- construction and working, characteristics, applications. MOSFET – types, construction and working, applications.

2.0 Transistor Biasing & Stabilization: Transistor as an amplifier, operating point, DC load line, Biasing- types of biasing, potential divider biasing, Stabilization, stability factors, Compensation techniques.

3.0 Small Signal Amplifiers: Classification of amplifiers, working and frequency response of two- stage RC coupled ,transformer coupled amplifiers, and Direct coupled Amplifier

4.0 Feedback Amplifers & Power Amplifiers: Feedback Amplifers- negative and positive feedback. Classification of negative feedback amplifiers, Darlington amplifier, Emitter follower. Power Amplifiers**-** push-pull Amplifier, Comparison of voltage and power amplifiers, Applications of power amplifiers. Heat sink – types and its importance.

5.0 Oscillators: Barkhausen criterion conditions, Classification of oscillators, RC oscillators - RC phase shift oscillator and Wein bridge oscillator. LC Oscillators - Hartley and Colpitts oscillators. Crystal Oscillator working, advantages of crystal oscillator. Reasons and remedies for instability in oscillator circuits. Applications of oscillators.

6.0 Sweep circuits &Multivibrators: Sweep circuits **-** Time base generators, Bootstrap sweep circuit, Miller sweep circuit, Current sweep circuit. Multivibrators**-** Classification of multivibrators, TransistorisedAstable, monostable and bistable multivibrators with waveforms. Schmitt trigger using transistor - operation and waveforms.

REFERENCE BOOKS:

1. Electronic Devices and Circuits by .G.K.Mithal
2. Electronic Devices and Circuits by .David A.Bell 4th edition PHI
3. Electronic Devices and Circuits – T.F. Bogart Jr, J.S.Beasley and G.Rico, Pearson Education,6th edition, 2004.
4. Electronic Principles by Albert Malvino. – J Bates. 7th edition Tata McGraw-Hill Education (TMH) Publishers.
5. Principles of Electronics by V.K. Mehta. S Chand & Company, 2008
6. Electronic Devices and Circuits by A.P.Godse

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 3.7
Unit Test-II	From 4.1 to 6.10

DIGITAL ELECTRONICS

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-303	DIGITAL ELECTRONICS	4	60	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Basics of Digital Electronics	12	26	2	2	CO1
2	Combinational Logic circuits	12	29	3	2	CO2
3	Sequential Logic Circuits	19	26	2	2	CO3
4	Registers and Memories	9	13	1	1	CO4
5	A/D and D/A converters	9	16	2	1	CO5,CO6
	TOTAL	60	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i) ii) iii) iv) v)	Familiarize with various number systems, postulates of Boolean algebra, logic gates. Acquaint with the combinational logic circuits. Acquaint with the Sequential logic circuits. Acquaint with the registers and memories. Acquaint with the A/D and D/A converters.	
Course outcomes	CO1	AEI-303.1	Convert a number from one system to another system, logic gates; simplify logic expressions using Boolean laws and K-map.
	CO2	AEI-303.2	Implement combinational logic circuits.
	CO3	AEI-303.3	Implement sequential logic circuits.
	CO4	AEI-303.4	Classify different registers, semiconductor memories.
	CO5	AEI-303.5	State the need of converters, define the terminologies pertaining to converters.
	CO6	AEI-303.6	Explain the principle of operation of A/D and D/A convertors.
Learning Outcomes	**1.0 Understand the basics of Digital Electronics** 1.1 Explain Binary, Octal, Hexadecimal number systems and compare with decimal system.		

	1.2 Convert one number system to another of the above systems. 1.3 Perform binary addition, subtraction, Multiplication and Division. 1.4 Write 1's complement and 2's complement numbers for a given binary number. 1.5 Perform subtraction of binary numbers in 2's complement method. 1.6 Compare weighted and Un-weighted codes. 1.7 Write Binary equivalent number for number in 8421, Excess-3 and Gray code and vice-versa. 1.8 State the use of alphanumeric codes (ASCII & EBCDIC) 1.9 State the importance of parity Bit. 1.10 List the types of parity bits. 1.11 State different postulates in Boolean algebra. 1.12 Write Boolean expressions for the given statement of the problem (Limited 3 variables only). 1.13 State De-Morgan's theorems. 1.14 Apply De-Morgan's theorems and other postulates to simple Boolean expressions. 1.15 Write Boolean expressions from the given truth table. 1.16 Use Karnaugh map to simplify Boolean Expression (up to 3 variables only). 1.17 Explain AND, OR, NOT operators with truth table. 1.18 Explain the working of an exclusive – OR gate with truth table. 1.19 Explain the working of NAND, NOR gates using truth tables. 1.20 Develop AND, OR, NOT operations using NAND, NOR gates. 1.21 List the numbers of two input Digital IC Logic gates. **2.0 Understand the working of combinational logic circuits** 2.1 Define combinational logic circuit. 2.2 State the function of the Half-adder. 2.3 Draw Half adder circuit using Exclusive OR gate and an AND gate. 2.4 Realise a Half-adder using NAND gates only and NOR gates only. 2.5 State the function of the full-adder. 2.6 Draw full adder using basic gates. 2.7 Show that two Half-adders and an OR – gate constitutes a full-adder. 2.8 Draw a 4 Bit parallel adder using full – adders. 2.9 Explain the working of the above circuit. 2.10 Draw and Explain 2's compliment parallel adder/ subtractor circuit. 2.11 Explain the working of a serial adder with a Block diagram. 2.12 Distinguish between serial and parallel adder. 2.13 Draw and explain the operation 4 X 1 Multiplexer 2.14 Draw and explain the operation 1 X 4 De-multiplexer 2.15 Draw and explain 2 X 4 and 3 X 8 decoders. 2.16 List the applications of Multiplexer and decoder. 2.17 Explain the working of 4 X 2 encoder. 2.18 Draw and explain one-bit digital comparator. **3.0 Understand the working of Sequential logic circuits** 3.1 Define Sequential logic circuit.

	3.2 Distinguish between synchronous and asynchronous sequential logic circuits. 3.3 Construct SR flip flop using NAND gates and explain its operation. 3.4 Explain JK flip flop with the help of truth table. 3.5 State the need for preset and clear inputs. 3.6 State the race around condition. 3.7 List the conditions for eliminating the race around condition. 3.8 Explain JK Master Slave flip flop with truth table. 3.9 Explain the D flip flop and T flip-flop with the help of truth table and diagram. 3.10 Define counter. 3.11 Differentiate between synchronous and asynchronous counters. 3.12 Define Modulus of the Counter. 3.13 Explain asynchronous ripple counter (MOD-16) with the help of flip-flops and timing diagrams. 3.14 Explain asynchronous ripple counter (MOD-10 or Decade. counter) with the help of flip-flops and gates. 3.15 Explain synchronous ripple counter (MOD-16) with the help of flip-flops and gates. 3.16 Explain the working of Ring counter and list its applications. **4.0 Understand working of Registers and memories** 4.1 Define the term Register. 4.2 State the need for a Register. 4.3 Explain the working of serial in Serial out, serial in Parallel out, Parallel in serial out and Parallel in parallel out Registers. 4.4 Explain the working of shift left and shift right Registers. 4.5 Explain the working of Universal shift register (74194 or equivalent) 4.6 List the applications of Register. 4.7 List various types of memories 4.8 Differentiate between ROM and RAM. 4.9 Explain basic principle of working of ROM. 4.10 State different types of ROM. 4.11 Explain basic principle of working of RAM. 4.12 Compare static RAM and dynamic RAM. 4.13 List different ROM and RAM ICs. **5.0 A/D and D/A converters** 5.1 State the need for A/D converters. 5.2 State the need for D/A conversion. 5.3 Explain the basic principle of D/A conversion. 5.4 Define the terms resolution, Accuracy, Monotonicity and settling time of D/A converter. 5.5 Explain D/A conversion using weighted resistors. 5.6 Explain D/A conversion using R-2R ladder network. 5.7 Explain A/D conversion using counter method. 5.8 Explain A/D conversion using successive approximate method.

COURSE CONTENTS

1.0 Basics of Digital Electronics
Binary, Octal. Hexadecimal numbering systems. Conversion from one system to another number system. Binary codes, excess-3 and gray codes. Logic gates: AND, OR, NOT, NAND, NOR, Exclusive-OR. Boolean algebra, Boolean expressions. Demorgan's Theorems. Karnaugh map.

2.0 Combinational logic circuits
Half adder, Full adder, Serial and parallel Binary adder. Parallel adder, Multiplexer, Demultiplexer, decoder, encoder, Digital comparator

3.0 Sequential logic circuits
Principle of flip-flops operation, RS, D, JK, T, JK Master Slave flip-flops. Binary counter, asynchronous ripple counter, decade counter., synchronous counter, Ring Counter.

4.0 Registers and memories

Shift Registers- serial in Serial out, serial in Parallel out, Parallel in serial out and Parallel in parallel out Registers. Universal shift registers-Applications.RAM, ROM, static RAM, dynamic RAM.

5.0 A/D and D/A Converters
Necessity of A/D and D/A converters.Weighted resistors and R-2R ladder method of D/A converters.Counter and SAR method of A/D converters.

Reference Books

1. Modern Digital Electronics By RP JAIN TMH
2. Digital Electronics Tokhem TMH
3. Digital Electronics Puri TMH
4. Digital Computer Fundamentals by Barty
5. Digital Electronics and logic design by B. Somanathan Nair, PHI
6.Digital Computer Electronics by Malvino., TMH
7.Digital logic and computer design by M. Morris Mano.

CO-PO/PSO MATRIX

CO No	*PO 1*	*PO 2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-303.1	*1*	*1*	*1*					*3*	*2*	
AEI-303.2	*1*	*1*	*1*					*3*	*2*	
AEI-303.3	*2*		*2*					*3*	*2*	
AEI-303.4	*1*		*1*	*2*				*3*	*2*	
AEI-303.5	*1*							*3*	*2*	

AEI-303.6	*1*			*2*	*1*			*3*	*2*	*1*
Average	*1.2*	*1*	*1.25*	*2*	*1*			*3*	*2*	*1*

3= Strongly mapped
2= Moderately mapped
1= slightly mapped

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 3.5
Unit Test-II	From 3.6 to 5.8

ELECTRONIC MEASURING INSTRUMENTS

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
AEI-304	ELECTRONIC MEASURING INSTRUMENTS	04	60	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Analog instruments	17	29	3	2	CO1,CO2
2	Digital instruments	11	26	2	2	CO2
3	Cathode Ray Oscilloscope	17	26	2	2	CO3
4	Signal generators	7	16	2	1	CO4
5	Test instruments	8	13	1	1	CO5
	TOTAL	60	110	**10**	**8**	

Upon completion of the course the student shall be able to		
Course Objectives	(i)	Familiarize with Analog and digital instruments.
	(ii)	Explain the working of cathode ray oscilloscope.
	(iii)	Explain the working of signal generators.
	(iv)	Explain the working of test instruments.

Course outcomes	CO1	AEI-304.1	Classify the analog instruments and bridge circuits.
	CO2	AEI-304.2	Explain the working of Analog andDigital instruments.
	CO3	AEI-304.3	Explain the working of cathode ray oscilloscope.
	CO4	AEI-304.4	Explain the working of AF and RF signal generators.
	CO5	AEI-304.5	Explain the working principles of test instruments.
LEARNING OUTCOMES	**1.0**	**Analog instruments**	
	1.1	Classify the analog measuring instruments.	
	1.2	List the different torques needed for driving analog instruments.	

	1.3 Explain the construction and principle of operation of PMMC instrument. 1.4 Explain the principle of operation of extending the range of DC ammeter. 1.5 Explain the principle of operation of extending the range of DC voltmeter. 1.6 Explain the construction and principle of operation of Moving Iron instrument. 1.7 Explain the principle and working of rectifier type voltmeters. 1.8 Explain the construction and principle of operation of series and shunt type ohmmeters. 1.9 State the need for high input impedance for a voltmeter. 1.10 Explain the working of FET input voltmeter with necessary circuit (DC/AC). 1.11 Explain the working of differential voltmeters. 1.12 Define sensitivity of voltmeter and explain loading effect. 1.13 State the use of Megger for insulation measurements. 1.14 Give the classification of bridge circuits. 1.15 Mention the balancing conditions of bridges (AC and DC). 1.16 Explain the resistance measurement using Wheatstone bridge. 1.17 Explain the inductance measurement using Maxwell's bridge. 1.18 Explain the capacitance measurement using Schering bridge. 1.19 Solve problems on sensitivity of voltmeter and above bridges. **2.0 Digital instruments** 2.1 List the advantages of digital instruments over analog instruments. 2.2 Explain the working of digital voltmeters (RAMP type, successive approximation type) with block diagrams. 2.3 List the specifications of digital voltmeters. 2.4 Explain the working of Digital Multimeter with block diagram. 2.5 List the specifications of Digital Multimeter. 2.6 Explain the working of Digital frequency meter with block digram. 2.7 List the specifications of Digital frequency meter. 2.8 Explain the working of Digital LCR meter with block diagram. 2.9 List the specifications of Digital LCR meter. **3.0 Cathode Ray Oscilloscope** 3.1 Draw the block diagram of general purpose CRO and describe the function of each block. 3.2 Sketch CRT and describe the function of each block. 3.3 State the necessity of time base generator. 3.4 Write the expression for deflection sensitivity. 3.5 List the conditions for stationary and flicker free waveforms. 3.6 Explain triggered sweep with necessary circuit, and mention its advantages. 3.7 List the front panel controls of CRO and state their function. 3.8 List its specifications of CRO. 3.9 List the applications of CRO. 3.10 Explain the procedure for measurement of voltage (DC and AC), frequency and phase using CRO. 3.11 Explain the Dual Trace Oscilloscope with block diagram.

	3.12 Explain the principle of operation of Storage oscilloscope with block diagram. 3.13 Explain the principle of operation of Digital oscilloscope with block diagram. **4.0 Signal generators** 4.1 Explain the working of AF Oscillator (sine and square) with block diagram. 4.2 List the front panel controls of AF Oscillator and state their function. 4.3 List specifications of AF Oscillator. 4.4 Explain the working of Function generator with block diagram. 4.5 List the applications of AF oscillators and function generators. 4.6 Explain the working of RF signal generator. 4.7 List specifications and applications of RF signal generator. 4.8 State the importance of shielding in RF generators. **5.0 Test Instruments** 5.1Define Q-Meter. 5.2Explain the working of Q-meter with diagram. 5.3Explain the working of Digital IC tester with block diagram. 5.4Explain the working of Logic analyzer with block diagram. 5.5State the necessity of Plotter and Recorders. 5.6List the different Recorders. 5.7Explain the working of XY recorders. 5.8Explain the working of Plotter.

C-PO/PSO MATRIX

CO No	*PO 1*	*PO 2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-304.1	2							2	1	
AEI-304.2	1							2	1	
AEI-304.3	2	1			2			2	1	
AEI-304.4	1	1						2	1	
AEI-304.5	1				1			2	1	
Average	1.4	1			1.5			2	1	

3= strongly mapped
2= moderately mapped
1= slightly mapped

COURSE CONTENTS

1. **Analog instruments:**
   PMMC Instrument, extending the range of instruments, Moving Iron Instruments, rectifier type voltmeter, Series and Shunt type ohmmeter, FET input voltmeter, Meggar, differential voltmeter, Wheatstone, Maxwell, Schering Bridge.
2. **Digital Instruments:**
   Digital voltmeter (Ramp Type, Successive Approximation Type) Digital Multimeter. Digital frequency meter, Digital LCR Meter.
3. **Cathode Ray Oscilloscope:**

   Block diagram of general purpose CRO, sweep circuits, triggered sweep circuit, front panel controls of CRO. Specifications and applications of CRO, dual trace CRO, Storage CRO, and Digital CRO.
4. **Signal generators**
   AF oscillator-specifications function generator, RF signal generator-specifications.
5. **Test instruments:**
   Q meter, Plotter and Recorders. Digital IC tester, Logic analyser.

Reference Books

1. Electronic instrumentation and measurements by David A Bell, PHI
2. Electronic Instrumentation by H S Khalsi,TMH
3. Electronic measurements by A K Shaurky
4. Electronic Measurements & Instruments by Cooper PHI
5. Modern Electronic Equipment by Khandpur
6. Electrical, Electronic Measurements and Instruments by Sawhney

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 2.9
Unit Test-II	From 3.1 to 5.8

SENSORS AND TRANSDUCERS

Course code	Course title	Periods/Week	Total no. of periods	Marks for FA	Marks for SA
AEI-305	**Sensors and Transducers**	06	90	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Fundamentals of Instrumentation	13	16	2	1	C01
2	Displacement and position measurement	14	13	1	1	CO2
3	Temperature measurement	11	16	2	1	CO3
4	Pressure measurements	11	13	1	1	CO4
5	Flow measurements	14	16	2	1	CO5
6	Level measurements	08	13	1	1	CO6
7	Miscellaneous measurements	08	13	1	1	CO7
8	Smart sensors	11	10	-	1	CO8
	TOTAL	90	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i) (ii)		Understand the importance of instrumentation fundamentals. Understand the various measurement techniques used for the measurement of displacement, position, temperature, pressure, flow, level, density, viscosity, weight, humidity and smart sensors.
Course outcomes	CO1	AEI-305.1	Understand the terminology related to Instrumentation.
	CO2	AEI-305.2	Explain the principles of displacement and position measurement using different transducers.
	CO3	AEI-305.3	Explain the principles of temperature measurement using different transducers

	CO4	AEI-305.4	Explain the principles of pressure measurement using different transducers
	CO5	AEI-305.5	Explain the principles of flow measurement using different flow meters.
	CO6	AEI-305.6	Explain the principles of level measurement.
	CO7	AEI-305.7	Explain principles of miscellaneous measurements.
	CO8	AEI-305.8	Explain principles of smart sensors for measurement.

Learning Outcomes

1.0 Fundamentals of Instrumentation

1.1 Draw and explain the block diagram of Measurement system.
1.2 Explain the basic characteristics of measuring system.
1.3 Understand the Static and Dynamic characteristics of an instrument.
1.4 Understand the terms: Accuracy, Precision, Error, Linearity, Hysteresis, Resolution, Threshold, Repeatability, Reliability, and Span.
1.5 Define calibration and state the need of calibration.
1.6 List different types of calibrations.
1.7 Explain primary, secondary, field and automatic calibration mechanisms.
1.8 Explain the above calibration methods for temperature, flow and pressure parameters.
1.9 Define the terms transducer and Sensor.
1.10 Give the classification of the transducers.
1.11 Define Active transducer and passive transducer with examples
1.12 State the basic requirements of Transducers.

