GOVERNMENT OF ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING

Andhra Pradesh : Mangalagiri

GLOBALLY COMPETITIVE

INDUSTRY READY

CURRICULUM (C-26)

INDUSTRY 4.0

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING 3 YEARS

GOVERNMENT OF ANDHRA PRADESH

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CURRICULUM -2026 (C-26)

1. PREAMBLE

The world is evolving rapidly, and education must evolve with it. In today's dynamic environment, our approach to learning must equip students not only with knowledge but also with the practical experience in innovation, critical thinking ability and problem-solving mindset required to excel in both academic and professional spheres.

At the heart of the new curriculum, lies the belief that education should be student-centric, fostering curiosity, creativity and a lifelong passion for learning. The State Board of Technical Education and Training (SBTET), Andhra Pradesh aims to create a safe, supportive, and inclusive learning environment where every student is encouraged to reach their fullest potential. This curriculum is designed to provide a strong foundation for lifelong growth and employability, ensuring that learners graduate not only with a diploma but also with the competence and confidence to thrive in a rapidly changing world.

The SBTET, A.P. has consistently strived to meet the aspirations of all stakeholders i.e., students, parents, industries, academia and society at large by keeping its diploma programmes relevant to emerging technologies and industrial advancements. To this end, SBTET, A.P. has regularly reviewed and updated its curricula through a systematic, evidence-based and consultative process.

Building on the success of earlier curriculum and responding to the demands of new-age technologies, SBTET, A.P. resolved to update the Polytechnic C-23 curriculum and introduce the new curriculum (C-26), aligning it with global technological trends, skill-development goals, and industry expectations. The revision process was initiated in November 2024, with comprehensive feedback collected from all stakeholders i.e., students, parents, industry experts, academia, alumni, faculty, heads of sections and principals across the state.

A pivotal meeting was convened under the chairmanship of Sri. Gummala Ganesh Kumar, I.A.S., Director of Technical Education & Chairman, SBTET, A.P. to discuss the revamping of the curriculum with an emphasis on industry relevance, academic flexibility, skill orientation and employability.

Further, Sri. Gummala Ganesh Kumar, I.A.S., reiterated the importance of industrial exposure, project-based learning, and practical training in bridging the gap between classroom learning and industry requirements. He highlighted the need to make the curriculum more innovative, flexible, and technology-driven to prepare students for emerging fields such as Artificial Intelligence (AI), Machine Learning (ML), Quantum Computing, Internet of Things (IoT), Drone Technology, and Industry 4.0.

To ensure a holistic and futuristic approach, two regional workshops were conducted with industry experts, academic experts from higher-level institutes and subject experts at Tirupati and Visakhapatnam. The Programme-wise expert committees comprising members from industry, higher-education institutions and polytechnic faculty were constituted. In the subsequent workshops conducted, these committees explored strategies to integrate the following key components into the curriculum, with the objective of enhancing employability and industry readiness:

- Internet of Things (IoT) for all programmes
- A balanced ratio of theory and practical components
- Emerging technologies such as Artificial Intelligence (AI), Machine Learning (ML), Quantum Computing, and Drone Technology
- Industry 4.0 and 5G Technologies
- Introduction of elective courses to provide flexibility and promote specialization in emerging domains
- Inclusion of audit courses to encourage innovative and holistic development, ethics, environmental awareness, entrepreneurship and lifelong learning beyond the core curriculum

- Adoption of Practicum-based Learning, wherein certain courses are designed to be taught through hands-on, activity-oriented, and experiential methods instead of the conventional lecture mode, enabling students to apply concepts directly through practice and experimentation

A series of workshops, consultations, and validation meetings with subject experts, industrialists, and academicians were conducted to comprehensively review and refine the draft curriculum. The final version was further vetted by industry professionals and academicians from reputed higher-education institutions to ensure academic rigor, practical relevance, and alignment with current and emerging industry needs.

The Curriculum 2026 (C–26) has been developed through the active participation of polytechnic faculty, industry representatives, and expert committees, following an Outcome-Based Education (OBE) framework in accordance with NBA guidelines.

This new curriculum reflects the collective vision of educators, industry experts, and policymakers to develop competent, innovative, ethical and highly employable diploma graduates. It equips learners with the skills, attitudes and mindset needed to embrace future challenges driven by AI, Quantum Computing, IoT, Industry 4.0, 5G and sustainable technologies.

The C–26 Curriculum has been approved by the Board Members, SBTET, Andhra Pradesh, for implementation from the academic year 2026–27.

2. KEY FEATURES OF THE C-26 CURRICULUM

- All subjects in the earlier curriculum (C-23) were comprehensively reviewed.
- Structured feedback from industry professionals and academic experts was incorporated.
- The C-26 curriculum has been redesigned with focused academic and industry-oriented enhancements.
- Increased exposure to computational and simulation tools is provided in the first year to strengthen analytical and problem-solving skills.
- Advanced concepts related to communication standards and real-time operating systems are introduced in higher semesters to enhance embedded systems competency.
- Practical training is strengthened through advanced development platforms and real-time, application-oriented laboratory experiments.
- The curriculum is enriched with new and emerging technology domains.
- Emphasis on computer-aided design and digital engineering tools.
- Focus on essential computing and digital proficiency skills.
- Inclusion of programming for engineering applications.
- Coverage of renewable and sustainable energy technologies.
- Introduction to unmanned and autonomous system technologies.
- Emphasis on modern measurement, control, and software-based instrumentation.
- Integration of artificial intelligence applications in instrumentation and automation.

3. ACKNOWLEDGEMENT

The members of the working group sincerely thank Sri Gummala Ganesh Kumar, I.A.S., Director of Technical Education and Chairman of SBTET, Andhra Pradesh, and Sri Kona Sasidhar, I.A.S., Principal Secretary, Skills Development and Training Department, for their valuable guidance and support during the revision of the C-23 Curriculum and the development of the new C-26 Curriculum.

We are also thankful to SBTET, Andhra Pradesh, Mangalagiri, for organizing a series of workshops at different stages. These workshops brought together teachers from polytechnics, experts from reputed national Institutes, universities, engineering colleges and professionals from industry. Their discussions and feedback helped to review the C-23 Curriculum and design the improved C-26 Curriculum.

We express our gratitude to Sri G.V.V. Satyanarayana Murty, Secretary, SBTET, Andhra Pradesh, Sri V. Padma Rao, Joint Director of Technical Education, Sri A. Ravi Kumar, Joint Secretary (Academic), SBTET, Andhra Pradesh and all officers from the Directorate of Technical Education and State Board of Technical Education and Training, Andhra Pradesh, for their encouragement and continuous support.

Finally, we sincerely thank all faculty members from various polytechnics across the state who contributed to this endeavour. Their ideas, teamwork, and commitment played a key role in shaping the C-26 Curriculum successfully.

4. RULES AND REGULATIONS

4.1 Duration and Pattern of Diploma Programmes

All Diploma Programmes approved by AICTE are of three years duration.

- The first year follows a yearly system.
- The remaining period (two years) follows a semester system.
- A run-through system is followed for all Diploma Programmes, as per eligibility rules.

4.2 Procedure for Admission into the Diploma Programmes:

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 into any of the Diploma Programmes 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, Mangalagiri. Only the candidates satisfying the following requirements will be eligible to appear for the Common Entrance Test for admissions into polytechnics (POLYCET).

The candidates seeking admission should have passed/appeared for S.S.C. examination, conducted by the Board of Secondary Education, Andhra Pradesh, or equivalent examination thereto, by the time of applying for the Common Entrance Test for admission into polytechnics (POLYCET). In case of candidates whose results of their qualifying examinations are 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 Diploma in Pharmacy programme for which entry qualification is 10+2 (MPC/BiPC), candidates need not appear for

POLYCET. A separate notification will be issued for admission into this Programme.

4.3 Medium of Instruction

The medium of instruction and examination for all Diploma programmes shall be English

4.4 Permanent Identification Number (PIN)

Every student is given a Permanent Identification Number (PIN) at the time of admission. This number is used to record and maintain the student's academic and examination details throughout the Diploma along with APAAR ID.

4.5 Number of Working Days per Semester/Year:

a) The academic year for all the programmes 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 the prescribed minimum is not achieved due to any reason, special arrangements shall be made to conduct classes and complete the syllabus.
e) The timings of the institutions shall be preferably from 9:30 a.m. to 4:30 p.m.

4.6 Eligibility (Attendance to appear for the Summative Assessment)

a) A candidate shall be permitted to appear for the Summative Assessment in all programmes, 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 first 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 / year and who have not paid the condonation fee in time are not eligible to take the Summative Assessment of that semester/year and they will be detained. They may seek readmission for that semester/year (when offered) in the next subsequent academic semester/year.

f) 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 industrial training at his own expense.

4.7 Readmission Rules

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

a) (i) Within 15 days after commencement of class work in any semester.

(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 Programme or first year course work in Engineering and Non-Engineering Diploma streams). Otherwise, such cases shall not be considered for readmission for that year and they are advised to seek readmission in the next 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 but not from the day on which he/she has actually reported to the class work.

d) A candidate detained in any year or semester shall be allowed

readmission to the same year/semester only in the subsequent academic year. This provision shall equally apply to the industrial training also.

4.8 Scheme of Evaluation

a) First Year:

Theory Courses: 70 marks for the Summative Assessment (3 hours) + 30 marks for Formative Assessment.

Laboratory/Drawing Courses: 60 or 30 marks for the Summative Assessment (3 hours) + 40 or 20 marks for Formative Assessment as per the allocated marks to that course.

b) III to V Semesters:

Theory Courses: 70 marks for the Summative Assessment (3 hours) + 30 marks for

Formative Assessment.

Laboratory/Drawing Courses: 60 or 30 marks for the Summative Assessment + 40 or 20 formative assessment as per the allocated marks to the course.

4.9 Formative Assessment Scheme:

Formative Assessment shall be conducted for awarding marks on the dates specified and it consists of two components namely, Assessment through Unit Tests and Continuous Internal Assessment (CIA).

Total Formative Assessment Marks (30) =Unit Test (20) + CIA (10)

a) **Theory Courses:**

Three-unit tests shall be conducted for I year and two Unit Tests for semesters. Unit test shall be of 90 minutes duration and for a maximum of 40 marks for each test.

S. No.	Type of Assessment	Weightage Assigned	Remarks
	Formative Assessment (30 Marks)		
1	Formative Assessment through Unit Tests (UT): 20 Marks		

	Testing of knowledge through Unit Tests for Year - UT1+UT2+UT3 for Semester - UT1 + UT2	20	Each Unit test shall be conducted for 40 marks and scaled down to 20. Average of all the unit tests will be taken as Unit Test marks
2	Formative Assessment through Continuous Internal Assessment (CIA) :10 Marks		
	1. Assignments	05*	All activities shall be recorded. Relevant records are to be filed and secured for further scrutiny of higher authorities
	2. Dynamic Learning Activities: Project Work/ Seminar /Group Discussion, Quizzes etc.	05**	
	T O T A L	30	

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

***At least one dynamic learning activity is to be conducted which carries 10 marks. The total marks should be scaled down to 5.*

b) Practical Courses:

Award of marks for Formative Assessment shall be as follows:

i) Drawing Courses:

Distribution of Marks for the Formative Assessment			
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 Assessments of Regular Class work Exercises.	From the average of TWO Unit Tests.	From the average of Assessment of Regular Class work Exercises.

- Each Unit Test will be conducted for a duration of 120 minutes with maximum marks of 40 and scaled down to 20 Marks.

ii) Laboratory Courses:

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

Courses, other than Drawing courses:

i. Formative Assessment for Laboratory Course shall be done on the basis of tasks performed by the student in the laboratory.

ii. Question paper for Formative Assessment shall be task-based and shall be designed to assess practical skills, procedures, and application of concepts.

b) Formative Assessment in Laboratory courses shall be done during the course of study and marks shall be awarded by the concerned teacher. Formative Assessment for laboratory courses can be done for 40 marks

Sl. No.	Type of Assessment	Weightage Assigned	Remarks
	Formative Assessment: 40 Marks		
1	Formative Assessment through Unit Tests (UT): 20 Marks		
	Practical & Theory evaluation: Testing of knowledge through Unit Tests for Year - UT1+UT2+UT3 for Semester - UT1 + UT2	20	Each Unit test shall be conducted for 20 Marks. Average of all the Tests will be taken as Unit Test marks
2	Formative Assessment through Continuous Internal Assessment (CIA) :20 Marks		
	Experiment wise observations, individual laboratory performance	20	
	T O T A L	40	

c) For laboratory examinations, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective Head of the Section, preferably choosing a qualified person from the list given below in order of preference. Appointment order copy shall be filed and secured.

i) Near by Industries.

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

iii) Govt./ University Engineering Colleges.

iv) Senior Faculty from nearby Polytechnics.

Internal examiner shall be the person concerned with Formative Assessment as mentioned in (b) above. The Summative Assessment shall be held along with all theory papers in respect of drawing courses.