2.0 Displacement and position measurements

2.1 Explain the principle of operation of the following.

2.1.1 Linear potentiometers
2.1.2 Linear variable differential transformers (LVDT)
2.1.3 Linear variable Reluctance transducers (LVRT)

2.2 Explain the principle of Inductive and capacitive proximity sensors for position measurement.
2.3 Explain the principle of Resistance strain gauge.
2.4 Derive the expression for gauge factor and solve simple problems.
2.5 Explain the principle of operation of Rotary variable differential transformer (RVDT).
2.6 State the importance of vibration monitoring.
2.7 Explain the principle of operation of the following for linear velocity measurement.
2.7.1 Moving coil type velocity transducer

		2.7.2 Moving iron type velocity transducer 2.8 Explain the principle of operation of the following for angular velocity measurement. 2.8.1 A.C Tacho generators 2.8.2 Photo electric Tachometer 2.8.3 Toothed rotor variable reluctance Tachometer. **3.0 Temperature measurement** 3.1 Explain the principle of operation the following 3.1.1 Thermo-resistive 3.1.2 Resistance Temperature Detectors 3.1.3 Thermistors 3.1.4 Acoustic 3.1.5 Piezoelectric 3.2Explain the principle of operation of the following 3.2.1 Bi-metallic strip 3.2.2 Liquid filled thermometers 3.2.3 Thermocouple 3.2.4 Optical pyrometer 3.2.5 Radiation pyrometer 3.3 Derive the expression of coefficient of temperature for RTD $\alpha = (R_T - R_0) / R_0 (T_2 - T_1)$ and solve simple problems. 3.4 Explain the principle of operation of Solid state sensors. 3.5 List any three IC temperature sensors with its ranges and uses 4.0 **Pressure measurement** 4.1 To know the description and principle of operation of Elastic elements for pressure measurement Like: 4.1.1 Membrane diaphragm 4.1.2 Thin plate diaphragm 4.1.3 corrugated diaphragm 4.1.4 Single capsules 4.1.5 Double capsules 4.1.6 Bellows 4.1.7 C-shaped bourdon tube 4.1.8 Twisted bourdon tube 4.1.9 Helical bourdon tube 4.2 Know the description and principle of operation of Electrical pressure transducers such as: 4.2.1 Potentiometric device 4.2.2 Strain gauge transducer 4.2.3 Variable reluctance sensor 4.2.4 Piezoresistive 4.2.5 Variable capacitance device 4.2.6 Thin plate pressure transducer 4.2.7 Tactile pressure transducer 4.2.8 Piezo – electric pressure transducer 4.3 Understand the necessity and principle of pressure multiplexer. 4.4 Understand the procedures for pressure calibration using dead weight tester. **5.0 Flow measurement** 5.1 Know the description, principle of operation and application of

		the following: 5.1.1 Head – type flow meter based on differential pressure measurement like Such as: 5.1.1.1 Orifice plate 5.1.1.2 Venturi tube 5.1.1.3 Pitot tube 5.1.2 Electromagnetic flow meters. 5.1.3 Rotameters (variable – area meters) 5.1.4 Mechanical flow meters 5.1.5 Positive displacement type 5.1.6 Turbine flow meters. 5.1.7 Anemometers 5.1.7.1 Cup type Anemometers 5.1.7.2 Hot wire/hot film type Anemometers. 5.1.8 Ultrasonic flow meters 5.1.9 Thermal flow meters. 5.1.10 Laser anemometers. **6.0 Level measurement** 6.1 Understand the principle of operation and application of the following: 6.1.1 Liquid level sight glass 6.1.2 Float Actuated level indicators 6.1.3 Resistive type level indicator. 6.1.4 Inductive type level indicator. 6.1.5 Capacitance type level indicators 6.1.6 Nucleonic level gauge. 6.1.7 Ultrasonic level gauge **7.0 Miscellaneous measurements** 7.1 Define the term density. 7.2 Explain the principle of operation of the following: 7.2.1 Displacement type densitometer 7.2.2 Fluid dynamic type densitometer 7.2.3 Capacitance type densitometer 7.3 Define the term Viscosity. 7.3 To understand the principle of operation of the following: 7.3.1 Capillary viscometers 7.3.2 Falling ball viscometers 7.3.3 Rotating viscometers 7.4 Explain the principle of operation of the following for weight measurement and list their applications: 7.4.1 Hydraulic load cells 7.4.2 Pneumatic load cells 7.4.3 Strain gauge load cells 7.5 Define Humidity and relative Humidity. 7.6 Explain the description and principle of operation of the following: 7.6.1 Condensation type Hygrometers 7.6.2 Electrolytic Hygrometers. **8.0 Smart sensors** 8.1 Differentiate sensor and smart sensor.

		8.2 Draw the block diagram of smart sensor and explain its architecture. 8.3 Explain the evolution of smart sensor as 1st, 2nd, 3rd, 4th, 5th generations. 8.4 Explain IR sensor and list its applications. 8.5 Explain motion detection sensors and list its applications. 8.6 Explain Accelerometer sensor and list its applications. 8.7 Explain about Hall Effect accelerometer and piezoelectric accelerometer. 8.8 Explain Gyroscope sensor and list its applications. 8.9 Explain the principle of operation, applications of Flame Sensors. 8.10 Explain the principle of operation, applications of Leak Detectors. 8.11 Explain the principle of operation, applications of Noise Sensors.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-305.1	*1*	*1*						*3*	*2*	
AEI-305.2	*1*	*1*			*1*			*3*	*2*	*1*
AEI-305.3	*1*	*1*			*1*			*3*	*2*	*1*
AEI-305.4	*1*	*1*		*1*				*3*	*2*	*1*
AEI-305.5	*1*	*1*						*3*	*2*	*1*
AEI-305.6	*1*	*1*						*3*	*2*	*1*
AEI-305.7	*1*	*1*						*3*	*2*	*1*
AEI-305.8	*1*	*1*						*3*	*2*	*1*
Average	*1*	*1*		*1*	*1*			*3*	*2*	*1*

3= Strongly mapped
2= Moderately mapped
1= Slightly mapped

COURSE CONTENTS

1. **Fundamentals of Instrumentation**

   Generalized Measurement System – Block Diagram-Functional description of measuring systems-Basic characteristics of a measuring system- Accuracy, Precision, Error, Linearity, Hysteresis, Resolution, Threshold, Repeatability, Reliability, Span-Transducer-Definition- Classification-Basic requirements of a transducer-Calibration. Classification of Transducers, Basic Requirements of transducers.

2. **Concept of Displacement and Position Measurements**

   Linear potentiometers, L.V.D.T, linear variable Reluctance Transducers, Inductivity & capacitive proximity sensors, Resistance strain gauge, RVDT, vibration monitoring, linear velocity measurement- moving coil type velocity transducers, moving iron type velocity transducers, Angular velocity speed measurements -AC Tacho generators, Photo electric tachometer, Toothed rotor variable reluctance tachometer.

3. **Temperature measurement**
   Bimetallic strip, liquid filled thermometer. Resistance temperature Detectors, thermocouple, Thermistor , Pyrometer, IC temperature sensors

4. **Pressure measurements**: Elastic elements used for pressure measurements and principle of pressure transducers, principle of pressure multiplexer, pressure calibration

5. **Flow measurements:** Head type of flow meters , electromagnetic flow meters, rotameters , mechanical flowmeters, Anemometers, Ultra sonic flow meters, thermal flowmeters , Pneumatic transmitters. Orifice plate, Electromagnetic flow meters and Turbine flow meters.

6. **Level measurements:** Liquid level sight glass , float actuated level indicator, resistance, inductance, capacitance type level indicators, nucleonic, Ultrasonic level gauges.

7 .**Miscellaneous measurements:** Displacement type, Fluid dynamic type, Capacitance type density measurement. Capillary viscometers, Falling ball viscometers, Rotating viscometers, Hydraulic load cells, Pneumatic load cells, Strain gauge load cells, Humidity, Relative humidity, Condensation type Hygrometer, Electrolytic hydrometer.

8. **Smart sensors:** Definition of smart sensor- block diagram and its architecture of smart sensor- Evolution of smart sensor-1st,2nd ,3rd,4th,5th generations - IR sensors, Motion

detection sensors- Accelerometer sensors- Gyroscope sensors- flame sensor-leak detector-noise sensor.

REFERENCE BOOKS:

1. Principles of Industrial Instrumentation By Patranabis.
2. Industrial Instruments and Control by S.K.Singh
3. Mechanical Measurements and Control by DS. Kumar
4. Instrument Engineer Hand Book by Liptack.
5. Electronics Instruments and Instrumentation Technology by M.M.S. Anand
6. Instrumentation Measurement, Devices and systems by Rangan Mani and Sharma.
7. Instrument Technology Vol-I BY E.B. Jones.
8. Transducers Technology by DVS Murthy.
9. Electronic Measurement and Instrumentation by Nakra & Chowdary.
10. Electrical and Electronics Measurement and Instrumentation by A.K. Sahwney

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 4.1
Unit Test-II	From 4.2 to 8.11

ALGORITHM DESIGN USING C WITH DATA STRUCTURES

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-306	ALGORITHM DESIGN USING C WITH DATA STRUCTURES	5	75	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	C Programming Basics	15	20	-	2	CO1
2	Pointers	8	16	2	1	CO1
3	Introduction to Data structures	8	16	2	1	CO2
4	Sorting	10	16	2	1	CO3
5	Searching	14	16	2	1	CO4
6	Linear data structures	10	16	2	1	CO5
7	Non Linear Data Structures	10	10	-	1	CO6
	TOTAL	**75**	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i)	Familiarise with the knowledge of different types of data structures, algorithms, sorting techniques, searching techniques, stack, queue and graph concepts etc.	
Course outcomes	CO1	*AEI-306.1*	Have a understanding of store and manage the addresses of dynamically allocated blocks of memory.
	CO2	*AEI-306.2*	Be able to analyze the efficiency of programs based on time complexity.
	CO3	*AEI-306.3*	Have a good knowledge of sorting techniques
	CO4	*AEI-306.4*	Be able to understand principle of searching techniques.
	CO5	AEI-306.5	Have a Understanding of stack, queue and linked list operation.
	CO6	AEI-306.6	Have knowledge of tree and graph concepts.

Learning Outcomes	**1.0 C Programming Basics** 1.1 Define High level language and low level language. 1.2 Explain the structure of C language. 1.3 List the steps involved in executing the C program 1.4 Mention the character set of C language. 1.5 Define the Keywords and list them 1.6 Define the Identifiers and list them. 1.7 List the data types used in C and explain them with examples. 1.8 Explain printf () and scanf () functions with examples. 1.9 Write the syntaxes of the following decision making statements and explain a. If b. If.. else. c. Nested if …else d. If… else ladder .. 1.10 Write the syntaxes of the following loop control statements and explain a. for b. while c. do… while 1.11 Define an Array. 1.12 Explain declaration and initialization of One Dimensional Array. 1.13 Explain accessing the elements in the Array. 1.14 Define String 1.15 Explain the String handling functions strcat(), strcmp(), strcpy() and strlen() with examples. 1.16 Define function. 1.17 Define function prototype. 1.18 Define a function call. 1.19 Define a structure 1.20 Explain declaring structure variable. 1.21 Define a Union. 1.22 Differentiate between structure and union. **2.0** ***Basics of Pointers*** 2.1 Define Pointer 2.2 Explain declaration and initialization of Pointers. 2.3 Explain Illustrate accessing the address of a variable using & operator. 2.4 Explain accessing a value of a variable through pointer. 2.5 List difference between address of operator (&) and de-referencing operators (*). 2.6 Explain about pointer arithmetic. 2.7 Explain precedence of address of operator (&) and de-referencing operators (*) 2.8 Explain relationship between arrays and pointers. 2.9 Explain accessing array elements using pointers.

	2.10 Explain Array of Pointers with examples. 2.11 Explain use of pointer to structure. 2.12 Explain concept of structures containing pointers. 2.13 Explain Self referential structures with examples **3.0 Introduction to Data Structures** 3.1 Explain dynamic memory management functions MALLOC, CALLOC, FREE andREALLOC and illustrate with examples to use these functions 3.2 Define data structure and classify them. 3.3 Explain linear data structures. 3.4 Describe nonlinear data structures. 3.5 Explain data types and abstract data types. 3.6 State algorithm analysis for time requirements. ***4.0 Sorting techniques*** 4.1 Define sorting. 4.2 State the need of sorting. 4.3 List the four methods of sorting 4.4 Explain the method of bubble sort. 4.5 Write the algorithm for bubble sort and define its complexity. 4.6 Discuss the program for bubble sort. 4.7 Explain the method of selection sort. 4.8 Write the algorithm for selection sort and define its complexity. 4.9 Discuss the program for selection sort. 4.10 Explain the method of insertion sort. 4.11 Write the algorithm for insertion sort and define its complexity. 4.12 Discuss the program for insertion sort. 4.13 Explain the method of quick sort. 4.14 Explain the method of merging sort. 4.15 Discuss the program to implement merge sort. 4.16 List applications of sorting. ***5.0 Searching Techniques*** 5.1 Define searching. 5.2 State the need of searching. 5.3 List two types of searching.

	5.4 Explain the method of Linear Search. 5.5 Write the algorithm for Linear Search and its complexity. 5.6 Discuss the program for Linear Search. 5.7 Explain the method of Binary Search. 5.8 Write the algorithm for Binary Search and its complexity. 5.9 Discuss the program for Binary Search. 5.10 Applications of searching and sorting. ***6.0 Linear Data structures*** 6.1 Define stack. 6.2 Explain the two operations of a stack. 6.3 Explain Implementation of stacks. 6.4 List applications of stacks. 6.5 Convert infix to postfix expression. 6.6 Evaluate postfix expression. 6.7 Define queue. 6.8 Explain the operations on queues. 6.9 Discuss application of queues. 6.10 Explain array implementation of queue. 6.11 Implement circular queues. 6.12 Explain priority queues. 6.13 Definition of sparse matrix – converting ordinary matrix to sparse matrix. 6.14 List advantages of linked lists. 6.15 State the purpose of dummy header. 6.16 Create a singly linked list and display it. 6.17 Perform insertion and deletion operation on a singly linked list. 6.18 Know how to search and replace an element in a single linked list. 6.19 Create a circular singly linked list. 6.20 Insert and delete elements in a doubly linked list. 6.21 Create a circular doubly linked list. ***7.0 Know the Tree structures***

	7.1	Define a tree.
	7.2	Explain the terminology related to tree.
	7.3	Define a binary tree.
	7.4	Explain the linear representation and linked list representation of a Binary tree.
	7.5	Write a program to create and display a tree.
	7.6	Perform traversal operation on trees.
	7.7	Construct a tree using in order and preorder traversal.
	7.8	Construct a tree using in order and post order traversal.
	7.9	Convert general trees to binary trees.
	7.10	Perform operations on a binary tree.
	7.11	List Applications of trees.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-306.1	**1**	**1**		**1**	**1**			**3**	**2**	
AEI-306.2	**2**	**2**		**2**	**2**			**3**	**2**	
AEI-306.3	**1**	**1**		**1**	**1**			**2**	**2**	
AEI-306.4	**1**	**1**		**1**	**1**			**3**	**1**	**1**
AEI-306.5	**1**	**1**		**1**	**1**			**2**	**2**	**1**
AEI-306.6	**1**	**1**		**1**	**1**			**1**	**1**	**1**
Average	**1.2**	**1.2**		**1.2**	**1.2**			**2.3**	**1.7**	**1**

3= Strongly mapped
2= Moderately mapped
1= Slightly mapped

COURSE CONTENT

1. **C-Programming Basics**
   Structure of a C programme, Character Set, Constants, Variables, Data types, Decision and Loop control Statements, Arrays and Strings, Functions in C, Structures and Unions.

2. **Pointers**

Pointer - Declaration and Initialization of Pointers- Accessing the address of a variable using & operator- Accessing a value of a variable through pointer - Differentiate address and de- referencing operators - Pointer Arithmetic- precedence of address and de-referencing operators - Relationship between Arrays and Pointers - Accessing array elements using pointers- Pointers as Function Arguments - Discuss Array of Pointers with examples- pointers and structures.

3. ***Introduction to Data structures***

Dynamic Memory allocation – Introduction to Dynamic memory allocation, allocating a block of memory using Malloc, Allocating multiple blocks of memory using Calloc, Releasing the usedspace using Free, and Altering the size of memory using Realloc.

Data structures – Data types & Abstract data type(ADT), Categorization of data structures - Linear & nonlinear , Algorithm analysis- time complexity – elementary asymptotic (big-oh, Omega, Theta notation) and space Complexity.

4. ***Sorting***

Sorting Algorithms– bubble sort program and algorithm analysis for time complexity, selection sort program and algorithm analysis for its time complexity, insertion sort program and algorithm analysis for time complexity, quick sort program and algorithm analysis for time complexity& Merge sort program and algorithm analysis for time complexity, Application of sorting techniques.

5. ***Searching***

Searching Algorithms – sequential (Linear) search - program and algorithm analysis, Binary search-program and algorithm analysis, and application of searching techniques.

6. ***Linear data structures***

Stack and Queues - Implementation of stacks, application of stacks, converting infix to postfix expression and evaluation of expression – Applications & Implementation of queues, Circular queues, Priority queue – sparse matrix.

Linked Lists – Creation of Singly linked lists – insert, delete, search and replace an element in a single linked list – Create circular singly linked list. Doubly linked list – Create, insert, delete elements in doubly linked list - Create circular double

linked list.

7. ***Non Linear Data Structures***

   Trees - Trees –Binary trees – Linear representation – Linked list representation, tree traversals, Tree Conversion & Applications

REFERENCE BOOKS

1. Understanding pointers in C- YashwanthKanetk.
2. Data Structures using C – E Balaguru Swamy
3. Data Structures: A Pseudocode Approach with C++ - Gilberg / Forouzan
4. Data Structures using C – Aaron M. Tanenbaum.
5. Data structures through C- Yashwanth Kanetkar.

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.Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 4.16
Unit Test-II	From 5.0 to 7.11

Electronic Circuits Lab

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
AEI-307	Electronic Circuits Lab	3	45	40	60

TIME SCHEDULE

S No	Chapter/ Unit Title	No. of Periods	COs Mapped
I	FET & MOSFET	09	CO1
II	Amplifiers	12	CO2
III	Oscillators & Multi vibrators	12	CO3
IV	Circuit simulation using P spice or equivalent	12	CO4
	TOTAL	45	

Upon completion of the course the student shall be able to:			
Course Objectives	1. Plot the characterics of electronic devices and to construct amplifiers and Oscillators.		
	2. Simulate rectifiers, amplifiers and Oscillator circuits using simulation software.		
	3. Learn the practical importance of Electronic Circuits.		
Course Out comes	**CO1**	*AEI-307.1*	Identify & Plot the characteristics of FET and MOSFET.
	CO2	*AEI-307.2*	Construct the Amplifiers and Plot their frequency responses.
	CO3	*AEI-307.3*	Construct Oscillators & Multi vibrators and obtain their output waveforms.
	CO4	*AEI-307.4*	Simulate amplifiers, Oscillators and multi vibrator using P-spice or equivalent.
LEARNING	**I. FET & MOSFET :**		

OUTCOMES	1. Identify the terminals of FET and plot the drain and transfer characteristics of FET. 2. Identify the terminals of MOSFET and plot the drain characteristics of MOSFET and calculate the values of Transconductance (g_m) and drain resistance (r_{ds}). **II. AMPLIFIERS**: 3. Perform an experiment on RC coupled Amplifier, plot its frequency response and measure the bandwidth (BW). 4. Perform an experiment on CE amplifier with and without feedback and compare its frequency response. **III. OSCILLATORS and MULTIVIBRATORS:** 5. Implement Colpitt's oscillator and verify the effect of varying the tank circuit component values and observe output waveforms. 6. Implement Crystal oscillator and observe output waveforms. 7. Implement RC Phase shift oscillator and verify the effect of varying the RC component values and observe output waveforms. 8. Construct transistorized stable multi vibrator and draw its waveforms. **IV. Circuit simulation using P spice or equivalent:** 9. Familiarize with the P spice modeling using e-CAD software ▪ Representation of passive elements ▪ Representation of active elements ▪ Representation of time Vary signals 10. Simulate of CE amplifier and observe the effect of disconnecting bypass capacitor. 11. Simulate Hartley oscillator circuit and observe the effect of change in component values. 12. Simulate transistorized Mono stable circuit and observe the effect of change in component values.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-307.1	***1***	***1***		***3***				3	2	
AEI-307.2	***1***	***1***		***3***				3	2	
AEI-307.3	***1***	***1***		***3***				3	2	
AEI-307.4	***1***	***1***			***1***			3	2	1
Average	***1***	***1***		***3***	***1***			3	2	1

3= strongly mapped 2= moderately mapped 1= slightly mapped

PROGRAMMING IN C& MATLAB

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
AEI-308	PROGRAMMING IN C & MATLAB	03	45	40	60

TIME SCHEDULE

S No	Chapter/ Unit Title	No. of Periods	COs Mapped
I	C Programming Basics	6	CO1
II	Decision & Loop Control Statements	9	CO2
III	Exercises on functions	6	CO3
IV	Arrays, Strings and Pointers in C	9	CO2
V	Structures and Unions	6	CO3
VI	MAT Lab	9	CO4
	Total	45	

Course Objectives	1. To familiarize with programming in Programming In C and MATLAB		
	2. To understand the programming concepts of Programming In C and MATLAB		
	3. To learn the practical importance and applications of programming in C and MATLAB.		
Course Out comes	CO1	AEI-308.1	Describe the usage of C Compiler.
	CO2	AEI-308.2	Apply loop, control statements, Arrays and strings in C language
	CO3	AEI-308.3	Apply pointers, functions, structures and unions in C- Language.
	CO4	AEI-308.4	Practice on basics of MATLAB.
LEARNING OUTCOMES	**I. C Programming Basics** 1. Familiarize with turbo Compiler features. 2. Write a program to display "WELCOME TO C PROGRAMMING" on the screen 3. Write a program to accept input of various data types and display on the screen **II. Decision & Loop Control Statements** 4. Write a program to find the largest of given three numbers using Decision (if, if-else, nested if –else) statements 5. Write a program to perform arithmetic functions using Switch – case statements 6. Write a program to find the factorial of a given number using		

	'for' loop 7. Write a program to print n natural numbers using 'while' loop 8. Write a program to find the sum of n natural numbers using 'do while' loop **III. Exercises on functions** 9. Write a program to find the factorial of a given number using recursion **IV. Arrays, Strings and Pointers in C** 10. Write a program to find the smallest element in an array 11. Write a program to find addition of two (3 X 3) matrices 12. Write a program using string functions for string comparison, copying and concatenation 13. Write program to find the swap two numbers using pointers **V. Structures and Unions** 14. Write a program to store information of students using Structures 15. Write a program to access Union members in C **VI. MAT LAB** 16. Familiarize with MATLAB Compiler environment, command line arguments, HELP and know about various tool boxes available in MATLAB 17. Write a program to check whether the entered year is leap year or not using decision making statements (if-end, if-else-end, nested if –else-end) 18. Write a program to find the factorial of a given number using loop control statements (while , for loops) 19. Write simple programs to create simple 1D & 2D arrays and perform addition & subtraction operations

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-308.1	***1***			***1***	1			3	2	
AEI-308.2	***1***			***1***	1			3	2	
AEI-308.3	***1***			***1***	1			3	2	
AEI-308.4	***1***			***1***	1			3	2	
Average	***1***			***1***	1			3	2	

3= strongly mapped 2= moderately mapped 1= slightly mapped

DIGITAL ELECTRONICS LAB

Course code	Course title	Total no. of periods	No. Of periods per week	Marks for FA	Marks for SA
AEI-309	DIGITAL ELECTRONICS LAB	45	3	40	60

TIME SCHEDULE

S.NO	Major Topics	No. of Periods	COs Mapped
I	Combinational Logic circuits	18	CO1
II	Sequential Logic Circuits	21	CO2
III	A/D and D/A converters	06	CO3
	TOTAL	**45**	

Upon completion of the course the student shall be able to			
Course Objectives		(i) ii)	Implement different combinational, sequential logic circuits and obtain truth tables. Explain A/D and D/A converters.
Course outcomes	CO1	*AEI-309.1*	Implement combinational logic circuits and verify truth tables.
	CO2	*AEI-309.2*	Implement Sequential logic circuits and verify truth tables.
	CO3	*AEI-309.3*	Verify the working of A/D and D/A converters
Learning Outcomes		**I. COMBINATIONAL LOGIC CIRCUITS** 1. Verify the truth tables of Logic gates - AND, OR, NOT (Using IC's) 2. Verify the truth tables of Logic gates - NAND, NOR, Exclusive OR 3. Implement Half-adder using IC logic gates. 4. Implement Full-adder using IC logic gates. 5. Verify the truth table of Multiplexer using IC 74153 6. Verify the truth table of De-multiplexers 7. Implement any given Boolean function using logic gates. **II. Sequential Logic Circuits** 8. Verify the truth tables for RS, D, T, and JK and Master - Slave JK	

		Flip-flops. 9. Verify function of counter (ICs like 7490, 7492, 7493, 74 C 93, 74160). 10. Verify function of shift register (ICs like 74104, 74185, 74 C 164, 7495, 74194 etc.) 11. Construct a comparator circuit using 7485 and verify the truth table. **III. A/D and D/A converters** 12. Verify the working Successive Approximation type A/D converter. 13. Verify the working of R-2R D/A converter.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-309.1	***2***							3	2	
AEI-309.2	***3***	***3***						3	2	
AEI-309.3	***1***				***1***			3	2	
Average	***2***	***3***			***1***			3	2	

3= strongly mapped
2= moderately mapped
1= slightly mapped

ELECTRONIC MEASURING INSTRUMENTS LAB

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-310	ELECTRONIC MEASURING INSTRUMENTS LAB	3	45	40	60

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	COs Mapped
I	Analog instruments	15	CO1
II	Digital instruments	15	CO2
III	Signal generators & CRO	15	CO3
	TOTAL	45	

Upon completion of the course the student shall be able to			
Course Objectives		(i)	Measure various parameters of electrical & electronics using measuring Instruments.
Course outcomes	CO1	*AEI-310.1*	Familiarize with the use of analog instruments.
	CO2	*AEI-310.2*	Familiarize with the use of digital instruments for the measurements for the measurements of various parameters.
	CO3	*AEI-310.3*	Handle the signal generator & CRO for measurement of different parameters.
Learning Outcomes		I. **Analog Instruments:-** 1. Conduct an experiment to Calibrate Ammeter and Voltmeter. 2. Conduct an experiment to extend the range of Ammeter and Voltmeter. 3. Conduct an experiment to convert an Ammeter to Voltmeter. 4. Conduct an experiment to construct series and shunt Ohmmeter. 5. Measure the Insulation resistance of a given equipment by using Megger. **II. Digital Instruments:-** 6. Study the front panel of a Digital LCR meter. 7. Measure Inductance (L), Capacitance (C) and Resistance (R) using digital	

		LCR meter. 8. Study the front panel of a digital IC tester. 9. Test some digital ICs using using Digital IC tester. 10. Measure the frequency of a given signal using digital frequency meter. **III. Signal Generator and CRO:-** 11. Measure the frequency of an Unknown Signal Using Lissajous figures on CRO. 12. Study the use of different types of probes used for CRO.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-310.1	2			1				2	2	
AEI-310.2	2			1	1			2	2	
AEI-310.3	2			1				2	2	
Average	2			1	1			2	2	

3= strongly mapped
2= moderately mapped
1= slightly mapped

SENSORS AND TRANSDUCERS LAB

Course code	Course title	No. Of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-311	SENSORS AND TRANSDUCERS LAB	3	45	40	60

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	COs Mapped
I	Displacement measurement	9	CO1
II	Velocity measurement	3	CO2
III	Temperature measurement	12	CO3
IV	Pressure measurement	3	CO4
V	Flow measurement	3	CO5
VI	Level measurement	6	CO6
VII	Density and Viscosity measurement	6	CO7,CO8
VIII	Weight & Humidity measurement	6	CO9
	TOTAL	45	

Upon completion of the course the student shall be able to			
Course Objectives		(i)	Practice various measurement techniques used for the measurement of displacement, Velocity, temperature, PH, Conductivity, humidity and moisture in process industries.
Course outcomes	CO1	*AEI-311.1*	Measure the linear displacement, angular displacement using different transducers
	CO2	*AEI-311.2*	Measure the velocity using tachometer
	CO3	*AEI-311.3*	Measure the temperature using RTD, Thermocouple, Thermistor
	CO4	*AEI-311.4*	Measure the pressure using pressure transducers.
	CO5	*AEI-311.5*	Measure the flow using flow meters.

	CO6	*AEI-311.6*	Measure the level using Level Indicators.
	CO7	*AEI-311.7*	Measure the density using densitometers
	CO8	*AEI-311.8*	Measure the viscosity using viscometers
	CO9	*AEI-311.9*	Measure the weight using load cells, and relative humidity using Hygrometer.
Learning Outcomes			**I. DISPLACEMENT MEASUREMENT** 1. Measure the Linear Displacement using LVDT and plot a graph between voltage and displacement. 2. Measure the Linear Displacement using Resistive Transducer and plot a graph between resistance and displacement. 3. Measure the Angular Displacement using Resistive Transducer and plot a graph between resistance and displacement. **II. Velocity measurement** 4. Measure the angular velocity using Tachometer and plot graph between voltage and velocity. **III. Temperature measurement** 5. Measure the Temperature using RTD and plot graph between temperature and resistance. 6. Measure the Temperature using Thermister and plot the following graphs (a) Between temperature and resistance (b) Between voltage and temperature 7. Measure the Temperature using Thermocouple and plot a graph between temperature and voltage.

		8. Measure the temperature using IC LM335 **IV. PRESSURE MEASUREMENT** 9. Measure the Pressure using Strain gauge pressure transducer. **V. FLOW MEASUREMENT** 10. Measure the Flow rate using Rotameter **VI. LEVEL MEASUREMENT** 11. Measure the Level using i. Float type level indicator ii. Resistive type level indicator iii. Bubbler type level indicator **VII. DENSITY & VISCOSITY MEASUREMENT** 12. Measure the Density of given sample using a densitometer. 13. Measure the viscosity of given sample using falling Ball viscometer. **VIII. WEIGHT & HUMIDITY MEASUREMENT** 14. Measure Weight using Load cell. 15. Measure the relative humidity using hygrometer.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-311.1	***1***							3	2	
AEI-311.2	***1***							3	2	
AEI-311.3	***1***				***1***			3	2	
AEI-311.4	***1***							3	2	
AEI-311.5	***1***				***1***			3	2	
AEI-311.6	***1***							3	2	
AEI-311.7	***1***							3	2	
AEI-311.8	***1***							3	2	
AEI-311.9	***1***							3	2	
Average	***1***				***1***			3	2	

3= strongly mapped 2= moderately mapped 1= slightly mapped

IV SEMESTER

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
IV SEMESTER

Subject Code	Name of the Subject	Instruction periods / week		Total Periods /semester	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
AEI-401	Data Communication and computer networks	3	-	45	3	20	80	100
AEI-402	Linear Integrated Circuits	3	-	45	3	20	80	100
AEI-403	Analytical and Biomedical Instrumentation	6	-	90	3	20	80	100
AEI-404	Process control	5	-	75	3	20	80	100
AEI-405	Industrial Electronics and control systems	5	-	75	3	20	80	100
PRACTICAL								
AEI-406	Linear IC Applications and e-CAD Lab	-	3	45	3	40	60	100
AEI-407	Biomedical instrumentation lab	-	3	45	3	40	60	100
AEI-408	Communication Skills	-	3	45	3	40	60	100
AEI-409	Analytical Instrumentation Lab	-	3	45	3	40	60	100
AEI-410	Process control Lab	-	3	45	3	40	60	100
	Activities		5	75	3			
	TOTAL	22	20	630	-	300	700	1000

AEI-408 common with all branches

DATA COMMUNICATION AND COMPUTER NETWORKS

Course code	Course title	Periods/Week	Total no. of periods	Marks for FA	Marks for SA
AEI-401	DATA COMMUNICATION AND COMPUTER NETWORKS	03	45	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Basics of Data communication & OSI Layer	09	16	2	1	CO1
2	LAN and DLL protocols	09	26	2	2	CO2
3	IP addressing and Network layer protocols	09	26	2	2	CO3
4	WAN protocols	06	13	1	1	CO4
5	Understand Network security	06	16	2	1	CO5
6	Understand Web Applications	06	13	1	1	CO6
	TOTAL	45	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i) (ii)		Understand the concept of data communication. Understand the various computer network layers and protocols.
Course outcomes	CO1	*AEI-401.1*	Apply physical layer functionality to select suitable media
	CO2	*AEI-401.2*	Apply MAC layer protocols for various topologies
	CO3	*AEI-401.3*	Use network layer protocols

	CO4	*AEI-401.4*	Use transport layer protocols
	CO5	*AEI-401.5*	Apply knowledge in securing the network
	CO6	*AEI-401.6*	Use application layer protocols
Learning Outcomes		**1.0Basics of Data communication & OSI Layer** 1.1Define data communication. 1.2State the need for data communication networking. 1.3Distinguish between analog and digital data. 1.4Define computer network and state its use. 1.5Draw the ISO: OSI 7 layer architecture and explain the function of each layer. 1.6List the different types of physical transmission media. 1.7Define simplex, half-duplex and full-duplex communication. **2.0 LAN and DLL protocols** 2.1Define Local area network and state its use. 2.2Explain different network topologies (Bus, Star, Ring) 2.3List the use of different networking devices such as a. Repeater/hub. b. Switch. c. Bridge. 2.4State the need for protocols in computer networks. 2.5State the need for flow control and error control protocols. 2.6Explain the topology of wireless LAN. 2.7Explain the Bluetooth technology. 2.8Write the applications of WAP. **3.0 IP addressing and Network layer protocols** 3.1 Define the terms Internet and Intranet. 3.2 Define internet protocol. 3.3 Distinguish between connection oriented (virtual circuit) and connectionless (datagram)services. 3.4Classify the two types of Internet Protocol addressing IPv4 and IPv6. 3.5State the needfor IPv6. 3.6Explain the use of routers in networking. 3.7Explain Cryptography **4.0 WAN protocols**	

		4.1 Know about WAN architecture. 4.2List the three commonly used WAN technologies. 4.3Describe the ARPANET and WWW. 4.4Explain different layers of TCP/IP. 4.5Explain the features of TCP. 4.6Compare OSI and TCP/IP model. **5.0 Network security** 5.1 State the need for network security. 5.2 List various Network security services. 5.3 Define message confidentiality and message integrity 5.4 Define message authentication and entity authentication. 5.5 Explain key management, digital signature and firewalls in securing the networks. 5.6 List Salient Features of I.T Act 5.7 State need for Cyber security 5.8 State various security threats of network. 5.9 List security Measures for threats. **6.0 Web Applications** 6.1 Write the role of DNS server. 6.2 Explain DNS namespace. 6.3Explain how email is transferred. 6.4Discuss POP server and SMTP server. 6.5Explain file transfer operation using FTP 6.6Write the role of of Web server. 6.7Write the role of of Web browser. 6.8List HTTP commands. 6.9Write the purpose of proxy server. 6.10 State the use of hyperlinks. 6.11 State the need of remote login.

CO-PO/PSO MATRIX

CO No	*PO 1*	*PO 2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*
AEI-401.1	*1*	*1*				*3*	*2*	
AEI-401.2	*1*	*1*			*1*	*3*	*2*	*1*
AEI-401.3	*1*	*1*			*1*	*3*	*2*	*1*
AEI-401.4	*1*	*1*		*1*		*3*	*2*	*1*
AEI-401.5	*1*	*1*				*3*	*2*	*1*
AEI-401.6	*1*	*1*				*3*	*2*	*1*
Average	*1*	*1*		*1*	*1*	*3*	*2*	*1*

3= Strongly mapped 2= Moderately mapped 1= Slightly mapped

COURSE CONTENTS

1. Basics of Data communication & OSI Layer

Introduction-concepts of data communication- analog and digital data-computer network-OSI 7 Layered architecture - physical transmission media -simplex, half-duplex and full-duplex communication.

2. LAN and DLL protocols Duration

Local area network-network topologies (Bus, Star, Ring) -Hub/Repeaters- bridges-routers-need for protocols-Ethernet frame format (IEEE 802.3)- flow control-error control- wireless LAN frame format-Bluetooth- WAP.

3. IP addressing and Network layer protocols

Internet and Intranet- Internet protocol-connection oriented (virtual circuit) and connectionless (datagram) services-IPv4 addressing -IPv6 addressing-router and routing- Cryptography.

4. WAN protocols

WAN architecture- ARPA NET and WWW- TCP/IP

5. Understand Network security.

Network security-security devices, security services. Firewalls, Public key and private algorithm-Salient Features of I.T Act-Cyber Security offences and penalties.

6. Understand Web Applications

DNS server- email transfer-POP server-SMTP server-FTP- Web server-Web browser-proxy server- hyperlinks –HTTP-remote login.