In case of drawing course earmarked as Practicum (practical course) the Summative Assessment shall be held along with practical papers.

d) Question Paper for Practical Examination: Question paper should cover the experiments / exercise prescribed to test various skills like handling, manipulating, testing, troubleshooting, repair, assembling and dismantling etc. from more than one experiment / exercise

e) Records pertaining to Formative Assessment marks of both theory and practical Courses are to be maintained for official inspection. All the evaluation formats/proformas shall be maintained as per the instructions issued by SBTET, A.P. from time to time

iii) Practicum Theory Courses:

Sl. No.	Type of Assessment	Weightage Assigned	Remarks
	Formative Assessment (30 Marks)		
1	Formative Assessment through Unit Tests (UT): 20 Marks		
	Theory & Practical evaluation: Testing of knowledge through Unit Tests for Year - UT1+UT2+UT3 for Semester - UT1 + UT2	20	Each Test shall be conducted for 40 Marks (Theory:30 Marks Practical:10 Marks) and scaled down to 20. Average of all the Tests will be taken as Unit Test marks
2	Formative Assessment through Continuous Internal Assessment (CIA) :10 Marks		
	a) Assignments	05*	All activities shall be recorded. Relevant records are to be
	b) Dynamic Learning Activities:	05**	

	Project Work/ Seminar/Group Discussion, Quizzes etc.		filed and secured for further scrutiny of higher authorities
	TOTAL	30	

Assessment for Practicum theory courses can be done for 30 marks

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

***At least one dynamic learning activity is to be conducted which carries 10 marks. The total marks should be scaled down to 5.*

iv) Practicum Practical Courses:

Assessment for Practicum practical courses can be done for 40 marks

Sl. No.	Type of Assessment	Weightage Assigned	Remarks
	Formative Assessment: 40 Marks		
1	Formative Assessment through Unit Tests (UT): 20 Marks		
	Practical & Theory evaluation: Testing of knowledge through Unit Tests for Year - UT1+UT2+UT3 for Semester - UT1 + UT2	20	Each Test shall be conducted for 40 marks (Theory:10marks Practical:30marks) and scaled down to 20. Average of all the Tests will be taken as Unit Test marks.
2	Formative Assessment through Continuous Internal Assessment (CIA) :10 Marks		
	Experiment wise observations, individual laboratory performance	20	
	T O T A L	40	

v) Activity Periods:

1.	a) Library	All activities shall be duly recorded & the relevant documents shall be filed and securely maintained for scrutiny by higher authorities. 0.5 or 1 Credits shall be awarded to the successful candidates for each semester/year accordingly.
	b) IPSGM/Sports & Games	
	c) Extra-curricular activities (NSS / NCC/ Clean & Green of Campus etc.)	

vi) Industrial Training:

In case of Industrial Training, SOP will be circulated by SBTET, A.P from time to time. The Formative Assessment and Summative Assessment shall be done as illustrated in the following table:

Assessment No	Upon completion of	Conducted by	Based on	Max Marks
Pre-Assessment	15 days to 30 days from the commencement of training	Mentor faculty member visits the industry 15 days to 30 days from the commencement of training and will submit a detailed report to the principal outlining each candidate's details and observed work culture		
1 (Formative Assessment)	Mid Semester Assessment after three months (at industry)	1.The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
2 (Formative Assessment)	Last month of training (at industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120

3 (Summative Assessment)	After completion of the training (at Institution)	1.The faculty member concerned, 2.HoS concerned 3.An external examiner from Industry	1.Demonstration of any one of the skills listed in learning outcomes	30
			2.Training Report	20
			3. Viva Voce	10
TOTAL				300

Each staff member shall be assigned a batch of students 10 to 15 as a mentor faculty for making assessment during industrial training.

vii) Project Work:

The guidelines to be followed for Project work are as follows:

- ✓ The Project Title and Abstract must be approved by a committee comprising the Principal, Head of the Section (HoS) and the concerned faculty members
- ✓ Students should be encouraged to undertake project work with the potential for publication in academic and professional journals

The Formative Assessment consisting of 40% of the total marks shall be distributed as follows:

Assessment	To be conducted at	Marks (Evaluated for)
Review-1	After the completion of 4 weeks from the start of the semester	10
Review-2	After the completion of 10 weeks from the start of the semester	15
Review-3	After the completion of 14 weeks from the start of the semester	15

The Summative Assessment consisting of 60% of the total marks shall be distributed as follows:

Assessment	To be conducted	Conducted by	Based on	Max Marks
Summative	After completion of the Project work	1.Project Guide 2.HoS concerned	1.Demonstration of skill relevant to the Project	30

		3.An external examiner	2. Project Report	20
			3. Viva Voce	10
TOTAL				60

4.10 Minimum Pass Marks

a) Theory Courses:

To pass a theory course, a candidate must secure a minimum of 35% in the Summative Assessment (i.e., Min 25 Marks) and a combined minimum of 35% from both the Formative and Summative Assessment marks put together.

b) Practical Courses:

For passing a practical Course, a candidate has to secure a minimum of 50% in Summative Assessment and a combined minimum of 50% of both Formative and Summative Assessment marks put together. In case of D.C.C.P., the pass mark for Typewriting and Shorthand is 45% in the Summative Assessment. There are no marks for formative assessment in case of Typewriting and Shorthand courses in D.C.C.P programme.

c) Industrial Training:

The Industrial training shall carry 300 marks and pass marks is 50% in each assessment at industry (Mid semester Assessment and second assessment) i.e 120 marks out of 240 and in final summative assessment 30 marks out of 60 marks at institution level put together i.e. 150 marks out of 300 marks.

d)The courses successfully completed shall be awarded the allotted credits and the corresponding grade shall be assigned based on the percentage of marks secured.

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 Programme.

b) The student can avail the improvement chance only once and it must be taken within the two examinations immediately following

the completion of their 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 the 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 including Consolidated Marks Memo(CMM) and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised Memorandum of marks including CMM and Original Diploma Certificate will be issued, else the submitted originals will be returned.

4.12 Rules of Promotion:

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

ii. A candidate shall be promoted to 3rd semester if he/she puts in 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.

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and paid 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/6th semester provided he/she puts in the required percentage of attendance in the 5th semester and pays the examination fee /promotion fee as prescribed by SBTET. A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-Voce) only if he/ she puts the required percentage of attendance, i.e., 90% in the 6th semester Industrial Training and pays the examination fee.

vi Industrial Training shall be treated as the 6th semester, irrespective of whether the training is undertaken during the 5th or 6th semester.

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 pays 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 pays the examination fee. A candidate who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by SBTET, A.P 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.

iii) A candidate shall be promoted to 5th semester provided he / she put 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.

iv) 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 pays the examination fee /promotion fee as prescribed by SBTET. A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-Voce) only if he / she puts the required percentage of attendance, i.e., 90% in the 6th semester Industrial Training and pays the examination fee.

4.13 Student Performance Evaluation

Successful candidates shall be awarded the Diploma under the following CGPA.

CGPA secured	Division
CGPA ≥ 7.5	First Class with Distinction (who completed Diploma within 3 years)
7.5 > CGPA ≥ 6	First Class
CGPA < 6	Second Class

Note: Candidate should acquire 120 credits to award diploma**.**

Awarding Grade and Grade Points

Students will be awarded Grades and Grade Points considering their Percentage of Marks Evaluated in each Theory and Practical Courses

and the Conversion of Percentage of Marks obtained in the Examinations to the Grade Points and Awarding Grades for Every Course is tabulated as shown below:

For Theory Courses		
Percentage of Marks	**Grade Points, GP (10)**	**Grade Awarded**
Above 90	10	A+
From 81 to 90	09	A
From 71 to 80	08	B+
From 61 to 70	07	B
From 51 to 60	06	C+
From 41 to 50	05	C
From 35 to 40	04	D
Below 35	0	F (FAIL)

For Practical Courses		
Percentage of Marks	**Grade Points, GP (10)**	**Grade Awarded**
Above 90	10	A+
From 81 to 90	09	A
From 71 to 80	08	B+
From 61 to 70	07	B
From 51 to 60	06	C+
Equal to 50	05	C
Below 50	0	F (FAIL)

The merit level of a student would be indicated by

1. "Semester Grade Point Average (SGPA) " for the Year or for a Semester.
2. "Cumulative Grade Point Average (CGPA)" for awarding Diploma.

Conversion Formula, EP = Equivalent Percentage = [CGPA Obtained] x 10

4.14 Examination Fee Schedule

Examination fees are as per the notifications issued by the State Board of Technical Education and Training (SBTET), Andhra Pradesh, from time to time.

4.15 Structure of Examination Question Paper

I. Formative Assessment:

a) Theory Courses

For First Year: Three Unit Tests.

For semesters: Two Unit Tests.

Each test shall be of 90 minutes duration, carrying a maximum of 40 marks and will consist of Part A and Part B

Part A (16 Marks):

1. Objective Type Questions:

Multiple Choice Questions / True or False / Fill in the Blanks-

4 × 1 marks = 4 marks

2. Short Answer Questions:

Four questions - 4 × 3 marks = 12 marks

Part B (24 Marks):

Essay-Type Questions: (Attempt any 3 out of 4)

3 × 8 marks = 24 marks

Total Marks:4 + 12 + 24 = 40 marks

Computation of Marks

First Year: Average of 3 tests

Semester System: Average of 2 tests

The marks obtained out of 40 shall be scaled down to 20 and treated as the Unit

Test marks for each course.

b) Drawing Courses (both Conventional/Hybrid) :

First Year:

Three-unit tests shall be conducted for 40 marks. The duration of each test is 120 minutes

The question paper pattern is as follows:

Part A: Answer all 4 question, 4 X 5M =20M.

Part B: Answer any 2 questions out of 4, 2 X 10M =20M.

Semesters:

Two-unit tests shall be conducted for 40 marks. The duration of each test is 120 minutes

The question paper pattern is as follows:

Part A: Answer all 4 questions, 4 X 5M =20M.

Part B: Answer one question out of two 1 X 20M =20M.

The marks obtained for 40 shall be scaled down to 20 marks and the average of 3tests/2tests shall be taken as final Unit test marks for the course. Remaining 20 marks are given by the teacher based on the performance of the student during regular class work of that course.

c) Laboratory/Workshops:

Fifty percent of the total marks shall be allotted to continuous

assessment in labs/workshops and the remaining fifty percent shall be derived from two tests

d) Assessment of Practicum Courses:

i)Practicum Theory Course (out of 30 Marks)

Theory and Practical Assessment: 20 Marks

Continuous Internal Assessment: 10 Marks

Total Marks for the course = 20+10= 30 Marks

ii) Practicum Practical Course (out of 40 Marks)

Practical & Theory Assessment: 20 Marks

Continuous Internal Assessment: 20 Marks

Total Marks for the course = 20+20 = 40 Marks

II. Summative Assessment:

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. Summative Assessment paper is of 3 hours duration.

a) Each theory paper has Section A (short answers) and Section B (essay questions).

Section A: Answer 10 out of 12 questions, Total = 10 × 3M = 30M

Section B: Answer 5 out of 8 questions, Total = 5 × 8M = 40M

Total theory marks for Summative Assessment = 70 Marks.

b) Drawing Course:

I year

Section A: 4 questions 4 X 5M = 20 marks (all to be answered).

Section B: answer 4 questions out of 6 questions. 4 × 10M = 40 marks.

Drawing Courses - III Semester to V Semester

As per the weightage of marks given in blueprint of the respective course

c) Practical Examinations:

For practical with total 60 marks: Experiment/exercise = 50 marks;

Viva-voce = 10 marks; Total = 60.

For practical with total 30 marks: Experiment/exercise = 25 marks; Viva-voce = 5 marks; Total = 30.

Question papers for practical are drawn by lottery and cover required skills. Changes to the pattern will be notified in advance.

d) Note on Laboratory Evaluation:

Laboratory teaching shall be task/competency based and the Semester-end question papers should follow SBTET norms.

4.16 Issue of Memorandum of Marks

All candidates who appear for the Summative Assessment 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. After successful completion of all courses, Consolidated Memorandum of Marks will be issued.

4.17 Maximum Period for Completion of Diploma

The maximum period to complete a Diploma is twice the duration of the course from the date of first admission (this includes any periods of detention or discontinuation). After this period, students will forfeit the right to complete the Diploma and will not be allowed to appear for exams. This applies to all the Diploma Programmes.

4.18 Eligibility for Award of Diploma

A candidate is eligible for the Diploma if:

i) They have pursued the course for not less than 3 years and not more than 6 years.

ii) Students must complete all the required courses. Those who fail to fulfil the requirements within the maximum permissible period shall forfeit their seat and will not be eligible for readmission

For IVC & ITI Lateral Entry students:

i) They must pursue the course for not less than 2 years and not more than 4 years.

ii)They must complete all required courses. Failure to meet the requirements within the maximum permissible period shall result in

forfeiture of the seat, and the student will not be eligible for readmission.

Note: As and when a new curriculum is introduced in future, existing curriculum students under C-26 scheme shall write their backlog courses if any in the new curriculum equivalent courses decided by the SBTET, AP.

4.19 Malpractice Cases:

If any candidate resorts to Malpractice during examinations, he / she shall be booked and the punishment shall be awarded as per SBTET, AP rules and regulations in vogue.

4.20. Discrepancies/ Pleas:

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

4.21. 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, Guntur District Andhra Pradesh only.

iii. In case of any ambiguity in the interpretation of the above rules, the decision of the Secretary, SBTET, A.P., Mangalagiri is final.

VISION

To emerge as a leading department in Electronics and Instrumentation Engineering education by empowering students with cutting edge skills in smart automation, AI and sustainable technologies, thereby contributing to national technological growth.

MISSION

M1	To impart quality technical education through student-centric teaching and state-of-the-art laboratory facility that simplify complex concepts of instrumentation.
M2	To bridge the gap between curriculum and industry requirements by providing hands on training in modern automation tools and facilitating industrial interactions.
M3	To continuously upgrade faculty skills to keep pace with rapid technological advancements and to empower students with design and troubleshooting skills that solve real-world industrial problems, ensuring immediate employability.
M4	To inculcate professional ethics, communication skills and a commitment to lifelong learning to make students responsible professionals and citizens.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

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

PEO1	To establish successful careers in the field of instrumentation, automation and process control.
PEO2	For employment in research and development organizations.
PEO3	To pursue higher education and engage in continuous learning to adapt to technological advancements.
PEO4	To demonstrate professional leadership, ethical responsibility and effective communication in their career.

PROGRAM 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 analyze 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 analyze individual needs and engaging updating in the context of technological changes.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The students of Electronics and instrumentation Engineering 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 techniques 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 behavior, ethics and effective communication with engineering community and the society.

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
FIRST YEAR

Course Code	Course Title	No. of Periods / Week		Practicum (Y/N)	Total No. of Periods /Year	Credits	Scheme of Examination			
		Theory	Practical/ Tutorial				Duration (hours)	FA Marks	SA marks	Total Marks
THEORY COURSES										
26IN101T	English Essentials	3	-	N	90	4	3	30	70	100
26IN102T	Engineering Mathematics - I	6	-	N	180	6	3	30	70	100
26IN103T	Engineering Physics	3	-	N	90	4	3	30	70	100
26IN104T	Engineering Chemistry and Environmental Studies	3	-	N	90	4	3	30	70	100
26IN105T	Electronic Devices and Circuits	6	-	N	180	6	3	30	70	100
AUDIT COURSE										
26IN106A	Electronic CAD	2	-		60	-	-	-	-	-
PRACTICAL COURSES										
26IN107L	Electrical Wiring, Electronic Devices and Circuits Lab	-	6	Y	180	6	3	40	60	100
26IN108L	Programming in C & Matlab	-	4	Y	120	3	3	40	60	100
26IN109L	Physics Lab	-	3*	N	90	1.5	3	20	30	50
26IN110L	Chemistry Lab	-		N		1.5	3	20	30	50
26IN111L	Computer and Digital Skills	-	3	N	90	3	3	40	60	100
26IN112C	Student Centric Activities	-	3	N	90	1	-	-	-	-
	TOTAL	**23**	**19**	**-**	**1260**	**40**	**-**	**310**	**590**	**900**

Note 1: One credit will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/ Clean and Green or Sports/Games.

* **Note 2**: For the Physics laboratory half of the first-year students of each programme will attend, while the remaining half will attend the chemistry laboratory. Thus, both laboratories will be engaged simultaneously during the three hour lab session

Note 3: 26IN101T, 26IN102T, 26IN103T, 26IN104T, 26IN109L, 26IN110L, and 26IN111L are common to all programmes

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III SEMESTER

Course Code	Course Title	No. of Periods / Week		Practicum (Y/N)	Total No. of Periods /Semester	Credits	Scheme of Examination			
		Theory	Practical/ Tutorial				Duration (hours)	FA Marks	SA marks	Total Marks
THEORY COURSES										
26IN301T	Basic Electrical Engineering & Electronic Measuring Instruments	6	-	N	90	4	3	30	70	100
26IN302T	Digital Electronics	6	-	N	90	4	3	30	70	100
26IN303T	Process Instrumentation	6	-	N	90	4	3	30	70	100
ELECTIVE COURSES										
26IN304E	Engineering Mathematics-II	3	-	N	45	2	3	30	70	100
26IN305E	Python Programming			Y						
AUDIT COURSE										
26IN306A	Solar Energy Systems	2	-	N	30	-	-	-	-	-
PRACTICAL COURSE										
26IN307L	Electronic Measuring Instruments Lab	-	6	N	90	2	3	40	60	100
26IN308L	Digital Electronics Lab	-	4	N	60	1.5	3	40	60	100
26IN309L	Process Instrumentation Lab	-	6	N	90	2	3	40	60	100
26IN310C	Student Centric Activities	-	3	N	45	0.5	-	-	-	-
	TOTAL	**23**	**19**	**-**	**630**	**20**	**-**	**240**	**460**	**700**

Note 1: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/ Clean and Green or Sports/Games.

Note 2: 26IN304E is common elective to all programmes.

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV SEMESTER

Course Code	Course Title	No. of Periods / Week		Practicum (Y/N)	Total No. of Periods /Semester	Credits	Scheme of Examination			
		Theory	Practical/ Tutorial				Duration (hours)	FA Marks	SA Marks	Total Marks
THEORY COURSES										
26IN401T	Linear Integrated Circuits	6	-	N	90	4	3	30	70	100
26IN402T	Industrial Electronics & Control Engineering	6	-	N	90	4	3	30	70	100
26IN403T	Process Control	6	-	N	90	4	3	30	70	100
ELECTIVE COURSES										
26IN404E	Data Communication and Computer Networking	3	-	N	45	2	3	30	70	100
26IN405E	Instrumentation in Process Industries									
AUDIT COURSE										
26IN406A	Drone Technology	2	-	N	30	-	-	-	-	-
PRACTICAL COURSES										
26IN407L	Linear IC Applications and E-Cad Lab	-	6	N	90	2	3	40	60	100
26IN408L	Communication & Employability Skills	-	4	N	60	2	3	40	60	100
26IN409L	Process Control Lab	-	6	N	90	1.5	3	40	60	100
26IN410C	Student Centric Activities	-	3	N	45	0.5	-	-	-	-
	TOTAL	**23**	**19**	**-**	**630**	**20**	**-**	**240**	**460**	**700**

Note 1: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/ Clean and Green or Sports/Games.

Note 2: 26IN408L is common laboratory to all programmes.

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V SEMESTER

Course Code	Course Title	No. of Periods / Week		Practicum (Y/N)	Total No. of Periods /Semester	Credits	Scheme of Examination			
		Theory	Practical/ Tutorial				Duration (hours)	FA Marks	SA Marks	Total Marks
THEORY COURSES										
26IN501T	Analytical and Biomedical Instrumentation	6	-	Y	90	4	3	30	70	100
26IN502T	ARM Microcontrollers	6	-	N	90	4	3	30	70	100
26IN503T	Industrial Automation	6	-	Y	90	4	3	30	70	100
ELECTIVE COURSES										
26IN504E	Industrial Management & Entrepreneurship	3	-	N	45	2	3	30	70	100
26IN505E	Virtual Instrumentation			Y						
AUDIT COURSE										
26IN506A	Artificial Intelligence based Instrumentation	2	-	N	30	-	-	-	-	-
PRACTICAL COURSES										
26IN507L	ARM Microcontrollers Lab	-	6	N	90	2	3	40	60	100
26IN508L	Internet of Things and Industry 4.0 Lab	-	6	Y	90	2	3	40	60	100
26IN509L	Project Work	-	4	N	60	1.5	3	40	60	100
26IN510C	Student Centric Activities	-	3	N	45	0.5	-	-	-	-
	TOTAL	**23**	**19**	**-**	**630**	**20**	**-**	**240**	**460**	**700**

Note: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/ Clean and Green or Sports/Games.

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI SEMESTER

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING								
SIXTH SEMESTER (INDUSTRIAL TRAINING)								
SL NO	Course Title	Duration	SCHEME OF EVALUATION					
			Assessment No	Upon completion of	Conducted by	Based on	Max Marks	Credits
1	**26IN601I Industrial Training**	**one semester**	Pre-Assessment	15 Days to 30 Days from the commencement of training	Mentor faculty member visits the industry one month after commencement of training and will submit a detailed report to the principal outlining each candidate's details and observed work culture			
			1 (Formative Assessment)	Mid-Semester Assessment (after three months - at the industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120	6
			2 (Formative Assessment)	Last month of training (at industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120	6
			3 (Summative Assessment)	After completion of the training (at Institution)	1. The faculty member concerned, 2. HoS concerned 3. An external examiner from Industry	1. Demonstration of any one of the skills listed in the learning outcomes	30	3
						2. Training Report	20	3
						3. Viva Voce	10	2
						TOTAL	300	20

The industrial training shall carry a maximum of 300 marks. The pass mark is 50% in the first and second assessments put together, and also 50% in the final summative assessment at the institution level.

FIRST YEAR

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
FIRST YEAR

Course Code	Course Title	No. of Periods / Week		Practicum (Y/N)	Total No. of Periods /Year	Credits	Scheme of Examination			
		Theory	Practical/ Tutorial				Duration (hours)	FA Marks	SA Marks	Total Marks
THEORY COURSES										
26IN101T	English Essentials	3	-	N	90	4	3	30	70	100
26IN102T	Engineering Mathematics - I	6	-	N	180	6	3	30	70	100
26IN103T	Engineering Physics	3	-	N	90	4	3	30	70	100
26IN104T	Engineering Chemistry and Environmental Studies	3	-	N	90	4	3	30	70	100
26IN105T	Electronic Devices and Circuits	6	-	N	180	6	3	30	70	100
AUDIT COURSE										
26IN106A	Electronic CAD	2	-	Y	60	-	-	-	-	-
PRACTICAL COURSES										
26IN107L	Electrical Wiring, Electronic Devices and Circuits Lab	-	6	Y	180	6	3	40	60	100
26IN108L	Programming in C & Matlab	-	4	Y	120	3	3	40	60	100
26IN109L	Physics Lab	-	3	N	90	1.5	3	20	30	50
26IN110L	Chemistry Lab	-		N		1.5	3	20	30	50
26IN111L	Computer and Digital Skills	-	3	N	90	3	3	40	60	100
26IN112C	Student Centric Activities		3	N	90	1	-	-	-	-
	TOTAL	**23**	**19**		**1260**	**40**		**310**	**590**	**900**

Note 1: One credit will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/ Clean and Green or Sports/Games.

* **Note 2**: For the Physics laboratory half of the first-year students of each programme will attend, while the remaining half will attend the chemistry laboratory. Thus, both laboratories will be engaged simultaneously during the three hour lab session

Note 3: 26IN101T, 26IN102T, 26IN103T, 26IN104T, 26IN109L, 26IN110L, and 26IN111L are common to all programmes

ENGLISH ESSENTIALS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN101T	ENGLISH ESSENTIALS	3	90	30	70	4

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Questions	No. of Essay Questions
1.	Exploring English	10	14	2	1
2.	The Better You!	10	11	3	1
3.	Drive to Destiny!	10	14		1
4.	Renew, Rewire & Resolve!	10	17	2	1
5.	Brains & Bots	10		1	
6	The Blue Planet: Mend or End	10	11	1	1
7	One World One Dream	10	11	1	1
8	The Net Norms	10	11	1	1
9	Managing Moods & Moments	10	11	1	1
	Total	90	100	12	8

COURSE OBJECTIVES

Upon completion of the course, the student shall be able

(i)	To inculcate knowledge of functional English and enrich vocabulary.
(ii)	To impart effective listening, speaking, reading, and writing skills.
(iii)	To sensitise the students on themes related to personality, technological advancements, sustainability, and human values.

COURSE OUTCOMES

CO1	IN101.1	Learn and apply various English grammatical concepts to communicate in academic, professional, personal, and social contexts.
CO2	IN101.2	Use appropriate vocabulary in academic, professional, and in business correspondence and on social media platforms.
CO3	IN101.3	Listen and understand, read and comprehend different forms of academic, professional, and general listening and reading materials.
CO4	IN101.4	Communicate effectively and fluently in oral and written forms in various life situations.
CO5	IN101.5	Display scientific temper and universal human values technology for holistic development and harmonious living through demeanour and communication.

LEARNING OUTCOMES

1.0 EXPLORING ENGLISH

1.1 To read and comprehend simple sentences in a short passage.

1.2 To apply certain rules of spelling, correct the misspelt words and use dictionary to enrich vocabulary

1.3 To identify various parts of speech suitable to context and use articles & prepositions accurately.

1.4 To describe a given situation/ picture using simple sentences.

1.5 To value the importance of English for employability.

2.0 THE BETTER YOU!

2.1 TO READ and comprehend formal and informal conversations.

2.2 To use words suitable to the context in spoken and written communication.

2.3 To use the appropriate forms of verbs.

2.4 To engage in conversations in both formal and informal contexts.

2.5 To demonstrate positive attitude in personal and academic spheres.

3.0 DRIVE TO DESTINY

3.1 To read and comprehend paragraphs for specific and general information, and distinguish different types of paragraphs

3.2 To distinguish word pairs and use them contextually.

3. 3 To frame sentences with proper subject-verb agreement.

3.4 To describe actions using appropriate tense.

3.5 To set and achieve academic and personal goals.

4.0 RENEW, REWIRE & RESOLVE

4.1 To read and comprehend the content and structure of e-mails for different purposes.

4.2 To recognize the root words and use appropriate affixes contextually.

4.3 To use various kinds of sentences for different communicative situations.

4.4 To draft E-mails for academic and professional purposes.

4.5 To apply the skills of critical thinking and creativity in solving problems.

5.0 BRAINS & BOTS

5.1 To read and comprehend the description of a process with sequence markers.

5.2 To communicate using phrasal verbs intelligibly.

5.3 To use active and passive voice appropriately.

5.4 To describe processes and procedures using appropriate sentence forms.

5.5 To appraise the importance and use of robotics and artificial intelligence in human life.

6.0 THE BLUE PLANET: MEND OR END!

6.1 To read and comprehend the content, structure and purpose of formal and informal letters.

6.2 To describe using appropriate forms of adjectives

6.3 To substitute phrases or clauses with a single word.

6.4 To draft personal and professional letters.

6.5 To realise the importance of environmental protection and ensure sustainability.

7.0 ONE WORLD - ONE DREAM

7.1 To read and comprehend essay and analyse its features

7.2 To identify and create shortened forms of words or phrases.

7.3 To report the expressions of the speaker to a third person with necessary grammatical changes.

7.4 To draft well-organized essays for academic and professional purposes.

7.5 To appraise the importance of inclusivity in the society.

8.0 THE NET NORMS

8.1 To comprehend and analyse the given text for making notes and summarising.

8.2 To use contemporary language in informal communication.

8.3 To split or combine ideas using conjunctions for effective communication.

8.4 To make notes of textual information and summarize the information.

8.5 To demonstrate ideal behaviour on the internet.

9.0 MANAGING MOODS & MOMENTS

9.1 To read and comprehend different types of reports.

9.2 To analyse and evaluate grammatical errors.

9.3 To use words and phrases in sentences of your own.

9.4 To draft organized and comprehensive reports on experiments, events, visits and incidents.

9.5 To assess the reasons and manage stress and manage time effectively.

CO-PO/PSO MAPPING

<table>
<tr><th>CO/PO</th><th>PO1</th><th>PO2</th><th>PO3</th><th>PO4</th><th>PO5</th><th>PO6</th><th>PO7</th><th>PS01</th><th>PS02</th><th>PS03</th></tr>
<tr><td>CO1</td><td colspan="4" rowspan="5">PO's 1 to 4 are not directly applicable for English course. However, activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.</td><td></td><td>3</td><td>2</td><td colspan="3" rowspan="5">Programme Specific Outcomes are Branch specific with technical aspects which are not directly applicable to English Language course.</td></tr>
<tr><td>CO2</td><td></td><td>3</td><td>2</td></tr>
<tr><td>CO3</td><td></td><td>3</td><td>2</td></tr>
<tr><td>CO4</td><td></td><td>3</td><td>2</td></tr>
<tr><td>CO5</td><td>1</td><td></td><td>2</td></tr>
<tr><td>Average</td><td></td><td></td><td></td><td></td><td>1</td><td>3</td><td>2</td><td></td><td></td><td></td></tr>
</table>

3-Strongly Mapped 2- Moderately Mapped 1- Slightly Mapped

Note: The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (iv) Library Visits etc.,

COURSE CONTENT

1.0 EXPLORING ENGLISH

Reading – Roleplay – Picture Interpretation – Sounds and Spellings – Parts of Speech – Articles and Prepositions

2.0 THE BETTER YOU!

Reading – Dialogue Writing – Synonyms and Antonyms – Word order – Verbs

3.0 DRIVE TO DESTINY

Reading – Paragraph Writing – Homophones, Homonyms, Homographs – Concord – Tenses

4.0 RENEW, REWIRE & RESOLVE

Reading – E-mail Writing – Roots, Affixes – Kinds of Sentences

5.0 Brains & Bots

Reading – Describing Process – Phrasal Verbs – Voice

6.0 THE BLUE PLANET: MEND OR END!

Reading – Letter Writing – One-word Substitutes – Degrees of Comparison

7.0 ONE WORLD - ONE DREAM

Reading – Essay Writing – Abbreviations & Acronyms – Reported Speech

8.0 THE NET NORMS

Reading – Note making & Summarising – Gen-Z Vocabulary – Synthesis of Sentences

9.0 MANAGING MOODS & MOMENTS

Reading – Report Writing – Usage – Error Analysis

The text book "English Essentials" (A Textbook of English for I Year Engineering Diploma Courses - by SBTET, AP) is the prescribed text for this course. It comprises various language inputs and activities addressing the Learning outcomes specified in each unit. Every unit will have six major components: Listening, Speaking, Reading, Writing, Vocabulary, Grammar. The activities will be designed as Individual, Pair and Group activities to facilitate self and peer learning.