REFERENCE BOOKS:

1. Computer Networks (4th Edition) by Andrew S. Tanenbaum
2. Network communication Technology by Ata Elahi Thomson
3. Data Communication and Networking by Godbole TMH
4. Data and Computer Communications: William Stallings 7th edition. PHI
5. Data Communication and Networking: Behrouz Forouzan 3rd edition.TMH

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 3.7
Unit Test-II	From 4.1 to 6.11

LINEAR INTEGRATED CIRCUITS

Course code	**Course title**	Periods/Week	**Total no. of periods**	**Marks for FA**	**Marks for SA**
AEI-402	LINEAR INTEGRATED CIRCUITS	03	45	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	**Weightage of marks**	**Short Questions**	**Essay Questions**	COs Mapped
1	Introduction to Operational amplifiers	7	16	2	1	CO1
2	Linear applications of Operational amplifiers	9	26	2	2	CO2
3	Active filters	7	26	2	2	CO3
4	555 Timer IC	9	26	2	2	CO4
5	Nonlinear applications of OP AMPs	13	16	2	1	CO4
	TOTAL	45	110	10	8	

	Upon completion of the course the student shall be able to		
Course Objectives	(i) ii) iii)		Familiarize with the characteristics of operational amplifiers. Know the applications of operational amplifiers. Describe the operation of LPF, HPF, BPF and BSF using OP Amp. Describe the operation of 555 timer and its applications.
Course outcomes	CO1	*AEI-402.1*	Familiarize with the characteristics of operational amplifiers.
	CO2	*AEI-402.2*	Explain the operation of different applications of operational amplifiers.
	CO3	*AEI-402.3*	Describe the operation of LPF, HPF, BPF and BSF using OP Amp.
	CO4	*AEI-402.4*	Describe the operation of 555 timer and its applications.
		1.0 Introduction to operational amplifiers 1.1 State the requirements of an operational amplifier.	

Learning Outcomes		1.2Draw the circuit of differential amplifier. 1.3Explain the operation of differential amplifier. 1.4Draw and explain the block diagram of a typical integrated circuit operational amplifier. 1.5Draw the schematic symbol of operational amplifier. 1.6List and sketch different package styles of analog ICs. 1.7Draw the pin diagrams of metal can package and dual-in-line package for a typical IC 741 or equivalent. 1.8List the basic specifications of ideal operational amplifier. 1.9Define Voltage gain $\mathbf{A_V}$, output impedance $\mathbf{Z_o}$, input impedance $\mathbf{Z_i}$, Bandwidth **BW**, input offset voltage $\mathbf{V_{io}}$, input offset current $\mathbf{I_{io}}$, input bias current $\mathbf{I_B}$, and also give the typical values for an ideal operational amplifier. 1.10 Define C.M.R.R and give the typical value for an ideal operational amplifier. 1.11 State the need for high C.M.R.R. 1.12 Define slew rate and give the typical value for an ideal operational amplifier. 1.13 List the applications of Operational Amplifier. 2.0 **Linear applications of operational amplifiers** 2.1 Explain the open loop operation of an operational amplifier. 2.2 Mention the effects of negative feedback on an amplifier. 2.3 Draw and explain the operation of inverting and non- inverting amplifiers. 2.4 Draw and explain the operation of Voltage follower circuit using operational amplifier. 2.5 Draw and explain the operation of summing amplifer and difference amplifier using OP-amp. 2.6 Solve simple problems on summing amplifier and difference amplifier using OP-amp. 2.7 Draw and explain the operation of ideal and practical integrator and differentiator circuits. 2.8 Draw and explain the operation of current to voltage converter

		using OP-amp. 2.9 Draw and explain the operation of voltage to current converter using OP-amp. 2.10 Draw and explain the operation of Instrumentation amplifier using Op-amp. **3.0 Understand the active filters** 3.1 Define Filter. 3.2 List the types of Active filters. 3.3 List the limitations/disadvantages of passive filters. 3.4 State how active filters overcome the above limitations. 3.5 Draw the ideal and practical frequency response plots for a 3.6 LPF, HPF, BPF, BSF and All Pass Filter. 3.7 Define Pass band and Stop band. 3.8 Draw and explain the operations of first order LPF and HPF using operational amplifier with its frequency responses. 3.9 Draw and explain the operations of first order BPF (narrow & wide) and BSF (narrow & wide) using operational amplifiers with its frequency responses. 3.10 List the disadvantages of active filters. 4.0 **Understand the operation and application of 555 Timer IC.** 4.1 Draw the block diagram of 555 timer IC. 4.2 Explain the operation of various blocks of a 555 timer IC. 4.3 Draw the pin diagram of 555 IC and Mention the function of each pin. 4.4 Draw and explain the operations of mono stable Multivibrator using 555 IC timer. 4.5 Draw and explain the operation of Astable multivibrator using IC 555 timer. 4.6 Mention the applications of 555 Timer IC. **5.0 Non-Linear Applications of operational amplifier** 5.1 Draw and explain the operation of square wave generator.

		5.2 Draw and explain the operation of wien bridge oscillator. 5.3 Draw and Explain the operation of Triangular wave generator. 5.4 Draw and explain the operation of basic comparator circuit. 5.5 Draw and explain the operation of Schmitt trigger circuit with its waveforms. 5.6 Explain the principle of operation of phase locked loop with the help of block diagram. 5.7 List the applications of PLL.

COURSE CONTENTS

1.0 **Introduction to Operational amplifiers:** Block diagram of typical operational amplifier; IC package, pin identification, **Definitions:** Input offset voltage, input offset current, input bias current, Voltage gain, input and output impedences, bandwidth,slew rate, CMRR, with reference to operational amplifier, specifications of ideal op-amp.

2.0 **Applications of Operational amplifiers:** Open loop op-amp configuration, inverting and non-inverting amplifier. Op-amp with feedback: adder, subtractor, integrator, differentiator, Instrumentation amplifier, voltage to current converter and current to voltage converter.

3.0 **Active Filters:** Low pass, high pass, Band pass and Band elimination filters, frequency responses.

4.0 **555 Timer IC:** Block diagram and operation of 555 timer IC, Monostable, Astable multivibrator operations using 555 timer IC.

5.0 **Non-Linear applications of Operational amplifier:** Square wave generator, wein bridge oscillator, Triangular wave generator, Basic comparator, Schmitt trigger, PLL.

REFERENCE BOOKS

1. Op Amps & Linear Integrated Circuits-- Ramakanth AGaykwad
2. linear Integrated Circuits -- Roy Chowdary
3. Integrated Circuits -- Botkar

CO-PO/PSO MATRIX

CO No	*PO1*	*PO 2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-402.1	*1*	*1*						*3*	*2*	
AEI-402.2	*1*	*1*			*1*			*3*	*2*	

AEI-402.3	*1*	*1*						*3*	*2*	
AEI-402.4	*1*	*1*						*3*	*2*	
Average	*1*	*1*			*1*			*3*	*2*	

3= Strongly mapped 2= Moderately mapped 1= Slightly mapped

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 2.10
Unit Test-II	From 3.1 to 5.7

ANALYTICAL AND BIOMEDICAL INSTRUMENTATION

Course code	Course title	Periods/Week	Total no. of periods	Marks for FA	Marks for SA
AEI-403	ANALYTICAL AND BIOMEDICAL INSTRUMENTATION	06	90	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Introduction to Spectrophotometer and analyzers	20	26	2	2	C01
2	Mass spectrometry and Chromatography	10	16	2	1	CO2
3	P^H , conductivity measurement and Nuclear Instrumentation	15	26	2	2	CO3
4	Introduction to bio-medical Engineering and diagnostic medical instruments	18	13	1	1	CO4
5	Blood Pressure, flow measurements and Therapeutic instruments	12	16	2	1	CO5
6	Modern Imaging Systems, Patient monitoring systems and patient safety	15	13	1	1	CO6
	TOTAL	**90**	110	**10**	**8**	

Upon completion of the course the student shall be able to		
Course Objectives	(i) (ii)	Familiarize with the knowledge of analytical instrumentation and Spectrophotometer, analyzers, Mass spectrometry, Chromatography, Nuclear Instrumentation. Familiarize with knowledge of bio-medical Engineering, Diagnostics Instruments, Blood Pressure and blood flow measurements, bio-medication equipment.

Course outcomes	CO1	*AEI-403.1*	Familiarize with different analytical and biomedical instruments.
	CO2	*AEI-403.2*	Explain the principle of operation of different analyzers and flame photometer, Refractometer polar meter and Chromatography
	CO3	*AEI-403.3*	Explain the measurement of P^H ,Conductivity using P^H meter, conductivity meter and detection methods of Nuclear radiation
	CO4	*AEI-403.4*	Explain the different types of electrodes used for ECG, EEG, EMG and electrical activity of heart and working of diagnostic medical instruments.
	CO5	*AEI-403.5*	Explain the working of blood pressure, blood flow measurements and working of therapeutic medical instruments.
	CO6	*AEI-403.6*	Understand modern image and patient monitoring system and safety of patient
Learning Outcomes		**1.0 Introduction to Spectrophotometer and analyzers** 1.1 Draw and explain the block diagram of Analytic instrumentation. 1.2 Define the term spectroscopy. 1.3 Define the terms atomic spectroscopy and molecular spectroscopy. 1.4 Draw and explain Electromagnetic spectrum. 1.5 Explain Prism and Grating Monochromators. 1.6 Explain the principle of operation of the following and list their applications a. U.V Spectrophoto meter b. Visible Spectrophotometer c. IR Spectrophotometer. 1.7 Explain the principle of operation of the following and list their applications a) Flame Photometer. b) Refractometer. c) Polari meter. 1.8 Explain principle of operation of the following and list their applications a. Paramagnetic gas analyzer. b. Electro chemical gas analyzer. c. Thermal conductivity type analyzer. **2.0 Mass spectrometry and Chromatography** 2.1 State the principle of Mass spectrometry. 2.2 Draw and explain the block diagram of mass spectrometer. 2.3 Define chromatography. 2.4 Classify chromatography. 2.5 Explain the principle of operation of the Gas Chromatography. 2.6 Explain the principle of operation of the Liquid	

		Chromatography. **3.0 P^H , conductivity measurement and Nuclear Instrumentation** 3.1 Define P^H. 3.2 Explain the operation of digital P^H -meters. 3.3 Define conductivity. 3.4 Explain the principle of operation of conductivity meter. 3.5 List the types of Radiations. 3.6 List the types of radiation detectors 3.7 Explain the method of Detection of neutrons. 3.8 Explain the working of the following Detection Methods. a) Geiger Muller method b) Ionization chamber c) Scintillation counter. **4.0 Introduction to bio-medical Engineering and diagnostic medical instruments** 4.1 Define bioelectric potentials. 4.2 Define resting and action potentials. 4.3 Define an electrode. 4.4 List the types of electrodes used for bioelectric potentials measurement. 4.5 Explain the different types of electrodes used for ECG, EEG and EMG. 4.6 Explain the electrical activity of heart. 4.7 List the Diagnostic Medical Equipments. 4.8 Draw and explain the building Blocks of an electro cardio graph (ECG). 4.9 Draw and explain the ECG Lead Configurations (Bipolar & Unipolar). 4.10 Draw the electrocardiogram. Indicate its amplitude and duration and state their importance. 4.11 Explain the arrangement of electrodes while monitoring EEG. 4.12 Explain the working principle of an EEG machine with Block diagram. 4.13 Draw the block diagram set up for EMG recording. **5.0 Blood Pressure, flow measurements and Therapeutic instruments** 5.1 List the types of direct blood pressure measurements (catheterization, percutaneous insertion and implantation of transducer in a vessel). 5.2 List the types of indirect blood pressure measurements. 5.3 State the need of pacemaker. 5.4 Classify different types of pacemakers. 5.5 Compare the internal pacemakers over external pacemakers. 5.6 List the types of Pacing modes. 5.7 Draw the block diagram of a ventricular synchronous demand pacemaker and explain its operation.

		5.8 State the need of defibrillators. 5.9 Draw and explain the circuit diagram of AC defibrillators. 5.10 Define dialysis. 6.0 **Modern Imaging Systems, Patient monitoring systems and patient safety** 6.1 Explain the operation of an X-ray machine with block diagram. 6.2 Explain the working of C.A.T Scanner with block diagram. 6.3 Explain the working of M.R.I with block diagram. 6.4 Explain patient monitoring in ICU and draw the system of arrangement. 6.5 Define micro and macro shock. 6.6 Differentiate between micro shock and macro shock. 6.7 List the preventive measures to reduce shock hazards. 6.8 List the general and safety requirements of electro medical equipment issued by Bureau of Indian Standards (BIS).

CO-PO/PSO MATRIX

CO No	*PO 1*	*PO 2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-403.1	**1**	**1**						**3**	**2**	
AEI-403.2	**1**	**1**	**1**					**3**	**2**	
AEI-403.3	**1**	**1**	**1**		**1**			**3**	**1**	
AEI-403.4	**1**	**1**	**1**		**1**			**3**	**2**	
AEI-403.5	**1**	**1**	**1**					**2**	**1**	
AEI-403.6	**1**	**1**	**1**					**1**	**2**	
Average	**1**	**1**	**1**		**1**			**2.5**	**1.6**	

3= Strongly mapped
2= Moderately mapped
1= Slightly mapped

COURSE CONTENTS

1 Introduction to analytical instrumentation and analyzers:

Block diagram of Analytic Instrumentation, monochromators - UV, IR, and Visible Spectro photometers.Flame Photometer, Refracto meter, Polari meter. Paramagnetic, Electro chemical and thermal conductivity gas analyzers.

2 **Mass spectrometery and chromatography:**
Principle of operation Mass spectrometer.Principle of operation of Gas and Liquid chromatography.

3. **P^{H}, conductivity measurement and nuclear instrumentation:**
PH measurement, Electrodes, Digital type of PH meter,Necessity of conductivity cell, principle of conductivity meter, Types of radiation- Alpha, Beta and Gamma Particles, Neutrons, Radiation detectors- Geiger Muller counter, Ionization chamber, Scintillation counter.

4. Introduction to Biomedical Engineering and Diagnostic Medical Instruments: Bioelectric potentials–Resting and action potential, Electrodes used for Bio potential measurement, Electrical activity of the heart, Electro cardio graph (ECG) – Block diagram; ECG waveform, Electro encephalograph (EEG) –Block diagram, EEG wave forms, Electro mayo graph (EMG) –Block diagram, EMG Wave form .

5. Blood Pressure, Blood Flow Measurements and Therapeutic Instruments: Direct and indirect Blood pressure measurement, Pacemakers - Need of Cardiac Pacemakers, internal and external pacemakers, differences between internal and external pacemakers, Ventricular synchronous demand pacemaker, Defibrillation-need of defibrillator,dialysis.

6. **Modern Imaging Systems, Patient Monitoring system and patient safety:** operation of an X-Ray machine, C.A.T. Scanner – M.R.I- operation-Patient monitoring in ICU, Physiological effects of electricity, Shocks- micro and macro shocks, Preventive measures of shock. Safety requirement by BIS.

REFERENCE BOOKS:

1. Instrumental Methods of Chemical Analysis by Willard, Merritt, Dean, Settle (CBS Publications & Distributors Pvt. Ltd.)
2. Instrumental Methods of Chemical Analysis by Chatwal & Anand (Himalaya Publishing house)
3. Hand Book of Analytical Instrumentation by R.S. Khandpur
4. Industrial Instrumentation by Donald P.Eckman.
5. Industrial Instruments and Control by S.K.Singh.
6. R.S.Kandpur -Hand Book of Biomedical Instrumentation , Tata Mcgraw Hill.

7. Leslie Cromwell & Fred .J. Weibell and Erich A.Preiffer -Biomedical Instrumentation and Measurements , PHI.
8. Dr. Arumugham -Biomedical Instruments
9. L.A.Taddes & Baker- Principles of Applied Bio medical Instrumentation
10. John.G.Webster- Medical Instrumentation
11. Levine - Advanced Biomedical Engineering
12. LELE- Computer the Machine, Tata McGraw Hill Co.,
13. Joseph Carr & Joseph Brown- Introduction to Biomedical equipment Technology

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 3.8
Unit Test-II	From 4.1 to 6.8

PROCESS CONTROL

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-404	Process Control	5	75	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Introduction to process control	10	16	2	1	CO1
2	Controller principles	15	26	2	2	CO2
3	Final control operation	20	26	2	2	CO3
4	Advanced process Control systems	15	26	2	2	CO4
5	Process instrument diagrams and standards	15	16	2	1	CO5
	TOTAL	**75**	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i) (ii)	Familiarize with the knowledge of a process control loop, controller principles, tuning, final control operations and advanced process control systems. Familiarize with the knowledge of process line diagrams and standards.	
Course outcomes	CO1	*AEI-404.1*	Familiarise with terms related to process control.
	CO2	*AEI-404.2*	Understand the controller principles
	CO3	*AEI-404.3*	Explain the principle of operation of final controller elements
	CO4	*AEI-404.4*	Explain the principle of operation of advanced process control system
	CO5	AEI-404.5	Understand the Process instrument diagrams and standards
Learning Outcomes		**1.0 Introduction to process control** 1.1 Define the terms process and process control.	

		1.2 Explain the development of automatic process control with example. 1.3 Draw the block diagram of a process control loop. 1.4 Describe each element in a process control loop. 1.5 Explain batch process and continuous process. 1.6 Define the terms controlled variable and manipulated variable. 1.7 Explain controlled variable and manipulated variable with an example. **2.0 Controller principles** 2.1 Define the terms process load, process lag and self-regulation. 2.2 Define the terms error, control lag, dead time, and cycling. 2.3 List the Discontinuous control modes. 2.4 Explain two positions, multi position and floating control modes. 2.5 List the continuous control modes. 2.6 Define proportional control mode. 2.7 Explain proportional control mode. 2.8 Define the terms proportional band, and offset. 2.9 List the characteristics of proportional control mode. 2.10 Define integral control mode. 2.11 Explain integral control mode. 2.12 List the characteristics of integral control mode. 2.13 Define derivative control mode. 2.14 Explain the derivative control mode. 2.15 List the characteristics of derivative control mode. 2.16 List the composite control modes. 2.17 Explain the Proportional-Integral Control modes. 2.18 List the characteristics of Proportional-Integral Control modes. 2.19 Explain PD and PID control modes. 2.20 List advantages and disadvantages of PI, PD & PID controllers. 2.21 State the need for tuning of PID controllers. 2.22 Explain the following methods of tuning of PID controllers a) Ultimate gain method b) Process reaction curve method. **3.0 Final control Operation** 3.1 Explain the Principle of final control operation. 3.2 Draw the block diagram of final control operation and explain its each block. 3.3 State the need for electric to pressure and pressure to electric

converters.

3.4 Explain the basic principle of Nozzle-Flapper system with a diagram.

3.5 Explain the principle of operation of Electric to Pressure converter.

3.6 Explain the principle of operation of Pressure to Electric converter.

3.7 List the different types of Actuators.

3.8 Explain the principle of Pneumatic Actuator with diagram.

3.9 Explain the principle of Hydraulic Actuator with diagram.

3.10 Explain the principle of Electro Pneumatic Actuator with diagram.

3.11 Explain the following Electrical actuators

a) Solenoid valve actuator

b) Stepper motor actuator

3.12 Solve simple problems on actuator.

3.13 Explain the constructional details of control valve.

3.14 Explain the following different types of control valves.

a) Flow – lift characteristics control valves such as Quick opening, Linear, Equal percentage valves,

b) Sliding stem Control valves, such as Single seat Plug, Double seat plug and Lifting gate control valves

c) Rotating shaft control valves, such as Rotating plug, Butterfly valves and Louvers.

4.0 Introduction to Advanced process Control systems

4.1 Define the following control system configuration.

a) Single variable control system.