REFERENCES

1. Martin Hewings : *Advanced Grammar in Use,* Cambridge University Press
2. Murphy, Raymond : *English Grammar in Use,* Cambridge University Press
3. Sidney Greenbaum : *Oxford English Grammar*, Oxford University Press
4. Wren and Martin (Revised by N.D.V. Prasad Rao): *English Grammar and Composition*, Blackie ELT Books, S. Chand and Co.
5. Sarah Freeman : *Strengthen Your Writing*, Macmillan

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 3.5
Unit Test – 2	From 4.1 to. 6.5
Unit Test – 3	From 7.1 to 9.5

ENGINEERING MATHEMATICS-I

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN102T	ENGINEERING MATHEMATICS-I	6	180	30	70	6

TIME SCHEDULE

S.No.	Chapter	No. of Periods	Marks Allotted	No. of Short Questions	No. of Essay Questions	COs mapped
Unit - I: Algebra						
1	Partial Fractions	6	4	0	1/2	CO1
2	Matrices and Determinants	25	18	2	1&1/2	CO1
Unit - II: Trigonometry						
3	Trigonometric Ratios	4	0	0	0	CO2
4	Compound Angles	8	3	1	0	CO2
5	Multiple and Sub-multiple angles	8	3	1	0	CO2
6	Transformations	9	4	0	1/2	CO2
7	Inverse Trigonometric Functions	8	4	0	1/2	CO2
8	Trigonometric Equations	8	4	0	1/2	CO2
9	Properties of triangles	8	4	0	1/2	CO2
10	Complex Numbers	8	3	1	0	CO2
11	Hyperbolic functions	2	0	0	0	CO2
Unit III: Co-ordinate Geometry						
12	Straight Lines	8	3	1	0	CO3
13	Circles	8	4	0	1/2	CO3
14	Conic Sections	10	4	0	1/2	CO3
Unit – IV: Differential Calculus						
15	Limits and Continuity	6	3	1		CO4
16	Differentiation	28	17	3	1	CO4
Unit – V: Integral Calculus						
17	Indefinite integration	18	11	1	1	CO5

18	Definite integration	8	11	1	1	CO5
	Total	180	100	12	8	
			Marks	36	64	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to	
(i)	To apply the principles of Algebra, Trigonometry and Co-ordinate Geometry to real-time problems in engineering.
(ii)	To build the concepts of indefinite integrals and definite integrals.

COURSE OUTCOMES

CO1	IN102.1	Resolve partial fractions and solve problems on matrices and determinants.
CO2	IN102.2	Use the concept of trigonometric functions, their inverses and complex numbers.
CO3	IN102.3	Find the equations and properties of straight lines, circles and conic sections in coordinate system.
CO4	IN102.4	Evaluate the limits and derivatives of various functions and apply to engineering problems.
CO5	IN102.5	Integrate various functions using different methods and evaluate definite integrals.

LEARNING OUTCOMES

C.O. 1 Resolve partial fractions and solve problems on matrices and determinants.

L.O. 1.1 Define rational, proper and improper fractions of polynomials.

1.2 Explain the procedure of resolving proper fractions of the type $\frac{f(x)}{(ax+b)(cx+d)}$

1.3 Define a matrix and order of a matrix.

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

1.5 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.

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

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

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

1.9 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.

1.10 Solve a system of three linear equations in three unknowns using Cramer's rule.

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

L.O. 2.1 Recall the trigonometric ratios and their values at specified angles.

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 using the identities 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 sub-multiple formulae.

2.10 Derive the formulae on transforming sum or difference of two trigonometric ratios into 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 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 sinx = k, cosx = k and tanx = 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 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 and Exponential (Euler) form with examples.

2.24 Explain the concept of hyperbolic trigonometric functions and list appropriate formulae.

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 - Explain the terms focus, directrix, eccentricity, axes and latus-rectum of a conic.

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

3.8 Describe the properties of Parabola $y^2 = 4ax$.

C.O. 4 Evaluate 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 $\lim_{x \to a} \frac{f(x)}{g(x)}$

4.3 State the Standard limits $\lim_{x \to a} \frac{x^n - a^n}{x - a}$, $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{x \to 0} \frac{\tan x}{x}$, $\lim_{x \to 0} \frac{a^x - 1}{x}$, $\lim_{x \to 0} \frac{e^x - 1}{x}$, (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 write 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 derivatives of standard algebraic, logarithmic, exponential and trigonometric functions using the first principle.

4.8 Find the derivatives of 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 Define maximum and minimum values of a function and find the maximum and minimum values for quadratic polynomials.

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

C.O. 5 Integrate various functions using different methods and evaluate definite integrals.

L.O. 5.1 Explain the concept of Indefinite integral as an anti-derivative.

5.2. 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.

5.3. Solve problems involving standard functions using these properties.

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

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

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

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

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

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

5.7. Evaluate integrals using decomposition method for integrand of the type $\dfrac{px+q}{(ax+b)(cx+d)}$.

5.8. Solve problems using integration by parts.

5.9 Use Bernoulli's rule to evaluate the integrals of the form $\int u.v\,dx$.

5.10. State the fundamental theorem of integral calculus.

5.11. Explain the concept of definite integral.

5.12. Solve simple problems on definite integrals.

5.13. State various properties of definite integrals.

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

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.

COURSE CONTENT

Unit-I: Algebra

1. **Partial Fractions:** Definitions of rational, proper and improper fractions of polynomials. Resolve rational fractions (proper fractions) of type $\frac{f(x)}{(ax+b)(cx+d)}$ into partial fractions.
2. **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.

Unit-II: Trigonometry

3. **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.
4. **Compound angles:** Formulas of sin(A±B), cos(A±B), tan(A±B), cot(A±B), and related identities.
5. **Multiple and sub-multiple angles:** Formulae for trigonometric ratios of multiple angles 2A, 3A and sub multiple angle A/2.
6. **Transformations:** Transformations of products into sums or differences and vice versa.

7. **Inverse trigonometric functions:** Definition, domains and ranges-basic properties.
8. **Trigonometric equations:** Concept of a solution, principal value and general solution of trigonometric equations:
   Sin x = k, cos x= k, tan x = k, where k is a constant. Solutions of simple quadratic equations and equations of type a sin x + b cos x=c.
9. **Properties of triangles:** Relations between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle.
10. **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.
11. **Hyperbolic functions:** Definition of hyperbolic and inverse hyperbolic trigonometric functions- and list formulae.

UNIT-III: Coordinate geometry

12 **Straight lines:** Various forms of a straight line - Angle between two lines, perpendicular distance from a point to the straight line, point of 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. **Conic sections**: Definition of a conic - Equation of a conic when focus, directrix and eccentricity are given - Properties of parabola in the standard form $y^2 = 4ax.$

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 – Define maximum and minimum values of a function and find the maximum or minimum values for quadratic polynomial. Functions of several variables, first order partial derivatives.

UNIT-V: Integral Calculus

17. **Indefinite Integration:** Integration regarded as an 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 and 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.

18. Definite Integration: Definite integral, fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals.

TEXTBOOK

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

REFERENCES

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.

E-LEARNING REFERENCES

1. https://www.khanacademy.org/
2. https://www.wolframalpha.com/
3. https://onlinecourses.nptel.ac.in/
4. http://tutorial.math.lamar.edu/

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED

FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 2.11
Unit Test – 2	From 2.12 to 3.8
Unit Test – 3	From 4.1 to 5.14

ENGINEERING PHYSICS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN103T	Engineering Physics	3	90	30	70	4

TIME SCHEDULE

S. No	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Questions	No. of Essay Questions	COs Mapped
1.	Units and Measurements	09	06	02	-	CO1
2.	Elements of Vectors	11	14	02	01	
3.	Mechanics	10	11	01	01	CO2
4.	Fundamentals of Astrodynamics	13	19	01	02	
5.	Energy and Thermal Physics	12	11	01	01	CO3
6.	Concepts of Acoustics	12	14	02	01	
7.	Electricity and Magnetism	13	14	02	01	CO4
8.	Modern Physics	10	11	01	01	
	Total	90	100	12	08	

COURSE OBJECTIVES

Upon completion of the course the student shall be able

(i)	To understand the basic concepts of physics for various Engineering applications as required for industries.
(ii)	To equip the students with the scientific advances in technology and make the student suitable for any industrial organization.

COURSE OUTCOMES

CO1	IN103.1	Familiarize with various physical quantities, their SI units and errors in measurements; Understand the concepts of vectors for solving engineering problems.
CO2	IN103.2	Solve problems in engineering using appropriate equations and formulae related to Mechanics; Understand the concepts of gravitation, planetary motion with reference to applications in satellites
CO3	IN103.3	Familiarize with the knowledge of various forms of energy, thermal physics and concepts of acoustics in relevance to the societal requirements.
CO4	IN103.4	Familiarize with the basic knowledge of electricity, magnetism and advances in Modern Physics such as photoelectric cell, optical fibers, superconductors and nanotechnology.

LEARNING OUTCOMES

1.0 UNITS AND MEASUREMENTS

1.1 Introduction to Units and Measurements.
1.2 Define the terms: a) Physical quantity b) Fundamental physical quantities and c) Derived physical quantities.
1.3 Explain the concept of units in measurement.
1.4 Define the term 'unit'.
1.5 Define fundamental units and derived units.
1.6 State the SI units of fundamental quantities along with their symbols.
1.7 State the common multiples and submultiples used in the SI system.
1.8 State the rules for writing SI units.
1.9 State the advantages of using SI units.
1.10 Differentiate between direct and indirect measurements.
1.11 Define accuracy and least count in the context of measurement.
1.12 Define error in measurement.
1.13 Define absolute, relative and percentage errors and state their respective formulae.
1.14 Solve numerical problems on errors in measurements.

2.0 ELEMENTS OF VECTORS

2.1 Explain the concept of vectors.
2.2 Define scalar and vector quantities with relevant examples for each.
2.3 Represent a vector geometrically.
2.4 Define equal vectors, negative vector, unit vector, position vector,

co-initial vectors, co-planar vectors.

2.5 Resolve a given vector into its rectangular components.

2.6 State and explain the triangle law of addition of vectors.

2.7 State the parallelogram law of addition of vectors.

2.8 Derive the expressions for the magnitude and direction of the resultant vector using the parallelogram law.

2.9 Illustrate applications of the parallelogram law of vectors using examples (i) Bow and arrow (ii) working of a sling (iii) Flying of a bird.

2.10 Define dot product (scalar product) of two vectors.

2.11 Explain (i) work done (ii) power as examples of dot product.

2.12 Define cross product (vector product) of two vectors.

2.13 Explain (i) linear velocity (ii) torque as examples of cross product.

2.14 Solve numerical problems on (i) resolution of vectors (ii) the parallelogram law of vectors iii) dot product.

3.0 MECHANICS

3.1 Define linear momentum; Mention its SI unit.

3.2 Define force. Mention its SI unit.

3.3 Define torque. Mention its SI unit.

3.4 Define concurrent forces, co-planar forces.

3.5 State and explain Lami's theorem.

3.6 State equations of motion of a body moving in a straight line with uniform acceleration.

3.7 Define projectile. Give examples.

3.8 Derive the equation for the path of an oblique projectile.

3.9 Define periodic motion.

3.10 Define Ideal Simple pendulum.

3.11 Write formula for the time period of a simple pendulum.

3.12 Solve numerical problems on equations of motion and simple pendulum.

4.0 FUNDAMENTALS OF ASTRODYNAMICS

4.1 Define acceleration due to gravity (g); Mention its SI unit.

4.2 State and explain Newton's universal law of gravitation.

4.3 Define universal gravitational constant (G) and mention its value in SI unit.

4.4 Derive the relationship between acceleration due to gravity (g) and the universal gravitational constant (G).

4.5 State and explain Kepler's laws of planetary motion.

4.6 Define orbital velocity and state its formula.

4.7 Define escape velocity and state its formula.

4.8 Derive the relationship between escape velocity and orbital velocity.

4.9 Define the term 'satellite'.

4.10 Define natural and artificial satellites. Give examples for each.

4.11 Mention the applications of artificial satellites.

4.12 Solve numerical problems on (i) Newton's law of gravitation (ii) orbital velocity (iii) escape velocity.

5.0 ENERGY AND THERMAL PHYSICS

5.1 Define work done; Mention its SI unit.
5.2 Define power; Mention its SI unit.
5.3 Define energy; Mention its SI unit.
5.4 List various forms of energy.
5.5 Define potential energy; Give examples and derive its equation.
5.6 Define kinetic energy; Give examples and derive its equation.
5.7 Derive the relationship between kinetic energy and linear momentum.
5.8 State the law of conservation of energy; Give any two examples.
5.9 State Boyle's law; Write its equation.
5.10 State Charles's volume law; Write its equation.
5.11 State Charles's pressure law; Write its equation.
5.12 Define an Ideal gas.
5.13 Derive the ideal gas equation (PV = nRT).
5.14 Solve numerical problems on (i) Work done (ii) Potential energy (iii) Kinetic energy (iv) Relation between K.E. and momentum (v) Gas laws

6.0 **CONCEPTS OF ACOUSTICS**

6.1 Define longitudinal waves. Give examples.
6.2 Define transverse waves. Give examples.
6.3 Define sound. Mention SI unit for intensity of sound.
6.4 Define musical sound.
6.5 Define noise.
6.6 Distinguish between musical sound and noise.
6.7 Define noise pollution.
6.8 Explain the sources of noise pollution.
6.9 Explain the effects of noise pollution.
6.10 Explain methods of minimizing noise pollution.
6.11 Define Beats. Write formula for beat frequency.
6.12 State Doppler's Effect. Mention its applications.
6.13 Explain the concept of echo.
6.14 Mention the applications of echo.
6.15 Define reverberation and reverberation time.
6.16 Write Sabine's formula and name the parameters in it.
6.17 Solve numerical problems on echo.