(i) Independent single variable control system

(ii) Interactive single variable control system

b) Compound variable control system and

c) Multivariable control system

4.2 Draw and explain the block diagram of cascade control system.

4.3 Justify how the cascade control system is better than single loop control system with an example.

4.4 List the applications of cascade control system.

4.5 Draw and explain the block diagram of feed forward control system.

4.6 Explain the feed forward control system with an example.

4.7 Distinguish between feedback and feed forward control

		systems. 4.8 Explain the operation of Ratio control with a diagram. 4.9 List the applications of Ratio control system. 4.10 Define Adaptive control. 4.11 Explain programmed adaptive control system with block diagram. 4.12 List the applications of adaptive control system. **5.0 To understand the process line diagrams, standards** 5.1 Draw the following line diagrams and symbols. a) Process line, connection to process or instrument supply b) Fluid pressure Line. c) Electric signal d) Pneumatic signal e) Hydraulic signal f) Capillary tube. g) Electromagnetic or Sonic signal (guided and not guided). h) Undefined signal. i) Mechanical link j) Internal system link (software or data link or computer signal) k) Orifice installed line. l) Point of measurement 5.2 Draw the symbols for the following controllers and transmitters. (a) Pressure transmitter (b) Flow Transmitter (c) Level Transmitter (d) Temperature Transmitter (e) Pressure Controller (f) Flow Controller (g) Level Controller (h) Temperature Controller 5.3 Draw the symbols for the following control valves (a) Hydraulically operated control valve (b) Pneumatically operated control valve (c) Electrically operated control valve (d) Butterfly valve (e) Solenoid Valve (f) Gate valve (g) Gate valve-hand operated (h) Globe Valve

		(i) Globe valve- hand operated 5.4 Draw the following general instruments by Balloon symbols (a) Instrument at locally mounted (b) Instrument at control centre (c) Instrument- bifunctional /two services (d) Instrument-transmitting type 5.5 Define piping and instrumentation diagram. 5.6 Explain the use of letter codes for identification of instruments. 5.7 List different standards used in Instrumentation. a) ISI b) ANSI c) BS d) ISA e) DIN

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-404.1	1	1						3	2	1
AEI-404.2	1	1						3	2	1
AEI-404.3	2	1			1			2	2	1
AEI-404.4	1	1						2	2	1
AEI-404.5	1	1						3	3	1
Average	1.2	1			1			2.6	2.2	1

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 3.6
Unit Test-II	From 3.7 to 5.7

COURSE CONTENTS

1. Introduction to process control:

Process control principle-process control block diagram –typical control variables-controlled variable, manipulated variable- Continuous and Batch process

2. **Controller principles**: -
process characteristics –process load – process lag-self regulation-control system parameters: - error-variable range–control lag-dead time - cycling. Controller modes–discontinuous-two-position, multi-position, floating, continuous control modes: - proportional, integral, derivative control mode. Composite control modes: - PI, PD and PID-Controller. tuning methods-Ultimate gain method and process reaction curve method.

3. **Final control operation:** -
Different types of the Actuators: - Pneumatic, Hydraulic, Electrical Actuators-different types of control valves.
4. **Advanced process Control systems**: -
Single variable – compound variable. Multivariable control systems–cascade control–feed forward control-ratio controls– adaptive control systems.

5. **Process instrumentation diagrams and standards:**
Line diagrams-Definition of P & I diagrams- Use of letter code of identification of Instruments-Introduction to standards that are widely used in instrumentation Viz., ISI, ANSI, BIS, ISA etc.

REFERENCE BOOKS

1. Automatic process control by Donald.P.Eckmann
2. Instrument Engineers Hand book by Liptak, Volume II
3. Control Valves by Chatwal & Anand
4. Instrument Technology by B.E.Jones, Volume I, II, III
5. Computer based Industrial Control by Krishnakanth
6. Process Control by Peter Harriot
7. Process Analysis & Control by Coughnour.
8. Process control instrumentation technology by Curtis .D.Johnson Seventh edition
9. Process Control by D.Patranabis
10. Chemical Process Control by George stephanopoulous
11. Process Control by K.Krishna swamy

INDUSTRIAL ELECTRONICS AND CONTROL SYSTEMS

Course code	Course title	Periods/ Week	Total no. of periods	Marks for FA	Marks for SA
AEI-405	INDUSTRIAL ELECTRONICS AND CONTROL SYSTEMS	05	75	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Power and opto Electronic Devices	15	29	3	2	CO1
2	Industrial Heating and welding	10	16	2	1	CO2
3	Basic Concepts of Control Systems and transfer functions	10	13	1	1	CO3
4	Block diagram algebra and signal flow graphs	15	26	2	2	CO4
5	Time Domain and frequency domain Analysis	25	26	2	2	CO5
	TOTAL	**75**	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i) (ii) (iii) (iv)		Learn the principles and working of power Electronic devices, opto electronic devices, Industrial heating and welding. Understand the importance of Control System Engineering in industry Evaluate the transfer Functions of system using block diagram algebra and signal flow graphs Analyze the system in Time & Frequency Domains and to evaluate its stability
Course outcomes	CO1	*AEI-405.1*	Describe Various Power Electronic Devices like SCR, DIAC, TRIAC etc. and Various Opto electronic Devices like Photo diode, Photo Transistor, LED etc.
	CO2	*AEI-405.2*	Explain Industrial Heating and welding.

	CO3	*AEI-405.3*	Understand the importance of Control System Engineering in industry and transfer Functions of system.
	CO4	*AEI-405.4*	Evaluate the system transfer function using block diagram algebra and signal flow graphs
	CO5	*AEI-405.5*	Analyze the system in Time and frequency Domains
Learning Outcomes		**1.0 Power and opto Electronic Devices** 1.1 List different thyristor family devices. 1.2 Sketch the ISI circuit symbols of SCR, SCS, SBS, SUS, DIAC, TRIAC and GTO SCR. 1.3 Explain the construction and working of SCR. 1.4 Explain the Two-transistor model of SCR and its V-I Characteristics. 1.5 Mention the ratings of SCR. 1.6 Explain the working of DIAC & TRIAC. 1.7 Explain the construction and working of UJT. 1.8 List the applications of DIAC, TRIAC & SCR. 1.9 Draw the circuit symbols of photo diode, photo transistor, LDR, LED. 1.10 Explain the working of photo diode and draw and explain its V-I characteristics. 1.11 Explain the working of photo transistor and draw and explain its V-I characteristics. 1.12 Explain the working of photo multiplier and draw and explain its V-I characteristics. 1.13 List the applications of photo diode, photo transistor and photo multiplier. 1.14 Explain the working of LDR. 1.15 Explain the working of photovoltaic cell. 1.16 Explain the working of LED. 1.17 Explain the working of LCD. 1.18 Explain the working of opto-coupler. 1.19 Explain the working of Discrete displays- Dot matrix, Bar matrix , Bar graph and Seven segment display. **2.0 Industrial Heating and welding** 2.1 Mention different industrial heating. 2.2 Explain the principle of Induction Heating and mention its merits. 2.3 List the applications of Induction Heating. 2.4 Draw the circuit of H.F power source for Induction Heating and explain its working. 2.5 Explain the principle of Dielectric heating. 2.6 List the dielectrics used for dielectric heating.. 2.7 List the types of resistance welding.	

		2.8 Explain principle of Resistance Welding process. 2.9 Draw basic circuit of A.C. resistance welding and explain the working. 3.0 **Basic Concepts of Control Systems and transfer functions** 3.1 State the importance of control engineering in day to day life and industry. 3.2 Distinguish between open loop and closed loop control system. 3.3 Explain the following systems with example a. Linear and Non-linear control system. b. Time variant and time invariant system. c. Continuous data and discrete data system. d. Digital control systems 3.4 Define Transfer Function. 3.5 List the properties and limitations of transfer functions of system. **4.0 Block diagram algebra and signal flow graphs** 4.1 Define block diagram of a system. 4.2 List the basic components of a block diagram 4.3 Mention the Rules for Block diagram reduction. 4.4 Solve simple Problems on block diagram reduction. 4.5 Define a signal flow graph of a system. 4.6 State the Mason's Gain formula. 4.7 Explain Mason's Gain formula with an example. 4.8 Solve problems to determine the transfer function using Mason's Gain formula **5.0 Time Domain and frequency domain Analysis** **5.1** Define the term time response of a system. **5.2** List the test signals in control system. **5.3** Obtain the time response of first order system for a unit step and unit impulse input. **5.4** Obtain the time response of second order system for a unit step input. **5.5** List the time domain specifications of second order system and define them. **5.6** Define Type and Order of a control system.

		5.7	Define type 0, Type 1 and Type 2 control systems.
		5.8	Define absolute and relative stability.
		5.9	Define frequency response of a system.
		5.10	List the frequency response plots.
		5.11	State and explain Routh Hurwitz criterion for stability of a system.
		5.12	Define Bode plot.
		5.13	Explain the procedure for magnitude plot of Bode plot.
		5.14	Explain the procedure for phase plot of Bode plot.
		5.15	Define Gain margin and Phase margin

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-405.1	**1**	**1**		**1**	**1**			**3**	**2**	
AEI-405.2	**1**	**1**		**1**	**1**			**3**	**2**	**1**
AEI-405.3	**1**	**1**						**3**	**2**	
AEI-405.4	**1**	**1**		**1**	**1**			**3**	**2**	**1**
AEI-405.5	**1**	**1**						**3**	**2**	
Average	**1**	**1**		**1**	**1**			**3**	**2**	**1**

3= Strongly mapped, 2= Moderately mapped, 1= Slightly mapped

COURSE CONTENTS

1. Power and opto Electronic Devices

Thyristor family devices- ISI circuit symbols - working of SCR--working of DIAC & TRIAC- construction and working of UJT- applications of SCR,TRIAC and DIAC- Operation and characteristics of photo diode- operation and characteristics of photo transistor- operation and characteristics of photo multiplier -Applications of photo diode ,photo transistor and photo multiplier- Working Principle of LDR-Principle of photo voltaic cell- - working of LED - working of LCD- working of discrete displays, dot-matrix and seven segment displays.

2. **Industrial Heating and welding**

Induction heating, Dielectric heating, Resistance welding,

3. **Basic Concepts of Control Systems and Transfer functions:**

Different types of control systems, Definition of transfer function and its properties.

4. **Block diagram algebra and signal flow graph:**

Block diagram reduction – rules for block diagram reduction, Signal flow graph and Mason's Gain formula**.**

5. **Time ad frequency Response analysis:** Transient response of first order system for step input, Impulse input-step response of II order system and specifications Type and order of a system – Type 0, Type 1 and Type 2 control systems-Relative and absolute stability -Routh Hurwitz criterion, bode plot.

REFERENCE BOOKS:

1. P.C.Sen ,Power Electronics
2. S.K.Bhattacharya, S.Chatterjee Industrial Electronics and Control
3. Harish,C Rai Khanna publications -Industrial Electronics
4. Katsuhiko Ogata ,2002, Modern Control Engineering, Vol.4 London.
5. B.S.Manke, 2005, Linear Control Systems, Khanna Publishers
6. Nagrath, I. J., and Madan Gopal,2008, Control systems, New Age International
7. Nagoor&Khani, 2016, Control system Engineering, RBA Publication

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 2.9
Unit Test-II	From 3.1 to 5.15

Linear IC Applications & e-CAD Lab

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
AEI-406	Linear IC Applications & e-CAD Lab	03	45	40	60

TIME SCHEDULE

S No	Chapter/ Unit Title	No. of Periods	COs Mapped
I	Operational Amplifier Circuits	21	CO1
II	555 Timers	06	CO2
III	PSpice /Proteus simulation or equivalent	18	CO3
	Total	45	

Upon completion of the course the student shall be able to:

Course Objectives	1.Implement OP-AMP circuits, timers and observe waveforms.		
	2. Simulate OP-AMP circuits using simulation software.		
Course Out comes	CO1	AEI-406.1	Implement the Circuits using OP-AMP and observe the waveforms.
	CO2	AEI-406.2	Implement Timer circuits using 555 IC timer.
	CO3	AEI-406.3	Simulate OP-AMP circuits using P-spice or equivalent.
LEARNING OUTCOMES	**I. Operational Amplifier Circuits** 1. To Implement and test IC 741 Op-Amp as a) Inverting amplifier b) Non Inverting amplifier c) Voltage follower (Buffer) and observe the wave forms. 2. To Implement and test 741 Operation amplifier as summer and Subtractor. 3. To Implement and test 741 Operation amplifier as Differentiator, and Integrator and observe the waveforms. 4. Implement Instrumentation Amplifier using Op-Amp and		

	calculate the gain. 5. Implement Schmitt trigger using Op-Amp and observe the waveforms. **II. 555 Timer** 6. Implement Monostable multi vibrator using 555 timers and observe output waveforms. 7. Implement Astable multi vibrator using 555 timers and observe output waveforms. **III.** PSpice /Proteus simulation or equivalent 8. Simulate inverting and non-inverting amplifier circuits and observe the waveforms. 9. Simulate summer and Subtractor circuits using op-amp. 10. Simulate Differentiator and Integrator circuits using op-amp and observe the waveforms. 11. Simulate Astable multivibrator using OPAMP in Pspice.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
*AEI-**406**.1*	3	3			1			3	2	
*AEI-**406**.2*	1	1			1			3	2	
*AEI-**406**.3*	2	2			1			3	2	
Average	2	2			1			3	2	

3= strongly mapped 2= moderately mapped 1= slightly mapped

BIO MEDICAL INSTRUMENTATION LAB

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-407	BIO MEDICAL INSTRUMENTATION LAB	3	45	40	60

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	COs Mapped
1	Measurement of non-Electrical Parameters	06	CO1
2	Diagnostic Medical Instruments	18	CO2
3	Therapeutic Instruments	06	CO3
4	Modern Medical Imaging Systems	15	CO4
	TOTAL	**45**	

	Upon completion of the course the student shall be able to		
Course Objectives		(i) (ii) (iii) (iv)	Measure the blood pressure using sphygmomanometer & Digital BP meter. Record the ECG, EEG, EMG waveforms. Understand the use of defibrillator. Demonstrate the X-ray Machine.
Course outcomes	CO1	*AEI-407.1*	Measure the blood pressure using sphygmomanometer and digital BP meter.
	CO2	*AEI-407.2*	Learn how to use ECG, EEG, EMG to record the waveforms.
	CO3	*AEI-407.3*	Know the working of defibrillator.
	CO4	*AEI-407.4*	Know the working of X-ray Machine and CT scanner.

Learning Outcomes		**I. Measurement of non-electrical parameters:** 1). Measure the blood pressure i.e systolic and diastolic blood pressure using sphygmomanometer. 2). Measure the blood pressure using automated digital blood pressure monitor. **II. Diagnostic Medical Instruments:** 3). Obtain PQRSTU waveform from ECG. 4). Record the EEG waveform. 5). Record the EMG waveform. **III. Therapeutic Instruments:** 6). Study the use of defibrillator. **IV. Modern Medical Imaging Systems** 7). Study and demonstration of X-ray machine. 8). Study the use of CT scanner.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-407.1	***1***	***1***	***1***	***2***	***2***			***2***	***2***	***1***
AEI-407.2	***2***	***2***	***2***	***2***	***2***			***2***	***2***	***1***
AEI-407.3	***1***	***1***	***1***	***2***	***2***			***2***	***2***	***1***
AEI-407.4	***2***	***2***	***2***	***2***	***2***			***2***	***2***	***1***
Average	***1.5***	***1.5***	***1.5***	***2***	***2***			***2***	***2***	***1***

3= strongly mapped
2= moderately mapped
1= slightly mapped

C23-AEI-408: English Communication Skills (Lab Practice)

Course Title : English Communication Skills	**Course code: C23-Common- 408 (Common to all Branches)**
Year/ Semester : IV Semester	**Number of Periods : 45 (3 periods per week)**
Type of Course : Practical	**Max Marks : 100 (Internal 40 + External 60)**

Course Objectives:	- to communicate effectively in diverse academic, professional and everyday situations
	- exhibit appropriate body language and etiquette at workplace
	- be employable through preparing appropriate job applications and attend interviews confidently with all necessary skills

CO No.	
CO1	Listen and comprehend the listening inputs related to different genres effectively
CO2	Communicate effectively in interpersonal interactions, interviews, group discussions and presentations
CO3	Acquire employability skills: job hunting, resume writing, attending interviews
CO4	Practise appropriate body language and professional etiquette

Course Delivery: Text book: **"English Communication Skills"**
by State Board of Technical Education and Training, AP

Sl No	**Unit**	**Teaching Hours**
1	Listening Skills	6
2	Workplace Etiquette	3
3	Introducing Oneself	3
4	Short presentation (JAM)	6
5	Group Discussion	6
6	Resume Writing and Cover Letter	3
7	Interview Skills	9
8	Presentation Skills	9
Total		*45*

Course Content:

UNIT I: Listening Skills **6 periods**

Pre – While- Post-listening activities- Listening to audio content (dialogues / speech/ narrations) - answering the questions and fill in the blanks- vocabulary

UNIT 2: **Workplace Etiquette** **3 periods**

Basics of Etiquette- politeness/ courtesy, good manners- features of work place etiquette- adaptability, positive attitude, body language.

UNIT 3: Introducing oneself **3 periods**

Speak about oneself - introduce oneself to a gathering/ formal & informal situations- Know about others- filling in the grid- introducing oneself in interviews

UNIT 4: Short Presentation **6 periods**

Dos and Don'ts in short presentation- speak for a minute without repetition, deviation & hesitation - the techniques to speak fluently – defining and describing objects, people, phenomena, events.- speaking on randomly chosen topics.

UNIT 5: Group Discussion **6 periods**

Fundamentals of Group Discussion- Dos and Don'ts- filling the Grid- possible list of topics- practice sessions- sample videos-Group activity

UNIT 6: Resume Writing and Cover Letter **3 periods**

Pre activity: answer the questions- jotting down biographical information- sample resumes- tips, Dos and Don'ts- model resumes- practice exercises on Resume writing

UNIT 7: Interview Skills **9 periods**

Pre –while-post activities: - things to do at three stages – respond to notifications- know the information about the organisation-practice FAQs - preparation of good/ suitable C V, Body language, tips for success in interviews, model / mock interviews.

UNIT 8: Presentation Skills **9 periods**

Preparatory work: observe pictures and answer questions- different kinds of presentations- PPTs, Flash cards, Posters, Charts. - tips to prepare aids, slide show, model PPTs, - checklist on pre, while and post presentations.

Mapping Course Outcomes with Programme Outcomes:

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**
CO	**POs 1 to 5 are applications of Engineering Principles, can't be directly mapped to English Communication Skills**					**1,2,3,4**	**1,2,3,4**

Unit wise Mapping of CO –PO

CO	**Course Outcome**	**COs / Unit Mapped**	**POs** mapping	**Cognitive levels as per Bloom's Taxonomy R/U/A/An (Remembering / Understanding / Applying/ Analyising)**
CO 1	Listen and comprehend listening inputs related to different genres effectively	Unit 1	6,7	R/U/A
CO2	Communicate effectively in interpersonal interactions, interviews, group discussions and presentations	Units 3,4,5,7,8	6,7	R/U/A/An
CO3	Acquire employability skills: job hunting, resume writing, attending interviews	Units 6,7	6,7	R/U/A/An
CO4	Practise appropriate body language and professional etiquette	Units 2, 3, 4,5,7,8	6,7	R/U/A

ANALYTICAL INSTRUMENTATION LAB

Course code	Course title	Total no. of periods	Marks for FA	Marks for SA
AEI-409	*ANALYTICAL INSTRUMENTATION LAB*	45	40	60

TIME SCHEDULE

S.NO	Major Topics	No. of Periods	COs Mapped
I	Spectro photometers	12	CO1
II	Flame Photo Meter	6	CO2
III	Dissolved Oxygen Meter	3	CO3
IV	Refractometer	6	CO4
V	Polarimeter	6	CO5
VI	Measurement of pH&Conductivity	12	CO6
	Total	45	

	Upon completion of the course the student shall be able to		
Course Objectives		(i) (ii)	Familiarize with the use of analytical instruments Measure the valve of pH and conductivity using pH meter and conductivity meter.
Course outcomes	CO1	***AEI-409.1***	Analyze the composition of the given sample using Spectro Photo Meters
	CO 2	***AEI-409.2***	Determine the presence of metal in a given sample using flame photometer
	CO 3	***AEI-409.3***	Determine the dissolved Oxygen in given sample using Dissolved oxygen meter
	CO 4	***AEI-409.4***	Find out the refractive index of the given sample using refractometer
	CO 5	***AEI-409.5***	Find the concentration of a given sample using Polarimeter

	CO 6	*AEI-409.6*	Measure the p^H value of the given solution using p^H meters and conductivity using conductivity meter.
Learning Outcomes		**I. SPECTRO PHOTO METERS.** **1.** Analyze the composition of the given sample using UV Spectro Ph Meter. **2.** Analyze the composition of the given sample using IR Spectro Phc Meter. **3.** Analyze the composition of the given sample using Visible Spectrc Meter. **II. FLAME PHOTO METER** **4.** Using Flame Photo Meter, determine the presence of metal in a giv sample. **III. DISSOLVED OXYGEN METER** **5.** Determine the dissolved Oxygen in given sample using Dissolvec meter. **IV. REFRACTOMETER** **6.** Find out the refractive index of the given sample using refractome **V. POLARIMETER** **7.** Find the concentration of a given sample using Polarimeter **VI. MEASUREMENT OF p^H &CONDUCTIVITY** **8.** Measure the p^H value of the given solution using p^H meter using a) Analog p^H meter b) Digital p^H meter **9.** Measure the conductivity of a given sample using conductivity me	

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-409.1	*2*				*1*			*3*	*2*	
AEI-409.2	*1*				*1*			*3*	*2*	
AEI-409.3	*1*				*1*			*3*	*2*	
AEI-409.4	*1*			*1*				*3*	*2*	
AEI-409.5	*1*			*1*				*3*	*2*	
AEI-409.6	*2*			*2*				*3*	*2*	*1*
Average	*1.33*			*1.33*	*1*			*3*	*2*	*1*

3= strongly mapped 2= moderately mapped 1= slightly mapped

PROCESS CONTROL LAB

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-410	*PROCESS CONTROL LAB*	3	45	40	60

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	COs Mapped
I	P,PI,PID Control Modes	21	CO1
II	Open loop and Closed loop Response	6	CO2
III	I/P & P/I Converters	9	CO3
IV	Control Valves	9	CO4
	TOTAL	**45**	

	Upon completion of the course the student shall be able to		
Course Objectives		(i)	Observe the P,PI,PID control actions of pressure ,flow, level and temperature processes.
		(ii)	Obtain open loop and closed loop response of pressure control loops.
		(iii)	Perform an experiment to convert I/P & P/I and to plot the characteristics
		(iv)	Plot the flow-lift characteristics of Linear, Quick opening and Equal percentage control valves
Course outcomes	CO1	*AEI-410.1*	Observe the P,PI,PID control actions of pressure ,flow, level and temperature processes.
	CO2	*AEI-410.2*	Obtain open loop and closed loop response of pressure control loops.
	CO3	*AEI-410.3*	Perform an experiment to convert I/P & P/I and to plot the characteristics

	CO4	*AEI-410.4*	Plot the flow-lift characteristics of Linear, Quick opening and Equal percentage control valves

Learning Outcomes

I. P,PI,PID Control Modes

1. Observe the action of the following control modes to pressure process
   - i) Proportional Control
   - ii) Proportional Integral Control
   - iii) Proportional Integral & Derivative Control
2. Observe the action of the following control modes to flow process
   - i) Proportional Control
   - ii) Proportional Integral Control
   - iii) Proportional Integral & Derivative Control
3. Observe the action of the following control modes to level process
   - i) Proportional Control
   - ii) Proportional Integral Control
   - iii) Proportional Integral & Derivative Control
4. Observe the action of the following control modes to temperature process
   - i) Proportional Control
   - ii) Proportional Integral Control
   - iii) Proportional Integral & Derivative Control

II. Open loop and Closed loop Response

5. Obtain open loop and closed loop response of pressure control loop

III. I/P & P/I Converters

		6. Perform an experiment to convert current (4-20mA) to Pressure(3-15 psi) using I/P converter and plot the characteristics between input current and output pressure. 7. Perform an experiment to convert Pressure(3-15 psi) to current (4-20mA) using P/I converter and plot the characteristics between input pressure and output current. **IV. Control Valves** 8. Plot the flow- lift characteristics of the following i) Linear control valve ii) Quick opening control valve iii) Equal percentage control valve

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-410.1	3	1			1			3	2	1
AEI-410.2	1	1			1			3	2	1
AEI-410.3	1	1			1			3	2	1
AEI-410.4	1	1			1			3	2	1
Average	1.5	1			1			3	2	1

3= strongly mapped
2= moderately mapped
1= slightly mapped

V SEMESTER

DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
CURRICULUM-23
V SEMESTER

Subject Code	Name of the Subject	Instruction periods / week		Total Periods /semester	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
AEI-501	Industrial Management & Entrepreneurship	4	-	60	3	20	80	100
AEI-502	Internet of Things and Industry 4.0	6		90	3	20	80	100
AEI-503	ARM microcontroller	5		75	3	20	80	100
AEI-504	Industrial Automation	5		75	3	20	80	100
AEI-505	Instrumentation in Process Industries	4		60	3	20	80	100
PRACTICAL								
AEI-506	Internet of Things and Industry 4.0 Lab		3	45	3	40	60	100
AEI-507	ARM microcontroller LAB		3	45	3	40	60	100
AEI-508	Life skills		3	45	3	40	60	100
AEI-509	Industrial Automation Lab		3	45	3	40	60	100
AEI-510	Project Work		3	45	3	40	60	100
	Activities		3	45	3			
TOTAL		24	18	630	-	300	700	1000

AEI-508 common with all branches.

INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP

Course code	Course title	No. of hours per week	Total no. of periods	Marks for FA	Marks for SA
AEI-501	INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP	4	60	20	80

TIME SCHEDULE

S.NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Basics of Industrial Management, Organisation structure & Organisational behaviour	10	16	2	1	CO1
2	Electronic Product design and Development stages	13	26	2	2	CO2
3	Electronic Product testing & documentation	13	26	2	2	CO3
4	Entrepreneurship Development.	10	16	2	1	CO4
5	Industrial Safety	7	16	2	1	CO5
6	Quality control	7	10	-	1	CO5
	TOTAL	**60**	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i) (ii) (ii)	To familiarize the concepts of management, ownership styles, organization structures, Industrial safety, quality control. To get Exposure to organizational behavioral concepts, basics of Electronic Product design, Development, testing and documentation stages in Electronic industries. To understand the concept Entrepreneurship Development in industries.	
Course outcomes	CO1	AEI-501.1	Explain the basics of management, Organisation structure & Organizational behaviour as applied to industry
	CO2	AEI-501.2	Explain Product Design and Development Stages applied

			to electronic industries
	CO3	AEI-501.3	Analyse the testing standardisation for Electronic products.
	CO4	AEI-501.4	Describe the role of entrepreneur in economic development and in improving the quality of life
	CO5	AEI-501.5	Explain about Industrial Safety, quality control.

Learning Outcomes

1.0 Basics of Industrial Management, Organization Structure & organizational behaviour

1.1 Define industry, commerce (Trade) and business.
1.2 State the need for management.
1.3 State the functions of Management.
1.4 Explain the principles of scientific management.
1.5 Differentiate: i) management and administration.
ii) Supervisory, middle and top level management
1.6 Explain the line, staff and Functional organization structures.
1.7 State motivation theories.
1.8 Explain Maslow's Hierarchy of needs.
1.9 List out different leadership models.
1.10 Explain the trait theory of leadership and behavioural theory of Leadership
1.11 Explain the process of recruitment and selection.
1.12 Explain different types of business ownerships and compare them
1.13 Define social responsibilities and Corporate social responsibility

2.0 Electronic Product design and Development stages

2.1 Explain the concept of product development with a block diagram.
2.2 Give classification of Electronic Products.
2.3 Explain the Techno Commercial Feasibility of a product.
2.4 Explain customer requirements.
2.5 Explain R&D prototype Assessment of reliability.
2.6 Explain factors for reliability of equipment.
2.7 Explain quality considerations.
2.8 List reasons for failure of an electronic product.
2.9 Explain Bath tub curve..
2.10 Explain Product packaging and storage
2.11 Estimate power supply requirements of an electronic product.
2.12 List two types of power supply protection devices.
2.13 Define noise reduction.
2.14 Explain grounding, shielding and guarding techniques.
2.15 Explain Thermal management.

3.0 Electronic Product testing & documentation

3.1 State the importance of product testing and Environmental testing.
3.2 Explain Dry heat testing, Vibration testing, random testing and Bump testing.
3.3 Explain Temperature extreme testing for linear and step stress profiles
3.4 Explain Vibration & temperature cycling.
3.5 Explain EMI and EMC compliance testing standardization.

	3.6 Explain UL and CE Certification of industrial electronic products. 3.7 State the importance of documentation. 3.8 List types of documentation. 3.9 Explain types of documents. 3.10 List rules for preparation of effective document. 3.11 Explain PCB documentation. 3.12 Explain Assembly and fabrication related documentation for Laminate grade. 3.13 Explain the preparation a manual document. 3.14 Explain the details of service manual. 3.15 Explain test report/manuals. 3.16 Explain product documentation, Bill of materials, Production test specifications. **4.0 . Entrepreneurship Development.** 4.1 Define the word entrepreneur. 4.2 Explain the requirements of an entrepreneur. 4.3 Determine the role of entrepreneurs in promoting Small Scale Industries. 4.4 Describe the details of self-employment schemes. 4.5 List the financial assistance programmes. 4.6 List out the organisations that help an entrepreneur 4.7 Explain the use of EDP Programmes 4.8 Understand the concept of make in India, Zero defect and zero effect. 4.9 Understand the importance for start ups. 4.10 Explain the conduct of demand surveys. 4.11 Explain the conduct of a market survey. 4.12 Evaluate Economic and Technical factors. 4.13 What is the feasibility study in project management? 4.14 What are the advantages of feasibility study? 4.15 Prepare feasibility report study. **5.0 Industrial Safety** 5.1 State the importance of safety in the industry. 5.2 Explain the principles of 5S safety system. 5.3 Explain the major hazards which may arise from the use of electrical equipment. 5.4 Explain the precautions to be taken to prevent accidents while using Machines. 5.5 Explain method of first aid treatment for someone suffering from electric shock. 5.6 State general electrical safety rules. 5.7 Explain the safety signs and colours. 5.8 Show various safety symbols and explain their meaning. 5.9 Explain the causes of Fire and fire accidents in industry. 5.10 Explain Fire prevention measures. 5.11 List 4 types of Portable fire extinguishers. 5.12 Explain the choice of above extinguishers. 5.13 Explain the First aid treatment in the case of burns. 6.0 **Quality Control** 6.1 Define the term quality control with respect to an industry. 6.2 State the importance of quality control in an industry.

	6.3	List and explain the key elements of a quality control.
	6.4	Define the term quality assurance.
	6.5	Differentiate between quality control and quality assurance.
	6.6	State the use of X-ray fluorescence machine in quality control of cement in cement industry.

CO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
AEI-501.1	1							1		
AEI-501.2	3	2	3		2		2	3	2	2
AEI-501.3	3	2	3	3	2		2	3	2	2
AEI-501.4	1				1			1		3
AEI-501.5	3	2		2	2		0	2		2
Average	2.20	3.00	3.00	2.50	1.75		1.33	2.00	1.33	2.25

3= Strongly mapped 2= Moderately mapped 1= Slightly mapped

COURSE CONTENT:

1. Basics of Industrial Management, Organisation Structure & organisational behaviour

Introduction: Industry, Commerce and Business; Definition of management; Functions of management - Principles of scientific management: –Administration and management;- levels of management; Organisation structure- behaviour of individual in an organisation- delegation an decentralisation- effective organisation- Motivational Theories; -Leadership Models; -decision making-Human resources requirement- process of recruitment, selection - Forms of Business ownerships -Social responsibility and Corporate Social responsibility

2. Electronic Product design and Development stages:

Introduction, Explain The Techno Commercial Feasibility of specifications, Explain R&D prototype Assessment of reliability, Estimating power supply requirements, Power supply protection devices, Noise reduction,. Grounding, Shielding and guarding techniques, Thermal management,

3. **Electronic Product testing and Documentation:**

Introduction to product testing, Environmental testing: Dry heat, Vibration temperature cycling, Bump and Humidity tests as specified in IS standards, EMI EMC compliance testing standardization, UL and CE Certification of industrial electronic products-PCB documentation, Assembly and fabrication related documentation Laminate grade, product documentation User manual service maintenance manual Bill of materials Production test specifications

4. Entrepreneurship Development.

Definition of Entrepreneur; Role of Entrepreneur; Concept of Make In India, ZERO defect, Zero Effect, Concept of Start-up Company, Entrepreneurial Development: Role of SSI, MSME, DICs, Entrepreneurial development schemes; Institutional support, financial assistance programmes; Market survey and Demand survey; Preparation of Feasibility study reports

5. Industrial Safety

Importance of safety in the industry-the principles of 5S safety system-the major hazards which may arise from the use of electrical equipment-precautions to be taken to prevent accidents while using Machines-method of first aid treatment for someone suffering from electric shock- general electrical safety rules-the safety signs and colours-various safety symbols and explain their meaning-causes of Fire and fire accidents in industry-Fire prevention measures-types of Portable fire extinguisher-choice of above extinguishers-the First aid treatment in the case of burns

6. Quality control

Definition, need and elements of quality control, use of X-ray fluorescence machine in quality control of cement in cement industry.

REFERENCE BOOKS

1. O.P Khanna, Industrial Engineering and Management
2. Buffa, Production Management
3. Banga& Sharma, Engineering Economics and Management Science
4. Flippo, Personnel Management
5. S.N. Chary, Production and Operations Management
6. Converging_Technologies_for_Smart_Environments_and_Integrated_Ecosystems_IERC_Bo ok_Open_Access_2013 pages-54-76
7. Electronic Product Design, R.G.Kaduskar, V.B.Baru, Wiley India
8. Electronic testing and fault diagnosis –G.C. Loveday (Ah wheeler Publication, India)

Table specifying the scope of syllabus to be covered for Unit Tests

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 3.6
Unit Test-II	From 3.7 to 6.6

INTERNET OF THINGS AND INDUSTRY 4.0

Course code	Course title	Periods/Week	Total no. of periods	Marks for FA	Marks for SA
AEI-502	INTERNET OF THINGS AND INDUSTRY 4.0	06	90	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Introduction to Industry 4.0	9	06	2	-	C01
2	Introduction to Internet of Things	11	06	2	-	CO2
3	IoT and M2M	12	23	1	2	CO3
4	Elements of IoT	12	23	1	2	CO4
5	IoT Application Development	12	16	2	1	CO5
6	Ethics in IoT	17	16	2	1	CO6
7	IoT Case Studies	17	20	-	2	CO7
	TOTAL	**90**	**110**	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i) (ii) (iii)		Explain internet of Things, industry 4.0 and its hardware and software components. Explain interface I/O devices, sensors & communication modules. Understand IoT based case studies and projects.
Course outcomes	CO1	*AEI-502.1*	Understand internet of Things, industry 4.0 and its hardware and software components.
	CO2	*AEI-502.2*	Interface I/O devices, sensors & communication modules.
	CO3	*AEI-502.3*	Remotely monitor data and control devices.
	CO4	*AEI-502.4*	Develop real life IoT based projects.
	CO5	*AEI-502.5*	Know about Ethics in IoT.
	CO6	*AEI-502.6*	Working on IoT case studies.

Learning Outcomes		**1.0 Introduction to Industry 4.0** 1.1 Introduction to Industry 4.0. 1.2 State the historical context of Industry 4.0. 1.3 Explain the general frame work of Industry 4.0. 1.4 List different application areas of Industry 4.0. 1.5 State the discrimination of Industry 4.0. 1.6 List the disciplines that contribute to Industry 4.0 development. 1.7 Define artificial intelligence. **2.0 Introduction to Internet of Things** 2.1 Define IoT and list the Characteristics of IoT 2.2 Explain Physical design of IoT 2.3 State Things in IoT and IoT protocols. 2.4 Explain about IoT enabling Technologies. 2.5 List different Wireless Sensor networks. 2.6 Explain about: a. Cloud Computing b. Big Data Analytics c. Communication Protocols d. Embedded Systems 2.7 Explain IoT Levels and Development Templates a. IoT Level-1 b. IoT Level-2 c. IoT Level-3 d. IoT Level-4 e. IoT Level-5 f. IoT Level-6 **3.0 IoT and M2M** 3.1 Explain basics of Networking. 3.2 State M2M and IoT Technology Fundamentals. 3.3 List different Devices and Gateways. 3.4 Explain Data Management.

		3.5 Explain Business Process in IoT. 3.6 Explain Everything as a Service (XaaS). 3.7 State the Role of cloud in IoT. 3.8 List Security aspects of IoT. 3.9 Explain basic fundamental architecture of IoT (4 Stage IoT architecture). **4.0 Elements of IoT** 4.1 List different types of IoT components. 4.2 Explain IoT hardware components. 4.3 Explain Computing Hardware (Arduino, Raspberry Pi). 4.4 State about Communication, Sensing, Actuation and I/O Interfaces. 4.5 State about software components of IoT. 4.6 Explain Programming APIs: 4.6.1 MQTT 4.6.2 Zigbee 4.6.3 Bluetooth 4.6.4 CoAP 4.6.5 UDP 4.6.6 TCP 4.7 Explain about IoT Communication Technologies. **5.0 IoT Application Development** 5.1 Explain the applications of IoT. 5.2 Explain the Solution framework for IoT applications. 5.3 Explain Device Integration and Implementation. 5.4 Explain about Data acquisition and integration. 5.5 Explain Device Data Storage in IoT. 5.6 Explain data storage on cloud/local server. 5.7 Explain Authentication. 5.8 Explain Authorization of devices. **6.0 Ethics in IoT** 6.1 Explain IoT Characterization, Privacy and Control. 6.2 Explain Disrupting control and Crowd Sourcing. 6.3 Explain the environment of IoT in Electronics and Internet Service. 6.4 Explain how IoT is part of a Solution. 6.4.1 Cautious optimism.