7.0 ELECTRICITY AND MAGNETISM

7.1 State and explain Ohm's law.
7.2 Define electrical resistance; Mention its SI unit.
7.3 Define specific resistance (resistivity);Mention its SI unit.
7.4 State and explain Kirchhoff's Current Law.
7.5 State and explain Kirchhoff's Voltage Law.
7.6 Derive an expression for the balancing condition of Wheatstone's bridge with neat diagram.
7.7 Describe Meter bridge with necessary circuit diagram.
7.8 Write formula to find unknown resistance using meter bridge.
7.9 Explain the concept of magnetic field.

7.10 Define uniform and non-uniform magnetic fields.
7.11 Define magnetic pole strength; Mention its SI unit.
7.12 Define magnetic moment; Mention its SI unit.
7.13 Define magnetic lines of force.
7.14 Write the properties of magnetic lines of force.
7.15 State Coulomb's inverse square law of magnetism. Write its equation.
7.16 Derive the expression for the moment of couple acting on a bar magnet placed in a uniform magnetic field.
7.17 Solve numerical problems on (i) Ohm's law (ii) Kirchhoff's first law (iii) Wheatstone bridge and Meter bridge (iv) Coulomb's inverse square law of magnetism.

8.0 MODERN PHYSICS

8.1 State and explain photoelectric effect.
8.2 Write Einstein's photoelectric equation and name the terms in it.
8.3 Explain the working of a photoelectric cell.
8.4 List the applications of the photoelectric cell.
8.5 Define critical angle.
8.6 Explain the phenomenon of total internal reflection.
8.7 Define optical fiber; Explain the principle and working of an optical fiber.
8.8 List the applications of optical fiber.
8.9 Define Superconductor and superconductivity.
8.10 List the applications of superconductors.
8.11 Define Nanotechnology and Nano materials.
8.12 Write applications of Nano materials.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1		1
CO2	3	2	1	1	1		2
CO3	3	2	1	1	1		2
CO4	3	2	1	1	3		2
Average	3	2	1	1	1.5		1.75

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) Techfest (vii) Mini project (viii) Group discussions (ix) Virtual labs (x) Library visit for e-books

COURSE CONTENT

1.0 Units and measurements:

Introduction – Physical quantity – Fundamental and Derived quantities – Unit- Fundamental and derived units - SI system of 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.

2.0 Elements of Vectors:

Introduction of Scalars and Vectors – Representation of a vector –Types of vectors - Resolution of vector into rectangular components – Triangle law of vectors - Parallelogram law of vectors- examples- derivation of magnitude and direction of resultant vector- Dot product- Cross product - Problems.

3.0 Mechanics:

Introduction to Mechanics – Momentum –force-torque. Concurrent and coplanar forces - Lami's theorem – equations of motion of a body moving in a straight line – projectile - path of projectile in oblique projection – periodic motion -Ideal simple pendulum- Time period of simple pendulum- Problems.

4.0Fundamentals of Astrodynamics:

Concept of acceleration due to gravity (g) -Newton's law of gravitation- Universal Gravitational constant G – Relation between g and G- Kepler's laws of planetary motion – Orbital velocity and escape velocity – Satellites: Natural and artificial - Applications of artificial satellites – Problems.

5.0 Energy and thermal Physics

Work done, Power and Energy - forms of energy - Potential energy - Kinetic energy- Momentum- K.E and Momentum relation – Law of Conservation of energy- Boyle's law - Charle's volume law -Charle's pressure law- Ideal Gas equation- Problems.

6.0 Concepts of Acoustics

Longitudinal wave- transverse wave- musical sound - noise - Noise pollution – Causes, effects, Methods of minimizing noise pollution- Beats - Doppler's Effect - applications - Echo- Reverberation - Reverberation time- Sabine 's formula - Problems.

7.0 Electricity and Magnetism

Ohm's law- Resistance - Specific resistance - Kirchoff's laws - Wheatstone's bridge- Meter Bridge. Concept of magnetic field- magnetic pole strength – Magnetic Moment- magnetic lines of force - Coulomb's inverse square law of magnetism– Torque acting on a bar magnet- Problems.

8.0 Modern Physics

Photoelectric effect – Einstein photo electric equation – photoelectric cell – Applications of photoelectric cell – critical angle, Total internal reflection- Optical Fiber - Principle – working-Applications of optical fibers - Superconductivity–applications – Nanotechnology – applications.

REFERENCES

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

TABLE SHOWING THE SCOPE OF SYLLABUS TO BE COVERED

FOR UNITTESTS

Unit test	Learning outcomes to be covered
Unit test - 1	From 1.1 to 3.12
Unit test - 2	From 4.1 to 6.17
Unit test - 3	From 7.1 to 8.12

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN104T	ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES	3	90	30	70	4

TIME SCHEDULE

S. No.	Unit Title/Chapter	No. of Periods	Weightage Marks	No. of Short Questions	No. of Essay Questions	COs Mapped
1	Basic Concepts of Chemistry	14	18	2	1.5	CO1
2	Solutions, Acids and Bases	14	18	2	1.5	CO1
3	Electrochemistry	12	11	1	1	CO2
4	Corrosion	8	11	1	1	CO2
5	Water Treatment	8	11	1	1	CO3
6	Polymers and Engineering Materials	10	11	1	1	CO4
7	Fuels and Alternative Energy Sources	6	3	1	0	CO4
8	Environmental Studies	18	17	3	1	CO5
TOTAL		90	100	12	8	

COURSE OBJECTIVES

Upon completion of course the student shall be able	
(i)	To develop a fundamental understanding of core chemical principles and their relevance to a wide range of engineering applications.

(ii)	To explore and analyze natural and anthropogenic environmental challenges through an interdisciplinary lens, incorporating physical, chemical and socio - cultural perspectives.
(iii)	To reinforce theoretical concepts by conducting relevant experiments exercises

COURSE OUTCOMES

CO1	IN104.1 & IN104.2	Explain the basics of atomic structure, chemical bonding, oxidation-reduction, mole concept, concentration expressing methods of solutions, acids-bases, pH and buffer solutions.
CO2	IN104.3 & IN104.4	Explain electrolysis, Galvanic cell, batteries and corrosion.
CO3	IN104.5	Explain the chemistry involved in the treatment of hardness in water.
CO4	IN104.6 & IN 104.7	Explain the preparation and applications of polymers, and understand the composition and uses of alloys, nanomaterials and green fuels.
CO5	IN104.8	Explain environmental concepts, pollution types, global issues, green chemistry principles and sustainable development goals.

LEARNING OUTCOMES

1.0 Basic Concepts of Chemistry

1.1 Explain the charge, mass of fundamental particles of an atom (electron, proton and neutron).
1.2 Understand the concept of Atomic number and Mass number.
1.3 Calculate the number of electrons, number of protons and number of neutrons in atoms, if Atomic number and Mass number are given.
1.4 Explain the Postulates of Bohr's atomic theory and its limitations.
1.5 Explain the values and significance of four Quantum numbers.
1.6 Define Orbital of an atom and draw the shapes of s, p orbitals.
1.7 Distinguish between orbit and orbital.
1.8 Explain (i). Aufbau principle (ii). Hund's rule and (iii). Pauli's exclusion principle.
1.9 Write the Electronic configuration of elements up to Atomic number 20.
1.10 Explain the significance of chemical bonding.
1.11 Understand the concept of Octet rule.
1.12 Define Ionic bond and explain it in the formation of NaCl.
1.13 Define Covalent bond and explain it in the formation of H_2, O_2 & N_2 molecules (Lewis Dot Method).
1.14 List out the Properties of Ionic compounds and Covalent compounds and distinguish between their properties.
1.15 Understand the electronic concept of oxidation, reduction and redox reactions

2.0 Solutions, Acids and Bases

2.1 Define the terms: (i). Solution (ii). Solute and (iii). Solvent with examples.

2.2 Classify solutions based on physical state of solvent with examples.
2.3 Define the terms: (i). Atomic weight, (ii). Molecular weight, and (iii). Equivalent weight.
2.4 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, $AlCl_3$).
2.5 Define Mole and solve numerical problems on Mole concept.
2.6 Define Molarity, Normality and solve numerical problems on Molarity and Normality.
(a). Calculate the Molarity & 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.
2.7 Explain Arrhenius theory of Acids and Bases and give its limitations.
2.8 Define pH and mention its Significance.
2.9 Define buffer solution and classify buffer solutions with examples. Give its applications.

3.0 Electrochemistry

3.1 Define the terms (i). Conductor (ii). Semiconductor (iii). Insulator. (iv). Electrolyte (Strong and Weak) and (v). Non-electrolyte. Give two examples for each.
3.2 Define Electrolysis and Explain electrolysis by taking an example of molten NaCl.
3.3 State the applications of electrolysis.
3.4 Understand Electrode potential and Standard reduction potential (SRP).
3.5 Define electrochemical series and state its significance.
3.6 Define Galvanic cell. Explain the construction and working of Galvanic cell.
3.7 Distinguish between electrolytic cell and galvanic cell.
3.8 Define battery and list the types of batteries with examples.
3.9 Explain the construction, working and applications of (i). Dry cell (Leclanché cell) and (ii). Lithium-ion battery.

4.0 Corrosion

4.1 Define the term corrosion.
4.2 State the factors which influencing the rate of corrosion.
4.3 Describe the formation of (a). Composition cell (b). Stress cell and (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 (through flow chart with examples) and
(b). Cathodic Protection Methods. ((i). Sacrificial Anode Process and (ii). Impressed Voltage Process)

5.0 Water Treatment

5.1 Define soft water and hard water.
5.2 Define hardness of water and classify its types.
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 Explain the method of softening of hard water by Ion exchange method (By indicative reactions).
5.7 Explain the concept of Reverse Osmosis in removing hardness of water.

5.8 List out the applications and advantages of reverse osmosis technique.
5.9 List out the essential qualities of drinking water/potable water.
5.10 Explain Municipal treatment of water for drinking purpose (only flow chart).

6.0 Polymers and Engineering Materials.

6.1 Explain monomers, polymers and the concept of polymerization.
6.2 Describe the methods of polymerization (a). Addition Polymerization of Polythene and (b). Condensation Polymerization of Bakelite (Only flow chart).
6.3 Define plastic. Write the monomers and uses of plastics:
(i). PVC and (ii) Nylon (6,6).
6.4 Define Biodegradable polymers. State applications of (i). PHBV and (ii). PBAT.
6.5 Define an alloy. Write the composition and applications of the following alloys:
(i). Stainless Steel and (ii). Nitinol.
6.6 Define Nano Materials and State applications of
(i). Graphene and (ii). Nanotubes.

7.0 Fuels and Alternative Energy Sources

7.1 Define the term fuel.
7.2 Classification of fuels as Natural fuels and Synthetic fuels.
7.3 Write the composition and uses of the following:
(i). LPG (ii). CNG and (iii). Power alcohol.
7.4 State the Renewable and Non- renewable energy sources with examples.
7.5 Define Green fuel. State the advantages and disadvantages of hydrogen as a green fuel.

8.0 Environmental Studies

8.1 Importance of environmental studies.
8.2 Define the following terms:
(i). Pollution, (ii). Pollutant, (iii). Sink, (iv). Receptor, (v). Particulate Matter, (vi). Dissolved Oxygen (DO) and (vii). Threshold Limit Value (TLV).
8.3 State the uses of forest resources.
8.4 Define deforestation. Explain the causes, effects and controlling methods of deforestation.
8.5 Define Air pollution. Explain the causes, effects and controlling methods of Air pollution.
8.6 Explain the global impacts of Air pollution: (i). Global Warming, (ii). Ozone Layer Depletion and (iii). Acid Rain.
8.7 Define Water pollution. Explain the causes, effects and controlling methods of Water pollution.
8.8 Define e – pollution. State the sources of e – pollution. Explain its health effects and its management.
8.9 Define Green Chemistry. List the Green Chemistry Principles.
8.10 Define Sustainable Development and List the Sustainable Development Goals.

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3									
CO2	3	1	1	1	1		1			
CO3	3	1	1	1	1		1			
CO4	3	1	1		1		1			
CO5	3	1			1	1	1			
Average	3	1	1	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 and (xi). Library Visits etc.

COURSE CONTENT

1.0 Basic Concepts of Chemistry

Atomic Structure:

Introduction - Fundamental particles – their mass and charge – Atomic number and Mass number - definition with examples – calculation of electrons, protons and neutrons in atoms – Bohr's atomic theory and limitations - Quantum numbers – Orbital concept, shapes of s, p orbitals – Distinguish between orbit and orbital - Aufbau principle - Hund's rule - Pauli's exclusion Principle - Electronic configuration of elements (Atomic number(Z) from 1 to 20).

Chemical Bonding:

Introduction – Octet rule - Types of chemical bonds – Ionic bond (NaCl) and Covalent bond (H_2, O_2 & N_2 molecules) as examples – Properties of Ionic and Covalent compounds. Electronic concept of oxidation, reduction and redox reactions.

2.0 Solutions, Acids and Bases

Solutions:

Introduction – Idea of solute, solvent and solution - Types of solutions based on physical state of solvent – Atomic weight – Molecular weight, Equivalent Weight (Acids, Bases and Salts) - Mole concept – Numerical problems on Mole concept - Methods of expressing concentration of a solution – Molarity - Normality – Numerical problems on Molarity and Normality.

Acids and Bases:

Introduction - Arrhenius theory of acids and bases – pH Scale – its significance – Buffer solution – Definition – Types of buffer solutions with examples – its applications.

3.0 Electrochemistry

Introduction - Conductors, Semiconductors, Insulators with examples - Electrolytes (Strong and Weak) and Non-electrolytes – Definition – Examples – Electrolysis – Definition – Electrolysis of molten NaCl – Applications of electrolysis – Electrode potential - Standard reduction potential – Definition – Electrochemical series – Significance – Construction and working of Galvanic cell – Differences between Electrolytic cell and Galvanic cell - Batteries - Types of batteries – Definition and examples – construction, working and applications of: (i). Dry Cell (Leclanché Cell) and (ii). Lithium-ion battery.

4.0 Corrosion

Introduction – Definition - Factors influencing the rate of corrosion – Composition cell, Stress cell and Concentration cell during corrosion – Rusting of iron and its mechanism – Prevention of corrosion - Protective Coating methods (flow chart with examples) - Cathodic Protection methods.

5.0 Water Treatment

Introduction – Soft and Hard water – Hardness of water – Types of hardness – salts responsible for hardness - Degree of hardness – Methods of expressing hardness (mg/L and ppm) – Disadvantages of using hard water in industries - Softening of hard water by Ion exchange method – Concept of Reverse Osmosis process – Applications and Advantages of Reverse Osmosis - Essential qualities of drinking water/potable water – Municipal treatment of water for drinking purpose (only flow chart).

6.0 Polymers and Engineering Materials

Polymers:

Introduction- Monomers - Polymers - Polymerization – Types of Polymerization – Addition polymerization (Polythene) and Condensation polymerization (only flow chart of Bakelite) - Plastics – monomers and uses of PVC and Nylon (6,6) - Biodegradable Polymers: (i). PHBV and (ii). PBAT (Composition and Uses).

Engineering Materials:

Alloys - Definition - Composition and applications of (i). Stainless Steel and (ii). Nitinol

Nano Materials – Definition - Applications of (i) Graphene and (ii). Nanotubes.

7.0 Fuels and Alternative Energy Sources

Introduction – Definition - Classification of fuels – Composition and uses of (i). LPG (ii). CNG and (iii). Power alcohol - Renewable and Non-renewable energy sources – Advantages and disadvantages of Hydrogen as a green fuel.

8.0 Environmental Studies

Introduction - Importance of environmental studies – Important terms related to environment – Pollution, Pollutant, Sink, Receptor, Particulate Matter, Dissolved Oxygen (DO), Threshold Limit Value (TLV) - Uses of forest resources – Deforestation - Definition – causes, effects, controlling methods –Air pollution – Definition, causes, effects, controlling methods - Global impacts of Air pollution – Global warming, Ozone layer depletion, Acid rain – Water pollution – Definition, causes, effects, controlling methods – e - pollution, Definition, sources, effects, management - Green Chemistry – Definition – Principles of Green Chemistry – Sustainable Development – Definition – Goals.

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5. Mahua Basu & S. Xavier-Fundamentals of Environmental Studies
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TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning outcomes to be covered
Unit Test – 1	From 1.1 to 2.9
Unit Test – 2	From 3.1 to 5.10
Unit Test – 3	From 6.1 to 8.10

ELECTRONIC DEVICES AND CIRCUITS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN105T	ELECTRONIC DEVICES AND CIRCUITS	06	180	30	70	6

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Questions	No. of Essay Questions	COs Mapped
1	Passive electronic components	35	17	3	1	CO1
2	Semiconductor Diodes and their applications	23	11	1	1	CO2
3	Transistors	17	11	1	1	CO2
4	FET AND MOSFET	18	11	1	1	CO3
5	Transistor biasing and stabilisation	17	06	2	-	CO4
6	Small Signal Amplifiers	20	11	1	1	CO4
7	Feedback amplifiers& Power Amplifiers	20	11	1	1	CO5
8	Oscillators	15	11	1	1	CO5
9	Sweep circuits & Multivibrators	15	11	1	1	CO5
TOTAL		180	100	12	08	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Familiarise with passive components and their use.
(ii)	Understanding and working of semiconductor diodes and their applications; transistors and their configurations.

(iii)	Understand the operation of FET, MOSFET.
(iv)	Understanding of transistor biasing and stabilization techniques.
(v)	Understand and working of different small signal amplifiers, feedback amplifiers, oscillators, sweep circuits and multivibrators.

COURSE OUTCOMES

CO1	IN105.1	Familiarise with different passive components and their use.
CO2	IN105.2	Analyze the working of semiconductor diodes, transistor and their configurations.
CO3	IN105.3	Explain the working of FET and MOSFET.
CO4	IN105.4	Explain transistor biasing, stabilization circuits, compensation techniques, working of small signal amplifiers.
CO5	IN105.5	Analyze the importance of feedback, categorize feedback amplifiers, explain push-pull power amplifier, various oscillator circuits, sweep circuits and multivibrators.

LEARNING OUTCOMES

1.0. PASSIVE ELECTRONIC COMPONENTS

1.1 Define the term resistance.
1.2 List the factors affecting the value of resistance and derive the relation $R=\rho\, l/A$.
1.3 Classify the resistors.
1.4 List the following specifications of a resistor and state their importance:
  a) Resistance Value
  b) Tolerance
  c) power rating
  d) Temperature coefficient of resistance
1.5 Explain the Colour Code of a Resistor.
1.6 Simple problems on colour coding of resistors.
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 State the effect of temperature on resistance in different materials and derive the relation $R_t=R_o(1+\alpha_o t)$. (No problems).
1.11 Describe the constructional details and working of carbon and wire-wound potentiometers.
1.12 Describe the constructional details and working of the rheostat and list its applications.
1.13 Define the term capacitance.
1.14 Classify the types of capacitors.
1.15 List the following specifications of a capacitor and state their importance:
  a) Capacitance Value
  b) Dielectric constant
  c) Dielectric strength
1.16 State the factors affecting the capacitance of a parallel plate capacitor.
1.17 Derive the equivalent capacitance of Capacitors connected in i) series, and ii) parallel.
1.18 Simple problems on series and parallel connected capacitors.
1.19 Define self-inductance, mutual inductance and coefficient of coupling.

1.20 Draw the symbols of iron core, air core, and ferrite core inductors.
1.21 Simple problems on self-inductance, mutual inductance and coefficient of coupling.
1.22 Classify inductors.
1.23 List the specifications of the inductor.
1.24 Write the expressions of equivalent inductance when they are connected in series aiding and opposing, when they are connected in parallel aiding and opposing (No derivation).
1.25 List the applications of A.F. and R.F. chokes.

2.0. SEMICONDUCTOR DIODES AND THEIR APPLICATIONS

2.1 State the electrical properties of solid Semiconductor materials.
2.2 Sketch energy level diagrams for conductors, Semiconductors and Insulators.
2.3 Define Intrinsic and extrinsic Semiconductors.
2.4 Distinguish between Intrinsic and extrinsic Semiconductors.
2.5 Describe the formation of P-type and N-type materials and sketch the energy band diagrams.
2.6 Identify the Majority and Minority carriers in P and N Type materials.
2.7 Distinguish between Drift and Diffusion current.
2.8 Explain the formation of a PN junction diode.
2.9 Explain the working of a PN junction Diode with various biasing voltages.
2.10 Sketch the forward and Reverse Bias Voltage characteristics of the diode.
2.11 List the specifications of a diode.
2.12 List the applications of a diode.
2.13 Draw and explain the working of basic clipper and clamper circuits using diodes.
2.14 Explain the formation and working of a Zener diode.
2.15 Sketch the characteristics of a Zener diode.
2.16 Distinguish between Zener breakdown and Avalanche breakdown.
2.17 Explain the working principle and list applications of the following
   a) Varactor diode
   b) Tunnel diode
2.18 Draw the symbols of a PN junction diode, Zener diode, Varactor diode and Tunnel diode.

3.0 TRANSISTORS

3.1 State the formation of a transistor.
3.2 Draw the symbols and explain the working of PNP and NPN Transistors.
3.3 List transistor configurations.
3.4 Explain the working of a transistor as an amplifier in the CE configuration.
3.5 Draw and explain the different transistor configurations (CB, CC).
3.6 Define cut-off, saturation and active regions.
3.7 Sketch the input/output characteristics of CB, CC and CE configurations.
3.8 Define alpha, beta and gamma Factors.
3.9 Obtain the relation between alpha, beta and gamma Factors.
3.10 Write the collector current expression in CB and CE modes of transistors.
3.11 Compare the performance characteristics of the transistor in CB, CE and CC configurations.

4.0 FET AND MOSFET

4.1 Classify FETs.

4.2 List the advantages of JFET over BJT.
4.3 Draw the symbols of the P-channel and N-channel JFET.
4.4 Explain the construction and working of the N-channel JFET.
4.5 Draw the drain and transfer characteristics of the N-channel JFET.
4.6 List the applications of FET.
4.7 List the types of MOSFETs.
4.8 Explain the construction and principle of operation of N-channel depletion and Enhancement type MOSFETs.
4.9 Explain the construction and principle of operation of CMOSFET.

5.0 TRANSISTOR BIASING AND STABILIZATION

5.1 State why CE Mode is widely used in amplifier circuits.
5.2 Define DC load line and AC load line.
5.3 Determine the Q-point (operating point) on the DC load line.
5.4 Define transistor biasing.
5.5 State the need for proper biasing in amplifier circuits.
5.6 List the types of biasing circuits.
5.7 Explain the potential divider method of biasing.
5.8 Define the term stabilisation.
5.9 State the need for stabilisation in amplifier circuits.
5.10 Define stability factors S, S_V and S_β.
5.11 List the compensation techniques.
5.12 Explain Diode and Thermistor compensation techniques.

6.0 SMALL SIGNAL AMPLIFIERS

6.1 Classify the amplifiers based on frequency, period of conduction, and coupling.
6.2 State the need for a multistage amplifier (Cascading of amplifiers).
6.3 List the types of couplings used in amplifiers.
6.4 Explain the principle of operation of a two-stage RC coupled amplifier with a circuit diagram and draw its frequency response.
6.5 Explain the principle of operation of a two-stage transformer-coupled amplifier with a circuit diagram and draw its frequency response.
6.6 Draw and explain the circuit of Direct Coupled Amplifiers.
6.7 Compare RC coupling, transformer coupling and Direct Coupling schemes used in amplifiers.

7.0 FEEDBACK AMPLIFIERS AND POWER AMPLIFIERS

7.1 Compare Negative and Positive feedback.
7.2 Explain the principle of negative feedback in amplifiers.
7.3 Classify negative feedback amplifiers.
7.4 Draw and explain the following block diagram arrangements of negative feedback amplifiers. (a)Voltage –Series (b) Voltage –Shunt (c) Current- Series (d) Current - Shunt
7.5 Explain the Emitter follower circuit and mention its advantages.
7.6 Explain the working of the Darlington amplifier circuit.
7.7 Distinguish between voltage amplifiers and power amplifiers.

7.8 Classify power amplifier circuits based on frequency, period of conduction, and configurations.
7.9 Draw and explain the circuit of a push-pull amplifier.
7.10 List the advantages of push-pull amplifiers.
7.11 List the applications of a power amplifier.
7.12 State the necessity of a Heat sink for a power transistor and a power I.C. device.
7.13 List the different types of heat sinks.

8.0 OSCILLATORS

8.1 List the Barkhausen Criterion conditions for an amplifier to work as an oscillator.
8.2 List the essentials of an oscillator.
8.3 Classify oscillator circuits.
8.4 Draw and explain the working of an RC phase shift and Wein bridge oscillator circuits.
8.5 State the conditions of sustained oscillations and give the expression for the frequency of oscillations of the RC phase shift oscillator and Wein bridge oscillator circuits.
8.6 Draw and explain the working of Hartley and Colpitts oscillator circuits.
8.7 Draw and explain the working of the Crystal oscillator circuit.
8.8 Write the expressions for the frequency of oscillation and mention the conditions for sustained oscillations of Hartley, Colpitts and Crystal oscillator circuits.
8.9 List the advantages of crystal oscillators over other types.
8.10 State the reasons for instability in oscillator circuits.
8.11 Suggest the remedies for instability in the oscillator.
8.12 List the applications of oscillators.

9.0 SWEEP CIRCUITS AND MULTIVIBRATORS

9.1 Define Sweep Voltage.
9.2 State the fundamental consideration of the sweep waveform.
9.3 Distinguish between voltage and current time-base generators.
9.4 Explain how a transistor works as a switch, in CE mode.
9.5 Draw and explain the Bootstrap sweep circuit.
9.6 Draw and explain Miller's sweep circuit using a transistor.
9.7 Draw a current sweep circuit using a transistor and explain its working with a waveform.
9.8 Classify Multivibrators.
9.9 Draw and explain the working of Transistorised Astable, Bistable and Monostable multivibrators with waveforms.
9.10 Draw and explain the working of the Schmitt trigger circuit using a transistor with waveforms.

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1	3	3	1			3	2	
CO2	1	1	3	3	1			3	2	
CO3	1	1	3	3	1			3	2	
CO4	1	1	3	3	1			3	2	
CO5	1	1	3	3	1			3	2	
Average	1	1	3	3	1			3	2	

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 PASSIVE ELECTRONIC COMPONENTS

Classification of resistors, colour code, Specifications, Constructional details of carbon and wire-wound Potentiometers - Effect of temperature on resistance. Classification, specifications of capacitors, capacitors connected in series and parallel. Self-Inductance, mutual inductance, coefficient of coupling, A.F. and R.F. chokes.

2.0 SEMICONDUCTOR DIODES AND THEIR APPLICATIONS

Electrical properties of semiconductor 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. Zener diode - Zener breakdown and Avalanche breakdown, Varactor diode, tunnel diode.

3.0 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.

4.0 FET AND MOSFET

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

5.0 TRANSISTOR BIASING & STABILIZATION

Transistor as an amplifier, operating point, dc load line, biasing- types of biasing, potential divider biasing, stabilisation, stability factors, compensation techniques.

6.0 SMALL SIGNAL AMPLIFIERS

Classification of amplifiers, working and frequency response of two-stage RC coupled, transformer coupled amplifiers, and Direct coupled Amplifier.

7.0 FEEDBACK AMPLIFIERS & POWER AMPLIFIERS

Feedback Amplifiers- 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.

8.0 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 the crystal oscillator. Reasons and remedies for instability in oscillator circuits. Applications of oscillators.

9.0 SWEEP CIRCUITS &MULTIVIBRATORS

Sweep circuits - time base generators, bootstrap sweep circuit, Miller sweep circuit, and current sweep circuit. Multivibrators- classification of multivibrators, transistorised Astable, Monostable and Bistable multivibrators with waveforms. Schmitt trigger using a transistor - operation and waveforms.

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TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Tests	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 2.6
Unit Test – 2	From 2.7 to 5.12
Unit Test - 3	From 6.1 to 9.10

ELECTRONIC CAD

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN106A	ELECTRONIC CAD	02	60	-	-	-

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Cos Mapped
1	Fundamentals of ECAD	14	C01
2	Familiarization of Different Electronic Components, Time-Varying Signals and semiconductor diodes	08	CO2
3	Rectifiers and Filters	12	CO3
4	Amplifiers	12	CO4
5	Oscillators	14	CO5
	TOTAL	60	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Understand the basics of Electronics CAD.
(ii)	Creating schematics, designing simple Printed Circuit Boards (PCBs), and using simulation tools with free, open-source software.