		6.4.2 Open IoT Definition. **7.0 IoT Case Studies** 7.1 Explain IoT Case Studies and Mini projects on: 7.1.1 Industrial automation. 7.1.2 Transportation. 7.1.3 Agriculture. 7.1.4 Healthcare. 7.1.5 Home Automation.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-502.1	*1*	*1*	*1*					*3*	*2*	
AEI-502.2	*1*	*1*	*1*					*3*	*2*	
AEI-502.3	*2*		*2*					*3*	*2*	
AEI-502.4	*1*		*1*	*2*				*3*	*2*	
AEI-502.5	*1*							*3*	*2*	
AEI-502.6	*1*			*2*	*1*			*3*	*2*	*1*
Average	*1.2*	*1*	*1.25*	*2*	*1*			*3*	*2*	*1*

3= Strongly mapped 2= Moderately mapped 1= Slightly mapped

COURSE CONTENTS

1.0 Introduction to Industry 4.0

Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial intelligence.

2.0 Introduction to Industry 4.0

Definition and characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols,Logical Design of IoT, IoT functional blocks, IoT communication Models, IoTcommunication API's, IoT enabling Technologies Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT Levelsand Deployment templates – IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4,IoT Level-5, IoT Level-6

3.0 IoT and M2M

Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT, Basic fundamental architecture of IoT (4 Stage IoT architecture).

4.0 Elements of IoT

Overview of IoT components, Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP, IoT Communication Technologies.

5.0 IoT Application Developments

6.0 Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

7.0 Ethics in IoT

Characterizing the IoT, Privacy, Control – Disrupting Control, Crowd sourcing; Environment – Physical thing, Electronics, Internet service; Solutions – The IoT as a part of the solution, cautious optimism, the open IoT definition.

7.0 IoT Case Studies

IoT case studies and mini projects based on Industrial Agriculture, Healthcare, Home Automation, automation,Transportation,

REFERENCE BOOKS:

1. Internet of Things Reference Architecture – Whitepaper – CISCO
2. IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, 2nd Edition – Perry Lea, Packt Publishing Limited, ISBN-10: 189214805
3. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
4. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
5. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
6. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
7. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs

8. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
9. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
10. Adrian McEwen, "Designing the Internet of Things", Wiley
11. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
12. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 4.7
Unit Test-II	From 5.1 to 7.1.5

ARM MICROCONTROLLERS

Course code	Course title	Periods/Week	Total no. of periods	Marks for FA	Marks for SA
AEI-503	ARM MICROCONTROLLERS	05	75	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Architecture of ARM Microcontrollers	15	29	3	2	C01
2	Instruction set of ARM Microcontrollers	15	16	2	1	CO2
3	Advanced ARM micro controllers	10	13	1	1	CO3
4	Arduino Controller	15	26	2	2	CO4
5	Applications using Arduino	20	26	2	2	CO5
	TOTAL	75	110	10	8	

Upon completion of the course the student shall be able to			
Course Objectives	(i)		Explain the architecture, programming and applications of ARM microcontrollers.
Course outcomes	CO1	*AEI-503.1*	Explain the functional block diagram of ARM microcontrollers.
	CO2	*AEI-503.2*	Explain the instruction set and addressing modes s of ARM microcontrollers.
	CO3	*AEI-503.3*	Write the assembly level language programs of ARM microcontrollers
	CO4	*AEI-503.4*	Introduction about advanced ARM microcontrollers
	CO5	*AEI-503.5*	Explain the functional block diagram and instruction set of Arduino.
Learning Outcomes		**1.0**	**Architecture of ARM micontrollers**
		1.1	Know various RISC processors in market.
		1.2	Discuss in general the Pipelining concept and its advantages.

		1.3 Explain Pipelining with an example. 1.4 Explain ARM Core Architecture. 1.5 List five Important Features of ARM controller. 1.6 Compare the different versions of ARM controller. 1.7 Explain Architecture of ARM controllers. 1.8 Explain Memory Map of ARM controller. 1.9 Explain Addressing Modes ARM controller. **2.0 Instruction set of ARM microcontrollers** 2.1 Explain Instruction set of ARM controller. 2.2 Explain Arithmetic instructions. 2.3 Explain Registers in ARM controllers. 2.4 Explain THUMB Instruction set Extensions of ARM controllers. 2.5 Explain the exception handling mechanism of ARM controllers. **2.6** Mention four applications of various versions of ARM controllers. **3.0 Advanced ARM Microcontrollers of MX series** 3.1 Describe the features of Cortex M3 Microcontroller. 3.2 List the specifications of Cortex M3 Microcontroller and describe their significance. 3.3 Explain the Architecture of Cortex M3 Microcontroller with a simplified Block diagram. 3.4 Describe the features of Cortex M4 Microcontroller 3.5 List the specifications of Cortex M4 Microcontroller and describe their significance. 3.6 Explain the Architecture of Cortex M4 Microcontroller with a simplified Block diagram. 3.7 List the real time applications of Cortex MX Microcontrollers. 3.8 Explain Pipelining in various ARM controllers. 3.9 List High level Languages and Cross compilers Used with Cortex series Microcontrollers. **4.0 Arduino Architecture** 4.1 Understand the concept of open source. 4.2 Explain the concept of Arduino processor environment. 4.3 Discuss advantages of Arduino platform. 4.4 Describe components on Arduino Board. 4.5 Discuss Arduino family boards and know their features. 4.6 Appreciate various sensors used with Arduino. **5.0 Programming with Arduino** 5.1 Understand system requirements for Arduino. 5.2 Explain downloading and installing Arduino Software. 5.3 Appreciate various drivers for Arduino. 5.4 Discuss process of developing a real time application. 5.5 Discuss Arduino application for automation of street lights.

		5.6 Discuss Arduino application for automation of watering of plants. 5.7 Discuss Arduino application for automation of smart house.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-503.1	**1**	**1**		**1**	**1**			**3**	**2**	
AEI-503.2	**1**	**1**		**1**	**1**			**3**	**2**	**1**
AEI-503.3	**1**	**1**						**3**	**2**	
AEI-503.4	**1**	**1**		**1**	**1**			**3**	**2**	**1**
AEI-503.5	**1**	**1**						**3**	**2**	
Average	**1**	**1**		**1**	**1**			**3**	**2**	**1**

3= Strongly mapped 2= Moderately mapped 1= Slightly mapped

COURSE CONTENTS

1. Architecture of ARM Microcontrollers

RISC Concept-Compare CISC and RISC Architecture- ARM Core Architecture-Important Features of ARM controller-Compare the Different versions of ARM controller- Architecture of ARM controllers- Memory Map of ARM controller-Addressing Modes ARM controller.

2. Instruction set of ARM Microcontrollers

Instruction set of ARM controller- Arithmetic instructions- Registers of ARM Processors- THUMB-Instruction set Extensions of ARM- Exception handling mechanism of ARM- Concept of Pipelining in ARM processors-Application of various versions of ARM.

3. Advanced ARM micro controllers

Need to improve speed and Interfacing Capabilities of ARM controllers- Cortex MX series Micro conntrollers- Cortex M3-Features and Specifications-Simplified Block Diagram- Cortex M3-Features and Specifications-Simplified Block Diagram-Real time Applications-High level Languages and Cross compilers Used with Cortex series Micro controllers

4. Arduino Controller

Open source concepts-concept of Arduino environment-advantages of Arduino platform- Arduino Board components-family of Arduino-sensors used in Arduino

5. Applications using Arduino

System requirements for Arduino – Process of downloading and installing Arduino software – drivers – simple applications using Arduino like, street lights, watering of plants and smart house

REFERENCE BOOKS:

1. Microcontroller Programming: The Microchip PIC By Julio Sanchez, Maria P. Canton CRC Press
2. PIC Microcontroller and Embedded Systems, Mazidi, McKinley and Danny Causey, Pearson Education, 2008
3. Advanced Microprocessor And Microcontrollers By B.P. Singh, New age International Publications
4. Micro Processors and Micro Controllers- M.Senthil Kumar, M.Saravanan and S.Jeevanathan Oxford University Press, 1stEdn, 2010
5. Getting Started with Arduino, Book by Massimo Banzi
6. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition
7. Cortex -M3 Technical Reference Manual
8. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph You
9. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media
10. ARM System Developer's Guide, Andrew Sloss, Dominic Symes and Chris Wright, Elsevier India, 1st Edition

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 2.6
Unit Test-II	From 3.1 to 5.7

INDUSTRIAL AUTOMATION

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-504	INDUSTRIAL AUTOMATION	5	75	20	80

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Introduction to PLC	15	16	2	1	CO1
2	PLC Programming	20	26	2	2	CO2
3	SCADA	15	26	2	2	CO3
4	Computer Control	15	26	2	2	CO4,CO5
5	Embedded systems	10	16	2	1	CO6
	TOTAL	**75**	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i)	Familiarise with the knowledge of PLC, programming of PLC , SCADA, computer control and Embedded systems	
Course outcomes	CO1	AEI-504.1	Explain the block diagram of PLC and list the different types of PLCs.
	CO2	AEI-504.2	Draw and explain the ladder diagrams for different logic functions and different applications.
	CO3	AEI-504.3	Familiarization with SCADA.
	CO4	AEI-504.4	Explain the block diagrams of data logger,DAS, DDC, DCS.
	CO5	AEI-504.5	Explain the principle of operation of ROBOT and CNC machine.
	CO6	AEI-504.6	Explain the software and hardware architectures of embedded systems.
Learning Outcomes	**1.0 Introduction to PLC** 1.1 Define automation 1.2 State the importance of automation. 1.3 Explain Relay based Control panel. 1.4 Define Programmable Logic Controller (PLC) and list the advantages of PLCs. 1.5 Compare Relay based and PLC based Control panel		

	1.6 Explain the Block diagram of PLC 1.7 List different types of PLCs based on I/O's ,memory and configuration 1.8 Explain Interfacing of PLC with PC. 1.9 List the manufacturers of PLC. 1.10 List the applications of PLC. **2.0 PLC Programming** 2.1 List different types of PLC programming techniques. 2.2 Define Ladder diagram 2.3 List the rules to follow in drawing Ladder diagram 2.4 List and explain PLC Instruction set 2.5 Draw ladder diagrams for AND, OR, NOT, NAND, NOR, EXOR and EXNOR gates. 2.6 Explain Timers-T ON, T OFF and Retentive timer with ladder diagram. 2.7 Explain Counter instructions -CTU, CTD 2.8 Explain ladder diagrams on arithmetic and comparison instructions 2.9 Draw and explain the ladder diagrams for following applications: I. DOL starter and STAR-DELTA starter II. Sequential control of induction motors, III. Traffic light controller IV. Level control controller V. Conveyer belt controller. **3.0 SCADA** 3.1 Define SCADA 3.2 Explain the hardware architecture of SCADA. 3.3 List the three main components of a SCADA. 3.4 Explain Remote Terminal Unit of SCADA. 3.5 Explain Master Station of SCADA. 3.6 Explain communication infrastructure of SCADA. 3.7 Explain the creation of graphic symbols using Graphic Display builder. 3.8 Explain Interfacing of SCADA with PLC. 3.9 List the applications of SCADA **4.0 Computer Control** 4.1 State the role of Computers in Process control 4.2 Explain the block diagram of Data Logger 4.3 List the applications of Data Logger 4.4 Explain the block diagram of Data acquisition system 4.5 Explain the block diagram of Direct Digital Control System (DDC) 4.6 Define a Robot. 4.7 Explain the operation of simple robot with block diagram. 4.8 List the applications of a Robot 4.9 Explain CNC Machine with block diagram. 4.10 List the applications of CNC Machine. **5.0 Embedded Systems** 5.1 Define the term Embedded system. 5.2 List the applications of embedded system. 5.3 List the components of Embedded system 5.4 Explain the hardware architecture of Embedded system 5.5 Explain the software architecture of Embedded system 5.6 List the commonly used processors in embedded systems. 5.7 State the need for communication interfaces.

	5.8 List the communication interfaces. 5.9 Explain serial communication using USB.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-504.1	**1**	**1**		**1**	**1**			**3**	**2**	
AEI-504.2	**2**	**2**		**2**	**2**			**3**	**2**	
AEI-504.3	**1**	**1**		**1**	**1**			**2**	**2**	
AEI-504.4	**1**	**1**		**1**	**1**			**3**	**1**	**1**
AEI-504.5	**1**	**1**		**1**	**1**			**2**	**2**	**1**
AEI-504.6	**1**	**1**		**1**	**1**			**1**	**1**	**1**
Average	**1.2**	**1.2**		**1.2**	**1.2**			**2.3**	**1.7**	**1**

3= Strongly mapped 2= Moderately mapped 1= Slightly mapped

COURSE CONTENT

1.0 Introduction to PLC

Importance of automation- relay based and plc based control panel- PLC Definition- Block diagram-Explanation- different types of PLCs- different types of PLC manufacturers-Interfacing PLC and PC

2.0 PLC Programming

Types of PLC programming- rules for programming -Instruction set- Ladder diagrams for logic functions- Ladder program using bit instructions for DOL starter, Star-Delta Starter, Traffic light control, level control, conveyor controller.

3.0 SCADA

SCADA definition, Architecture and explanation, remote terminal unit, master station, communication infrastructure of SCADA, Graphical symbols used in SCADA, Interfacing of
SCADA with PLC, applications of SCADA.

4.0 Computer Control

Role of computers in process control, Data Logger, Data Acquisition, Direct Digital Control System,DCS, Robot and its Applications, CNC Machine.

5.0 Embedded Systems:

Definition of Embedded system, applications, software and hardware architectures, serial
Communication using USB.

REFERENCE BOOKS

1. Industrial control engineering by Jacob
2. Industrial automation and process control by Jon Sterenson
3. Programmable Logic controllers by John W.Webb
4. Introduction to PLC by Gary Dunning- Delmar Cengage learning.
5. Embedded Real Time Systems-Dr KVKK Prasad.
6. Computer based industrial control- Krishna Kanth.

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 3.4
Unit Test-II	From 3.5 to 5.9

INSTRUMENTATION IN PROCESS INDUSTRIES

Course code	Course title	No. of hours per week	Total no. of periods	Marks for FA	Marks for SA
AEI-505	Instrumentation in Process Industries	4	60	20	80

TIME SCHEDULE

S.NO	Major Topics	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Methods of power generation in Power Plant	07	23	1	2	CO1
2	Instrumentation and control in power Plant	17	16	2	1	CO2
3	Petro Chemical Plant Instrumentation	12	29	3	2	CO3
4	Iron and Steel Plant Instrumentation	12	23	1	2	CO4
5	Pulp and Paper Plant Instrumentation	12	19	3	1	CO5
	TOTAL	**60**	110	**10**	**8**	

Upon completion of the course the student shall be able to			
Course Objectives	(i)	Familiarize with the knowledge of methods of power generation in different power plants like thermal, Hydroelectric, Wind, Solar, and Nuclear Power Plants.	
	(ii)	Familiarize with the knowledge of instrumentation control in Petrochemical plant, Iron and steel Plant, Pulp and paper plant.	
Course outcomes	CO1	AEI-505.1	Explain the process of power generation in thermal, Hydroelectric, Wind, Solar ,Nuclear Power Plants
	CO2	AEI-505.2	Explain the instrumentation and control in power plant
	CO3	AEI-505.3	Explain the instrumentation and control in petro chemical plant
	CO4	AEI-505.4	Explain the instrumentation and control in Iron and steel Plant

	CO5	AEI-505.5	Explain the instrumentation and control in Pulp and paper plant

Learning Outcomes

1.0 Methods of power generation in Power Plant

1.1 List various power generation methods.

1.2 Give the principle of power generation in thermal power plant.

1.3 Draw the general layout of thermal power plant

1.4 Explain the above layout of thermal power plant.

1.5 Explain the process of power generation with the help of diagrams of following

a. Hydroelectric power plant
b. Wind power plant
c. Solar power plant
d. Nuclear power plant

2.0 Instrumentation and Control in Power Plant

2.1 State the Importance of measurement and instrumentation in power plant.

2.2 Draw the block diagram of boiler process in thermal power plant and explain each block.

2.3 Draw and explain a typical combustion system of a boiler.

2.4 List the important variables that need to be measured in thermal power plant.

2.5 List the measuring locations/points and types of sensors instruments in a thermal power plants of the following parameters

a) Pressure
b) Temperature
c) Flow
d) Level
e) Vibration

2.6 Explain a method of measurement of flow of feed water with a differential pressure transducer diagram.

2.7 Explain single element drum level control of boiler with a diagram.

2.8 Explain steam temperature control single-stage diagram.

2.9 Explain steam/header pressure control with a feed forward-plus-Feedback control diagram.

2.10 Explain series fuel – air ratio control.

2.11 Explain furnace draft control

2.12 Explain the measurement of turbine shaft speed with a toothed-wheel diagram

2.13 Mention the turbine trip conditions.

2.14 Explain eccentricity measurement of turbine with a diagram.

3.0 Petro Chemical plant Instrumentation.

3.1 Define petroleum refinery.

3.2 Draw the general layout of a Petro chemical plant.

3.3 Explain the above layout of petro chemical plant.

3.4 List basic steps in refinery process (separation, conversion & treatment).

3.5 Define the following unit operations

a) Thermal cracking
b) Catalytic cracking
c) Polymerization

	d) Alkalization e) Isomerisation 3.6 List the bi products of crude oil. 3.7 Define the term distillation column. 3.8 Define batch distillation and continuous distillation columns. 3.9 Explain the working of batch distillation column with a diagram. 3.10 Explain the working of continuous distillation column with a diagram. 3.11 List various physical parameters to be measured in distillation column. **4.0 Iron and Steel Plant Instrumentation (ISP)** 4.1 Draw flow scheme of pig iron production and explain. 4.2 Draw flow scheme of steel production and explain. 4.3 List raw materials in ISP 4.4 List different types of furnaces used in ISP 4.5 Explain the working of blast furnace with a diagram 4.6 Explain the working of oxygen furnace with a diagram 4.7 Explain the working of electric furnace with a diagram 4.8 Explain the measurement of molten metal level 4.9 Explain the measurement of temperature of furnace. **5.0 Pulp and Paper Plant Instrumentation (PPPI)** 5.1 Define the term pulp. 5.2 List the types of pulping processes (Mechanical and Chemical processes). 5.3 Draw the block diagram of mechanical pulping process and explain. 5.4 Draw the block diagram of chemical pulping process and explain. 5.5 Define the term paper. 5.6 Draw the general layout of paper making process 5.7 Explain the basic process of making the paper based on the layout. 5.8 List the raw materials for making paper. 5.9 List the various types of paper products. 5.10 List the physical properties of paper. 5.11 List types of control system units used in pulp and paper industry. 5.12 Explain the controlling of paper thickness with a diagram. 5.13 Explain the graphic displays and alarms in PPP

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-505.1	***2***							***3***	***2***	
AEI-505.2							***2***	***3***	***2***	
AEI-505.3	***2***	***2***						***3***	***2***	
AEI-505.4	***2***	***2***						***3***	***2***	
AEI-505.5	***2***	***2***						***3***	***2***	
Average	***2***	***2***					***2***	***3***	***2***	

3= Strongly mapped 2= Moderately mapped 1= Slightly mapped

COURSE CONTENT:

1.0 **Methods of power generation in Power Plant: -** Thermal power plant layout- Hydroelectric power plant- Wind power plant-Solar power plant-Nuclear power plant.