COURSE OUTCOMES

CO1	IN106.1	Basics of ECAD and familiarization with electronic components and time-varying signals
CO2	IN106.2	Simulation of V-I characteristics of semiconductor diodes
CO3	IN106.3	Construction and simulation of rectifiers and filters
CO4	IN106.4	Simulation of Transistor Amplifier circuits
CO5	IN106.5	Simulation of few AF and RF Oscillator circuits

LEARNING OUTCOMES

THEORY

1.0 FUNDAMENTALS OF E-CAD

1.1. State the function of the schematic capture phase and how it differs from PCB layout.

1.2. Explain the complete ECAD design flow, starting from the initial conceptual idea to the final manufacturing output. (Your answer should detail the purpose of each major stage, including schematic capture, simulation, PCB layout, and verification, and describe how each stage builds upon the previous one.)

1.3. Discuss the critical role of verification in the ECAD process.
(Focus on two specific verification steps: circuit simulation and the Design Rule Check (DRC).)

1.4. What is a net list, and what is its role in the design process?

1.5. How does a simulation tool help you when designing a circuit?

1.6. What are Gerber files, and state its need?

1.7. List the available industry standard, open source and Free ECAD software for electronic devices and circuits simulation.

LABORATORY

2.0 FAMILIARIZATION OF DIFFERENT ELECTRONIC COMPONENTS, TIME-VARYING SIGNALS, AND SEMICONDUCTOR DIODES.

2.1 Represent and label Active and Passive components.

2.2 Represent time-varying signals and label them.

2.3 Construct and simulate the V-I characteristics of the following:

a. PN junction diode.
b. Zener diode.
c. Light-emitting diode.
d. Photodiode.

3.0 RECTIFIERS AND FILTERS

Construct, simulate, and observe the output waveforms of the following:

3.1 Half-wave rectifier.

3.2 Full-wave rectifier

3.3 C Filter

3.4 LC Filter

4.0 AMPLIFIERS

Construct and simulate the frequency response of the following:

4.1 CE Amplifier.

4.2 CB Amplifier.

4.3 RC Coupled Amplifier.

5.0 OSCILLATORS

Construct, simulate, and calculate the frequency of the following:

5.1 RC Phase Shift Oscillator

5.2 Wein Bridge Oscillator

5.3 Hartley Oscillator

5.4 Colpitt's Oscillator

CO-PO/PSO MAPPING

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	1			2	2	1
CO2	2	1	1		1			2	1	
CO3	2	2	3	1	2			3	3	1
CO4	2	2	3	1	2			3	3	1
CO5	2	2	3	1	2			3	3	1
Average	2.2	1.8	2.4	1	1.6			2.6	2.4	1

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

Note:

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 FUNDAMENTALS OF E-CAD

Role of ECAD, Schematic vs. PCB Layout, ECAD Design Flow: Verification, Netlist, Simulation Tools, Gerber Files, ECAD Software.

2.0 COMPONENTS & DIODES

Components: Represent active (control) and passive (store/consume) parts. Signals: Represent time-varying signals and label their parameters. PN Diode: Simulate forward bias conduction. Zener Diode: Simulate reverse breakdown voltage. LED: Simulate forward bias and light emission. Photodiode: Simulate reverse current from light.

3.0 RECTIFIERS AND FILTERS

Half-wave and Full-wave Rectifiers-output waveforms, Average and RMS voltages, ripple factor. C Filter- LC Filter- output waveforms.

4.0 AMPLIFIERS

CE Amplifier: Simulate frequency response and gain, CB Amplifier: Simulate frequency response for high-frequency gain, RC Coupled Amplifier: Simulate frequency response to find bandwidth.

5.0 OSCILLATORS

AF Oscillators: Wein Bridge Oscillator, RC Phase shift oscillator-find frequency. RF Oscillators- Hartley Oscillator, Colpitt's oscillator-calculate frequency.

REFERENCES

1. Robert L. Boylestad and Louis Nashelsky - Electronic Devices and Circuit Theory, published by Pearson.
2. Adel S. Sedra and Kenneth C. Smith - Microelectronic Circuits , Oxford University Press
3. Muhammad H. Rashid - SPICE for Circuits and Electronics, Publisher: Cengage
4. Kraig Mitzner - Complete PCB Design Using OrCAD Capture and PCB Editor, Publisher: Newnes (an imprint of Elsevier)
5. Tim Williams - The Circuit Designer's Companion , Publisher: Newnes (an imprint of Elsevier)

ELECTRICAL WIRING, ELECTRONIC DEVICES AND CIRCUITS LAB

(PRACTICUM-PRACTICAL)

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN107L	ELECTRICAL WIRING, ELECTRONIC DEVICES AND CIRCUITS LAB	6	180	40	60	6

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	COs Mapped
1	Electrical wiring practice	24	CO1
2	Switches and Relays	21	CO2
3	Identification of components	15	CO3
4	Soldering Practice	15	CO4
5	Study and use of electronic equipment	18	CO5
6	Microphones & Loudspeakers	18	CO2
7	Power Supplies and Batteries	21	CO2
8	PCBs	18	CO4
9	Testing of electronic components, Devices, and Rectifiers	30	CO5
	TOTAL	180	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to	
(i)	Familiarise with electrical wiring, Soldering, and Identification of components and equipment.
(ii)	Familiarise with switches, relays, microphones, and loudspeakers.
(iii)	Describe rectifier circuits, DC power supplies, PCB materials, and their fabrication.
(iv)	Familiarise with the Study, testing, and use of different types of electronic components and equipment.

COURSE OUTCOMES

CO1	IN107.1	Familiarisation with various tools used in electrical wiring, Connection of tube light, the function of choke, tube, and starter, and ceiling fan.
CO2	IN107.2	Familiarization with various switches, connectors, cables, fuses, relays, microphones, loudspeakers, rectifier circuits, DC power supplies and their applications.
CO3	IN107.3	Identification of different types of resistors, capacitors, and inductors, and determination of their values using codes and meters.
CO4	IN107.4	Familiarisation with various soldering tools and Practice on Soldering, PCB materials and their fabrication.
CO5	IN107.5	Measurement of the value of resistors, AC/DC Voltages, currents, using analog and digital Multimeters. Measurement of different signal frequencies and amplitudes using CRO and function generators. Draw forward and reverse bias characteristics of the semiconductor diode, Zener diode, transistor in CB mode, and CE mode.

LEARNING OUTCOMES

1.0 ELECTRICAL WIRING PRACTICE

LABORATORY

1.1 Familiarisation of various tools used in electrical wiring.
1. Cutting pliers, 2. Insulation remover 3. Pocket knife 4. Electrical Tester 5. 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 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.

1.4 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.

1.5 Simple staircase wiring – one lamp control with two switches.

1.6 Perform Tube light connection.

1.7 Connection of ceiling fan and reversing the direction of ceiling fan.

2.0 SWITCHES AND RELAYS

THEORY

2.1 Define a switch.

2.2 Classify switches according to poles and throws (SPST, SPDT, DPST,DPDT, Multipole multi-throw).

2.3 Sketch the I.S.I symbols of SPST, SPDT, DPST, DPDT, Multi-pole multi throw switches.

2.4 List the different types of switches.

2.5 Explain the working of toggle, rotary, slider switches and mention their applications.

2.6 State the need of fuse in electronic equipment.
2.7 Mention different types of fuses.
2.8 Mention the ratings of fuse.
2.9 State the necessity of connectors in electronic circuits.
2.10 List the different types of connectors.
2.11 Mention the use of MCB.
2.12 Define a relay.
2.13 Classify different relays based on principle of operation, polarization, and application.
2.14 Mention specifications and applications of relays.
2.15 Explain the construction & working of a general-purpose electromagnetic relay.
2.16 List the contact materials used in relays and list their characteristics.

LABORATORY

2.17 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 fibre.

2.18 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.

2.19 Identifying the following 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

2.20 Identify different types of switches and relays.
2.21 Test the working of different types of switches, relays.

3.0 IDENTIFICATION OF COMPONENTS

LABORATORY

3.1 Familiarise with the symbols of electronic circuit components by drawing.
3.2 Identify different types resistors with different wattage.
3.3 Identify different types of capacitors.
3.4 Identify different types of Inductors.
3.5 Identify colour coding of different resistors.
3.6 Find the value of a given Resistor using colour code.
3.7 Measure the value of resistor using ohmmeter / multi meter and compare with the colour code value.

4.0 SOLDERING PRACTICE

LABORATORY

4.1 Familiarisation of various soldering tools, Components & different cables.
4.2 Assemble and disassemble components using soldering irons
4.3 Use different types of soldering irons.
4.4 Use solder squeezer on electronic PCBs.
4.5 Use instant soldering gun.

5.0 STUDY AND USE OF ELECTRONIC EQUIPMENT

LABORATORY

5.1 Measurement of AC/DC Voltages and currents using voltmeters and current Meters.
5.2 Measurement of voltage, current and resistance using analog and digital Multi meters.
5.3 Perform the continuity test for different components and devices using analog and Digital multi meters.
5.4 Study and use of AF / RF signal generators.
5.5 Study and use of C.R.O. (single trace & Dual trace) for measuring frequency and amplitude.
5.6 Study and use of single channel and dual channel regulated power supply units.

6.0 MICROPHONES & LOUD SPEAKERS

THEORY

6.1 Define Microphone.
6.2 List the different types of microphones based on impedance, polar characteristics and principle of working.
6.3 Explain the working of carbon, Crystal and dynamic microphones.
6.4 Mention the specifications of microphones.
6.5 Define Loudspeaker.
6.6 Explain the constructional features and principle of operation of PMMC Loudspeaker.
6.7 Mention the necessity of Baffle for a Loudspeaker and list the types of Baffles (like open, infinite, bass reflex, acoustic labyrinth).
6.8 Mention the use of woofers and tweeters.
6.9 Give the need for a Horn loud speaker.
6.10 Mention the specifications of Loudspeaker.

LABORATORY

6.11 Identify different types of microphones and loud speakers.
6.12 Identify microphones and loudspeaker connections.
6.13 Test the given loud speaker and measure the voice coil resistance-using multimeter.
6.14 Arrange the Public Address system and test the performance.

7.0 POWER SUPPLIES AND BATTERIES

THEORY

7.1 State the necessity of D.C. power supply for Electronic circuits.
7.2 Define cycle, Frequency, Time Period, Maximum Value, Average value, RMS value, Form Factor, peak factor for sinusoidal AC quantities.
7.3 Describe the working of HW, FW and Bridge Rectifier circuits with wave forms.
7.4 Define PIV, Ripple factor and Efficiency and write their expressions for the above circuits.
7.5 Compare HW, FW and Bridge Rectifiers
7.6 Define Voltage Regulation.
7.7 Define a filter circuit.
7.8 State the need for a filter circuit in power supplies.
7.9 List the types of filter circuits.
7.10 State the need for a regulated power supply and list its specifications.
7.11 List the types of storage batteries.
7.12 List the uses of storage batteries.
7.13 Explain about maintenance free battery and list their applications.
7.14 Classify UPS.
7.15 Explain the working of Off Line UPS and Online UPS.

8.0 PCBs

THEORY

8.1 State the need of PCB in electronic equipment.
8.2 Classify PCBs.
8.3 List the standard PCB specifications.
8.4 List the types of laminates used in PCBs.
8.5 Explain the following in PCB Layout planning.
a)Layout Scale
b) Grid system.
8.6 Spacing specifications for component holes and conductor widths.
8.7 List the methods of transferring layout on the copper clad sheet.
8.8 List the steps involved in screen-printing for making PCBs.
8.9 List the materials used in screen-printing.
8.10 Describe the photo processing technique for PCB preparation.
8.11 Explain the methods of etching, cleaning and drilling of PCB.
8.12 List the steps involved in making double-sided PCB.
8.13 Define soldering.
8.14 State the need of flux in soldering.
8.15 List the materials used in soldering.
8.16 List the soldering methods of PCBs.

LABORATORY

8.17 Solder on printed circuit boards using passive and active components.

9.0 TESTING OF ELECTRONIC COMPONENTS, DEVICES AND RECTIFIERS

LABORATORY

9.1 Identify leads and testing of different diodes (PN Junction Diode, Zener Diode) and transistors using Multimeter.
9.2 Study of data manuals/ application manuals for diodes and transistors.
9.3 Draw forward and reverse bias characteristics of semiconductor diode and calculate forward and reverse resistance of diode.
9.4 Draw reverse bias characteristics of Zener diode and find out the zener voltage.
9.5 Draw input and output characteristics of transistor in CB mode.
9.6 Draw input and output characteristics of transistor in CE mode.
9.7 Implement Half wave rectifier with and without filter.
9.8 Implement Full wave rectifier with and without filter.
9.9 Implement Bridge rectifier with and without filter.

CO-PO/PSO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	1	3	2	1
CO2	3	3	3	3	3	3	1	3	2	1
CO3	3	3	3	3	3	3	1	3	2	1
CO4	3	3	3	3	3	3	1	3	2	1
CO5	3	3	3	3	3	3	1	3	2	1
Average	3	3	3	3	3	3	1	3	2	1

3= strongly mapped, 2= moderately mapped, 1= slightly mapped
Note: The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

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 1.7, 2.17 to 3.7
Unit Test – II	From 4.1 to 5.6, 6.11 to 6.14
Unit Test-III	From 8.17 to 9.9

REFERENCES

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.

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.

PROGRAMMING IN C & MATLAB (PRACTICUM-PRACTICAL)

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN108L	PROGRAMMING IN C & MATLAB	04	120	40	60	03

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	COs Mapped
1	C Programming Basics	16	CO1
2	Decision & Loop Control Statements	24	CO2
3	Exercises on functions	20	CO3
4	Arrays, Strings and Pointers in C	28	CO4
5	Structures and Unions	12	CO4
6	MATLAB	20	CO5
	TOTAL	120	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able	
(i)	To Identify and explain the fundamentals of C and MATLAB programming.
(ii)	To Apply basic programming concepts to solve simple mathematical and logical problems.
(iii)	To develop structured programs using C and MATLAB for practical applications.

COURSE OUTCOMES

CO1	IN108.1	Describe the basic structure of C programs, data types, and operators.
CO2	IN108.2	Apply decision-making and looping constructs to solve simple problems.