2.0 Instrumentation and Control in Power Plant: Block diagram of boiler process in thermal power plant- combustion system of a boiler- measurement of flow of feed water - single element drum level control of boiler- steam temperature and pressure control- series fuel – air ratio control- furnace draft control measurement of turbine shaft speed- eccentricity measurement of turbine.

3.0 Petro-chemical Plant Instrumentation: Plant layout- Crude oil-Distillation column, Batch and continuous distillations.

4.0 Iron and Steel Plant Instrumentation:-Manufacturing process of Iron and steel- Furnace types- blast, oxygen and electric furnaces- Measurement of molten metal level and temperature of furnace.

5.0 Pulp and Paper Plant Instrumentation: - Mechanical and Chemical pulping processes - Paper production-Physical properties of paper-Types of paper products- controlling of paper thickness - Control system units

Reference Books:

1. A course in power plant engineering – Arora and Domkundwar
2. Power plant Instrumentation – K.Krishnaswamy and ponnibala
3. Principles of Indusrial Instrumentation – D. Patranabis,TMGH.
4. Instrumentation in Process Industries -- Bela G.Liptak
5. Hand book of applied Instrumentation -- D.M. Consodine
6. Chemical Process Industries -- Austine G.T. Shreeves
7. Power Plant performance -- Gill A.B.
8. Power Station Instrumentation -- Jervis M.J.

Table specifying syllabus to be covered for UNIT tests.

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 3.4
Unit Test-II	From 3.5 to 5.13

INTERNET OF THINGS AND INDUSTRY 4.0 LAB

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-506	INTERNET OF THINGS AND INDUSTRY 4.0 LAB	3	45	40	60

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	COs Mapped
1	Software Installation	5	CO1
2	Interfacing one component with another Component	10	CO2
3	Write a program on arduino/Raspberry Pi to perform various operations	10	CO3
4	To Install MySQL data base on Raspberry Pi and perform basic SQL operations	10	CO4
5	Write a Program to create TCP server on Raspberry Pi	5	CO5
6	Write a program to create UDP server on Arduino/Raspberry Pi	5	CO6
	TOTAL	**45**	

Upon completion of the course the student shall be able to			
Course Objectives		(i) (ii) (iii)	Familiarize with software installation. Interfacing one component with another. Write a programs on arduino/Raspberry Pi to perform various operations.
Course outcomes	CO1	*AEI-506.1*	Know about Software Installation
	CO2	*AEI-506.2*	Interfacing one component with another component
	CO3	*AEI-506.3*	Write a program on arduino/Raspberry Pi to perform various operations
	CO4	*AEI-506.4*	To Install MySQL data base on Raspberry Pi and perform basic SQL operations
	CO5	*AEI-506.5*	Write a Program to create TCP server on Raspberry Pi
	CO6	*AEI-506.6*	Write a program to create UDP server on Arduino/ Raspberry Pi

Learning Outcomes		**List of Experiments** 1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation. 2. To Interface LED/Buzzer with Arduino/Raspberry Pi and write a program to Turn ON LED for 1 second after every 2 seconds. 3. To Interface Push Button/Digital Sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is PRESSED or at sensor detection. 4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. 5. To interface Motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed. 6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it. 7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth. 8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFFwhen '1' or '0' received from smart phone using Bluetooth. 9. Write a program on arduino/Raspberry Pi to upload temperature and humidity data to things peak could. 10. Write a program on arduino/Raspberry Pi to retrieve temperature and humidity data from things peak could.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-506.1	*2*	*2*			*2*			*3*	*2*	*1*
AEI-506.2	*1*	*1*			*1*			*3*	*2*	*1*
AEI-506.3	*1*	*1*			*1*			*3*	*2*	*1*
AEI-506.4	*1*	*1*						*3*	*2*	*1*

AEI-506.5	*1*	*1*						*3*	*2*	*1*
AEI-506.6	*1*	*1*						*3*	*2*	*1*
Average	*1.14*	*1.14*			*1.34*			*3*	*2*	*1*

3= strongly mapped
2= moderately mapped
1= slightly mapped

ARM MICROCONTROLLERS LAB

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-507	ARM MICROCONTROLLERS LAB	3	45	40	60

TIME SCHEDULE

S. NO	Major Topics	No. of Periods	COs Mapped
I	Familiarization of Microcontroller kit & Keil software	06	CO1
II	Programming using Microcontroller Kit/ Keil software	21	CO2
III	Interfacing with Microcontrollers	18	CO3
	TOTAL	**45**	

Upon completion of the course the student shall be able to			
Course Objectives		(i) (ii) (iii)	Familiarize with ARM microcontroller kit and Keil software. Write the assembly language Programs of ARM microcontroller to the specific task. Interface them with ARM Microcontroller
Course outcomes	CO1	*AEI-507.1*	Knowledge of ARM arithmetic & Logical instructions and addressing modes. Creating files and choosing appropriate components in KEIL.
	CO2	*AEI-507.2*	Knowledge of ARM Bit manipulating and Control Operations instructions and addressing modes. Creating files and choosing appropriate components in KEIL.
	CO3	*AEI-507.3*	Knowledge of conditional operations. Instruction set of ARM Processor.
	CO4	*AEI-507.4*	Knowledge of port configuration and loop instructions based applications.

Learning Outcomes		**I. ARM PROGRAMMING** 1. Practice programs using Arithmetic and Logical instructions. 2. Practice programs using Bit Byte manipulations. 3. Practice programs using Control Operations 4. Practice Assembly programs using instructions like Conditional Execution of ARM 5. Practice Assembly programs using instructions like logical shift copying of ARM 6. Practice Assembly programs using instructions like Branch instruction of ARM 7. Practice Assembly programs using instructions like THUMB instructions of ARM. **II. MICROCONTROLLER BASED APPLICATIONS** 8. Microcontroller based Voltmeter. 9. Temperature measurement and controller. 10. PWM generator for DC motor speed control.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-507.1	3	1			1			3	2	1
AEI-507.2	1	1			1			3	2	1
AEI-507.3	1	1			1			3	2	1
AEI-507.4	1	1			1			3	2	1
Average	1.5	1			1			3	2	1

3= strongly mapped
2= moderately mapped
1= slightly mapped

AEI-508: Life Skills

Course Title : Life Skills	**Course code : AEI-508 (Common to all Branches)**
Year/ Semester : V Semester	**Total periods : 45**
Type of Course : Lab Practice	**Max Marks : 100 (Sessional 40 + External 60)**

Course Objectives:	understand the relevance of life skills in both personal and professional lives
	practise life skills complementarily in life-management to lead a happy and successful life

	Course Outcomes:
CO1	exhibit right attitude and be adaptable in adverse and diverse situations
CO2	set appropriate goals and achieve them through proper planning, time management and self-motivation
CO3	solve diverse real-life and professional problems with critical thinking and creativity for a stress-free life
CO4	be an ideal team player and manifest as a leader

Course Delivery:

Text book: **"Life Skills" –** by State Board of Technical Education and Training, AP

Sl no	Unit	Teaching Hours
1	**Attitude**	4
2	**Adaptability**	4
3	**Goal Setting**	4
4	**Motivation**	4
5	**Time Management**	4
6	**Critical Thinking**	4
7	**Creativity**	4
8	**Problem Solving**	5
9	**Team work**	4
10	**Leadership**	4
11	**Stress Management**	4
	Total	45

Course Content:

UNIT I: Attitude ***matters!***
Preparatory activity-Role play; Generating word bank; Types of attitude. Read the passage and answer the related questions, read the story and discuss issues raised; Express opinions on the given topic and fill the grid with relevant words.

UNIT 2: **Adaptability…** ***makes life easy!***
Pair work-Study the given pictures and understand adaptability -read the anecdote and discuss, read the story and answer the questions, role play

UNIT 3: Goal Setting… ***life without a goal is a rudderless boat!***
Short term goals and long term goals-SMART features, observe the pictures and answer questions- matching- read the passage and answer questions-filling the grid.

UNIT 4: Motivation… ***triggers success!***
Types of motivation-difference between motivation and inspiration- matching different personalities with traits - dialogue followed by questions - writing a paragraph based on the passage.

UNIT 5: Time Management ... ***the need of the hour!***

Effective Time Management- Time quadrant - Group task on management of time- Time wasters-fill in the grid, read the story and answer the questions- prioritising tasks.

UNIT 6: Critical Thinking… ***Logic is the key!***

Preparatory activity-read the passage and answer the questions- differentiate between facts and assumptions- components of critical thinking- complete the sets of analogies- choose the odd one out- true or false statements- decide which of the conclusions are logical.

UNIT 7: Creativity…. The essential YOU!!

Definition- Pre-activity-read the anecdote and answer the questions- matching celebrities with their fields of specialisation- think of creative uses of objects- think creatively in the given situations.

UNIT 8: Problem Solving… ***there is always a way out!***

Preparatory activity-read the story and answer the questions- discuss the given problem and come out with three alternative solutions- group activity to select the

best solution among available alternatives- discuss the problem and plan to analyse it.

UNIT 9: Team Work… ***Together we are better!***

Advantages of team work- Characteristics of a team player- Activity-Observe the pictures and classify them into two groups- team game - read the story and answer the questions- fill in the grid.

UNIT 10 : Leadership… the ***making of a leader!***

Characteristics of effective leadership- styles of leadership- Activity-read the dialogue and answer the questions- identify the people in the picture and describe them- discuss leadership qualities of the given leaders- filling the grid- read the quotes and write the name of the leader.

UNIT 11: Stress Management … ***live life to the full !!***

Types of stress- Strategies for Stress Management- Activity-read the passage and answer the questions, read the situation and write a paragraph about how to manage stress.

Mapping COs with POs

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**
COs	**POs 1 to 5 are applications of Engineering Principles, can't directly be mapped with Life Skills**					**1,2,3,4**	**1,2,3,4**

Unit wise Mapping of COs- POs

CO	**Course Outcome**	**CO Unit Mapped**	**PO mapped**	**Cognitive levels as per Bloom's Taxonomy R/U/Ap/An/Ev/Cr** **(Remembering/ Understanding/ Applying/Analysing/ Evaluating/ Creating)**
CO 1	To exhibit right attitude and be adaptable to adverse and diverse situations	All Units (1 to 11)	6,7	U/Ap/ An
CO2	To set appropriate goals and achieve	Units 3,4,5	6,7	U/Ap/An

	them through proper planning, time management and self-motivation			
CO3	To solve diverse real-life and professional problems with critical thinking and creativity for a stress-free life	Units 6,7,8,11	6,7	U/Ap/An/ Ev/ Cr.
CO4	To be an ideal team player and manifest as a leader	Units 9,10	6,7	U/Ap/An/ Ev

INDUSTRIAL AUTOMATIONLAB

Course code	Course title	No of periods per week	Total no. of periods	Marks for FA	Marks for SA
AEI-509	INDUSTRIAL AUTOMATIONLAB	**3**	***45***	***40***	***60***

TIME SCHEDULE

S.NO	Major Topics	No. of Periods	COs Mapped
1	**Familiarization of PLC trainer**	03	CO1
2	**PLC Programming**	18	CO2
3	**Interfacing with PLC**	12	CO3
4	**SCADA**	12	CO4
	TOTAL	**45**	

	Upon completion of the course the student shall be able to		
Course Objectives		(I) (ii) (iii) (iv)	Familiarize with PLC Trainer. Familiarize with the Ladder diagram programming. Understand the interfacing with PLC. Understand the use of SCADA Software.
Course outcomes	CO1	*AEI-509.1*	Familiarize with PLC Trainer.
	CO2	*AEI-509.2*	Understand the Ladder programming.
	CO3	*AEI-509.3*	Understand the interfacing with PLC.
	CO4	*AEI-509.4*	Use of SCADA Software for creation of graphic symbols.
			I**. Familiarization with PLC.** 01. Familiarization with PLC trainer. II. **PLC programming**. 02. Implement the basic logic gates (AND, OR, NOT) using ladder programming. 03. Implement the Universal gates (NAND, NOR) using Ladder program

Learning Outcomes		L 04. Implement the EX-OR and Ex-NOR gates using PLC. 05. Write the program on ON-Delay Timer and OFF-delay Timer using Ladder programming. 06. Write the program on Retentive and non-retentive Timer using Ladder diagram programming. 07. Write the program on Up counter and Down Counter using Ladder diagram programming. III. **Interfacing with PLC.** 08. Implement the Traffic light controller using PLC with Ladder diagram programming. 09. Implement the Sequential control of induction motor using PLC with Ladder diagram programming. 10. Implement the Conveyer controller using PLC with Ladder programming. 11. Implement the Level controller using PLC with Ladder programming. IV. **SCADA** 12. Implement the Sequential control of induction motor using SCADA software 13. Implement the Conveyer controller using SCADA software.

CO-PO/PSO MATRIX

CO No	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
AEI-509.1	***1***	***1***			***2***			***3***	***2***	***1***
AEI-509.2	***2***	***2***			***2***			***3***	***2***	***1***
AEI-509.3	***2***	***2***			***2***			***3***	***2***	***1***
AEI-509.4	***2***	***2***			***2***			***3***	***2***	***1***
Average	***1.75***	***1.75***			***2***			***3***	***2***	***1***

3= strongly mapped
2= moderately mapped
1= slightly mapped

PROJECT WORK

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
EC-510	PROJECT WORK	03	45	40	60

LEARNING OUTCOMES:

1.0 Project work

1.1 Identify different works to be carried out in the Project

1.2 Collect data relevant to the project work

1.3 Carryout need survey

1.4 Select the most efficient method from the available choices based on preliminary investigation

1.5 Design the required elements of the project work as per standard practices

1.6 Prepare the working modules / equipment required for the project work

1.7 Estimate the cost of project, technological need, computer skills, materials and other equipment

1.8 Prepare the plan and schedule of starting time and sequence of operations to be carried out at various stages of the project work in detail

1.9 Prepare critical activities at various stages of the project work

1.10 Test various conditions with different electrical input parameter if required

1.11 Implement project work and record the results.

1.12 Preparation of project report.

VI SEMESTER

INDUSTRIAL TRAINING

Course Code	Course title	No of periods/week	Duration	Marks for FA	Marks for SA
AEI -601	INDUSTRIAL TRAINING	42	6 months	240	60

TIME SCHEDULE

S No	Unit Title	Duration	COs Mapped
1	Apply knowledge and skill already learnt in the institution.	1 month	CO1
2	Acquire the required skills of manufacturing processes, assembling, servicing, and supervising in the engineering fields.	2 months	CO2
3	Involve in product design, development, quality testing and production exhibiting the strength, teamwork spirit and self-confidence	2 months	CO3
4	Prepare product document	1 month	CO4
	Total	**6 months**	

Course Objectives	1.Expose to real time working environment 2. Enhance knowledge and skill already learnt in the institution. 3. Acquire the required skills of manufacturing processes, assembling, servicing, and supervising in the engineering fields. 4. Instil the good qualities of integrity, responsibility and self-confidence.

CO No		COURSE OUTCOMES
CO1	AEI-601.1	Apply knowledge and skill already learnt in the institution.
CO2	AEI-601.2	Acquire the required skills of manufacturing processes, assembling, servicing, and supervising in the engineering fields.

CO3	AEI-601.3	Involve in product design, development, quality testing and production exhibiting the strength, teamwork spirit and self-confidence
CO4	AEI-601.4	Prepare product document

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
AEI-601.1	3					3		3	3	
AEI-601.2	3			2	3	3	3	3	3	
AEI-601.3	3	3	3	3	3	3	3	3	3	3
AEI-601.4	3	3	3	3	3	3	3	3	3	3
Average	3	3	3	2.7	3	3	3	3	3	3

3=strongly mapped
2=moderately mapped
1=slightly mapped

LEARNING OUTCOMES :

1. Apply knowledge and skill already learnt in the institution.
2. Acquire the required skills of manufacturing processes, assembling, servicing, and supervising in the engineering fields.
3. Involve in product design, development, quality testing and production exhibiting the strength, teamwork spirit and self-confidence
4. Prepare product document

Scheme of evaluation

SI.No.	Subject	Duration	Scheme of evaluation		
			Item	Nature	Max. Marks
1	Industrial Training	6 months	1.First Assessment at Industry (After 12 Weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			2.Second Assessment at the Industry (After 20 weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			Final Summative assessment at institution level	Training Report	20
				Demonstration of any one of the skills listed in learning outcomes	30
				Viva Voce	10
TOTAL MARKS					300

Weightage of marks for Assessment of Learning Outcomes during first and second assessment

Sl.No	*Learning Outcome*	*Max Marks Allotted For first assessment*	*Max Marks Allotted For second assessment*
1	Apply knowledge and skill already learnt in the institution.	*50*	*10*
2	Acquire the required skills of manufacturing processes, assembling, servicing, and supervising in the engineering fields.	*70*	*30*
3	Involve in product design, development, quality testing and production exhibiting the strength, teamwork spirit and self-confidence	-	*40*
4	Prepare product document, deploy product at customer site and attend after sales servicing	-	*40*
	Total	***120***	***120***

GUIDELINES FOR INDUSTRIAL TRAINING OF DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING PROGRAMME

- Duration of the training: 6 months.
- Eligibility: As per SBTET norms
- Training Area: Students can be trained in Industry certification
- The Industrial Training shall carry maximum 300 marks
- Pass marks is 50% in assessment at industry (first and second assessment put together) and also 50% in final summative assessment at institution level.
- Formative assessment at industry level shall be carried out by the representative of the industry, where the student is undergoing training and the faculty from the concerned section in the institution.
- If the student fails to secure 50% marks in assessment at industry (first and second assessment put together), the student should reappear for 6 months industrial training at his/her own expenses.
- If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.
- Final Summative assessment at institution level is done by both internal, external examiners and faculty members who assessed the students during Industrial Training.
- During Industrial Training the candidate shall put a minimum of 90% attendance.
- If the student fails to secure 90% attendance during industrial training, the student should reappear for 6 months industrial training at his/her own expenses.

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