CO3	IN108.3	Use functions, parameter passing methods, and recursion in C programming.
CO4	IN108.4	Implement arrays, strings, and pointers to solve computational problems and use preprocessor directives. Apply structures and unions to organize and process data effectively.
CO5	IN108.5	Demonstrate MATLAB commands for computation and visualization.

LEARNING OUTCOMES

1.0 C PROGRAMMING BASICS

THEORY

1.1 Identify the structure of a C program.
1.2 Classify keywords, data types, and variables.
1.3 Explain operators used in C.

LABORATORY

1.4 Write a C program to display "WELCOME TO C PROGRAMMING".
1.5 Write a C program to accept and display input of different data types.
1.6 Write a C program to calculate the area of a circle.
1.7 Write a C program to convert Celsius to Fahrenheit.
1.8 Write a C program to calculate simple interest.

2.0 DECISION & LOOP CONTROL STATEMENTS

THEORY

2.1 Explain if, if-else, nested if-else, and switch statements.
2.2 Explain looping constructs (for, while, do-while).

LABORATORY

2.3 Write a C program to find the largest of three numbers.
2.4 Write a C program to perform arithmetic operations using switch.
2.5 Write a C program to find the factorial of a number using for loop.
2.6 Write a C program to print the first n natural numbers using a while loop.
2.7 Write a C program to find the sum of n natural numbers using a do-while loop.
2.8 Write a C program to check whether a number is even or odd.
2.9 Write a C program to check whether a number is positive or negative.
2.10 Write a C program to generate a multiplication table.
2.11 Write a C program to find the sum of digits of a number.

3.0 FUNCTIONS

THEORY

3.1 State the purpose of functions.
3.2 Explain parameter passing and return values.
3.3 Define and illustrate recursion.

LABORATORY

3.4 Write a C program to create and call a simple function to print a welcome message.
3.5 Write a C program to add two numbers using a function (with arguments, with return value).
3.6 Write a C program to check whether the give number is prime number or not With function.
3.7 Write a C program to calculate factorial using recursion.

3.8 Write a C program to implement a menu-driven calculator using functions.

4.0. ARRAYS, STRINGS, AND POINTERS IN C

THEORY

4.1 Define arrays and strings.
4.2 Demonstrate array initialization and element access.
4.3 Explain the String handling functions strcat(), strcmp(), strcpy(), strncpy(), strncat(), strncmp(), strupr(), strlwr(), and strlen().
4.4 Explain the concept of pointers and dereferencing operators.

LABORATORY

4.7 Write a C program to find the smallest element in an array.
4.8 Write a C program to search an element in an array.
4.9 Write a C program to add two 2×2 matrices.
4.10 Write a C program using string functions for strcat(), strcmp(), strcpy(), strncpy(), strncat(), strncmp(),strupr(),strlwr() and strlen().
4.11 Write a C program to reverse a string.
4.12 Write a C program to swap two numbers using pointers.

5.0. STRUCTURES AND UNIONS

THEORY

5.1 Define structure and union in C.
5.2 Explain pre-processor directives (#include, #define).
5.3 Differentiate between structure and union.

LABORATORY

5.4 Write a C program to store the information of students using structures.
5.5 Write a C program using structures to read and display a book database consisting of the following fields: Title, Author, Number of Pages, and Price.
5.6 Write a C program to access Union members.
5.7 Write a C program to find size of a structure and union.
5.8 Write a C program using pre-processor directives.

6.0. MATLAB

THEORY

6.1 Familiarize with MATLAB Compiler environment, command line arguments, HELP and know about various tool boxes available in MATLAB.
6.2 Compare MATLAB and C programming approaches.
6.3 Explain MATLAB commands for arrays, matrices, and visualization.

LABORATORY

6.4 Write a MATLAB program to generate row and column vectors.
6.5 Write a MATLAB program to use commands: ones, zeros, rand, linspace, clc, clear.
6.6 Write a MATLAB program to use built-in functions on an array: max, min,length, sum.
6.7 Write a MATLAB program to perform matrix operations (addition, subtraction).
6.8 Write a MATLAB program to check whether a year is a leap year.
6.9 Write a MATLAB program. to calculate factorial using loops.
6.10 Write a MATLAB program to plot a line, parabola, sine wave, exponential curve, and circle.
6.11 Write a MATLAB program to plot sine and cosine waves for different frequencies.

6.12 Write a MATLAB program to solve quadratic equations.
6.13 Write a MATLAB program to simulate a voltage divider.
6.14 Write a MATLAB program to create a function file.
6.15 Write a MATLAB program to create and execute anonymous and symbolic functions.

CO-PO/PSO MAPPING

CO No	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1		3	3	1
CO2	3	3	3	3	2	1		3	3	1
CO3	3	3	3	3	3	1		3	3	1
CO4	3	3	3	3	2	1	3	3	3	1
CO5	2	1	2	3	2			2	2	2
Average	2.8	2.6	2.8	3	2.2	1	3	2.8	2.8	1.2

3= Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

Note: The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.4 to 1.8, 2.3 to 2.11, 3.4 to 3.8,
Unit Test – 2	From 4.7 to 4.12, 5.4 to 5.8
Unit Test-3	From 6.4 to 6.15

PHYSICS LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN109L	PHYSICS LAB	3	90	20	30	1.5

Note: For the Physics laboratory, half of the first-year students of each programme will attend, while the remaining half will attend the Chemistry laboratory. Thus, both laboratories will be engaged simultaneously during the 3-hour lab session.

TIME SCHEDULE

S. No	Chapter/ Unit Title	No. of Periods	Cos
1.	Vernier calipers	03 + 03	CO1
2.	Micrometer (Screw gauge)	03 + 03	
3.	Verification of Lami's theorem using concurrent forces	03 + 03	
	Revision	03 + 03	
4.	Determination of 'g' using simple pendulum	03 + 03	CO2
5.	Focal length and focal power of convex lens by distant object method and U-V method	03 + 03	
6.	Verification of Boyle's law using Quill tube	03 + 03	
	Revision	03 + 03	
7.	Drawing of magnetic lines of force	03 + 03	CO3
8	Resonance apparatus–Determination of velocity of sound in air	03 + 03	
9	Refractive index of a solid using travelling microscope	03 + 03	
	Revision	03 + 03	
	Experiments for demonstration		
10	Meter bridge–Determination of resistance and specific resistance of material of given wire	03 + 03	CO4
11	Projectile motion- study the range of a projectile for different launch angles	03 + 03	
12	Generation of Beats using water columns	03 + 03	
	Total	45+ 45	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to

(i)	Apply practical physics principles to operate, troubleshoot, and optimize engineering devices.
(ii)	Develop scientific skills through designing, conducting, and evaluating industry-relevant experiments to enhance technical proficiency.

COURSE OUTCOMES

CO1	IN109.1	Apply measurement techniques to improve accuracy; Explain forces maintaining equilibrium in physical systems.
CO2	IN109.2	Determine acceleration due to gravity experimentally; Investigate refraction of light at curved surfaces; Relate the gas pressure to volume variations at constant temperature.
CO3	IN109.3	Analyze the combined effect of magnetic fields (Earth and artificial magnet); Determine velocity of sound in air using resonance; Demonstrate U-V method to understand the refraction of light at curved surfaces.
CO4	IN109.4	Apply Kirchhoff's laws to compute the resistivity of a wire; Examine the projectile motion parameters; Observe and Interpret beat generation phenomenon.

LEARNING OUTCOMES

1. Apply measurement techniques using Vernier Calipers to determine the volumes of a cylinder and a sphere.
2. Use a screw gauge to measure and determine the thickness of a glass plate and the cross-sectional area of a wire.
3. Verify Lami's Theorem by analysing a system of concurrent forces.
4. Conduct simple pendulum experiment to calculate the acceleration due to gravity (g) and interpret the result through an $L–T^2$ graph.
5. Determine the focal length and power of a convex lens using distant object method and U–V method, and compare the results.
6. Verify Boyle's Law using a Quill tube by noting pressure (P) and length of air column(L).
7. Illustrate the behaviour of lines of magnetic field around a bar magnet using magnetic compass.

8. Determine the velocity of sound in air at room temperature and at 0°C using resonance apparatus.
9. Determine the refractive index of a solid by using the measurements taken with a travelling microscope.
10. Demonstrate the use of a meter bridge to determine the resistance and specific resistance of a given wire.
11. Simulate projectile motion and observe the range of the projectile for different launch angles using appropriate experimental setup.
12. Demonstrate the phenomenon of beats by creating beat patterns using water columns.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	1	1	1	1
CO2	3	1	1	1	1	1	1
CO3	3	1	1	1	1		1
CO4	3	1	1	2	1		1
Average	3	1	1	1.25	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) 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, etc.

COURSE CONTENT

Name of the Experiment	Competencies (Revised Bloom's Taxonomy)	Key Competencies (Revised Bloom's Taxonomy)
1. Practice on Vernier Calipers	• Determine the least count • Place the object in accurate position. • Interpret scale readings • Calculate volume of cylinder and sphere	• Interpret Vernier readings • Compute volume using appropriate formulae • Apply measurement data to calculate physical quantities
2. Practice on Screw Gauge	• Determine the least count and zero error • Place the object in accurate position. • Interpret scale readings • Calculate thickness and cross-sectional area	• Analyze scale readings for zero error • Compute thickness and area from measurements • Apply micrometer data to solve practical problems
3. Verification of Lami's Theorem	• Setup experimental arrangement • Apply appropriate weights • Measure angles between forces • Analyze data to verify theorem	• Interpret directions and angles of forces • Evaluate force relationships • Validate Lami's Theorem using experimental data
4. Simple Pendulum	• Arrange the pendulum properly • Measure the time taken for 20 oscillations • Compute time period and acceleration due to gravity • Plot $L–T^2$ graph	• Measure oscillation intervals accurately • Calculate g using experimental data • Interpret $L–T^2$ graph to confirm relationship
5. Focal Length and Power of Convex Lens	• Place the object and convex lens in proper positions. • Measure image distance • Compute focal length and power	• Determine focal length using both methods • Validate optical formulae using experiment
6. Boyle's Law Verification	• Record atmospheric pressure • Measure air column length and calculate the enclosed pressure • Analyze data for PxL consistency	• Setup quill tube in different positions for multiple readings • Interpret pressure–length data
7. Drawing of Magnetic Lines of force	• Draw meridian and set magnet orientation • Sketch the lines of	• Visualize field pattern accurately • Analyze field symmetry

	magnetic field using compass.	
8. Velocity of Sound – Resonance Method	• Assemble apparatus and adjust reservoir • Identify resonating lengths • Calculate velocity of sound at room temperature and at 0^{o}C.	• Detect resonance points • Compute velocity using resonance data • Extrapolate to standard temperature
9. Refractive Index of a solid using Traveling Microscope	• Determine least count • Measure real and apparent thickness • Calculate refractive index	• Analyze scale readings • Apply refraction formula • Interpret refractive index of a solid.
10. Meter Bridge	• Connect circuit properly • Measure balancing length, radius of given wire • Compute resistance and specific resistance	• Analyze circuit behavior • Calculate unknown resistance • Interpret experimental values for resistivity
11. Projectile motion- study the range of a projectile for different launch angles	• Setup and align launcher • Adjust launch angles • Measure range	• Observe the variations in horizontal range for different angles of projection. • Evaluate trajectory data
12. Generation of Beats using water columns	• Setup beat source using glasses or online tone generator • Generate close frequencies • Detect and analyze beat pattern	• Observe frequency interference • Interpret beat frequency data • Analyze patterns using mobile sensors/ software

REFERENCES

1. NCERT Physics Laboratory Manual for Class XI.

2. NCERT Physics Laboratory Manual for Class XII.

3. Experiments in Physics: A Laboratory Manual by Daryl W. Preston, Joseph W. Kane, Morton M. Sternheim

SCHEME OF VALUATION FOR END PRACTICAL EXAMINATION

Activity	Marks
Aim, Apparatus, Formulae	6
Tabulations and Readings	12
Calculations	4
Precautions, Results	3
Viva-voce	5
Total marks	**30**

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED

FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From Experiment 1 to 4
Unit Test – 2	From Experiment 5 to 8
Unit Test-3	From Experiment 9 to 12

CHEMISTRY LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN110L	CHEMISTRY LAB	3	90	20	30	1.5

Note: For the Physics laboratory, half of the first-year students of each programme will attend, while the remaining half will attend the Chemistry laboratory. Thus, both laboratories will be engaged simultaneously during the 3-hour lab session.

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	COs Mapped
1.	Introduction to Fundamentals of Analytical Chemistry.	03+03	CO1
2.	Chemical Recognition by Sensory Cues.	03+03	CO1
3.	Preparation of Standard Na_2CO_3 Solution.	03+03	CO1
4.	Estimation of HCl Using Standard NaOH Solution.	03+03	CO2
5.	Determination of Alkalinity of Water Sample.	03+03	CO2
	Revision	03+03	
6.	Estimation of Mohr's Salt Using Standard $KMnO_4$ Solution.	03+03	CO3
7.	Determination of Total Hardness of Water Using Standard EDTA Solution.	03+03	CO4
8.	Estimation of Chlorides Present in Water Sample Using Standard $AgNO_3$ Solution.	03+03	CO4
9.	Analyzing pH of Common Compounds Using Visual and Instrumental Methods.	03+03	CO5
	Revision	03+03	
	Demonstration Experiments		
10.	Demonstration of Copper Deposition on an Object by Using Electrolysis Process.	03+03	CO5
11.	Demonstration of Construction and Working of a Galvanic Cell.	03+03	CO5
12.	Open Ended Experiments/Micro Projects – I.	03+03	CO5
13.	Open Ended Experiments/Micro Projects – II.	03+03	CO5
	TOTAL	45+45	

COURSE OBJECTIVES

Upon completion of the course the shall be able	
(i)	To Perform fundamental analytical chemistry techniques, identify chemical substances using sensory cues and accurately prepare standard solutions.
(ii)	To Evaluate and judge the neutralization point in acid base titration.
(iii)	To Evaluate the endpoint of reduction and oxidation reaction.
(iv)	To Judge the stable end point of complex formation, stable precipitation.
(v)	To Determine the pH of compounds, demonstrate copper deposition using electrolysis, and the working of a galvanic cell.

COURSE OUTCOMES

CO1	IN110.1	Perform fundamental analytical chemistry techniques, identify chemical substances using sensory cues and accurately prepare standard solutions.
CO2	IN110.2	Evaluate and judge the neutralization point in acid base titration.
CO3	IN110.3	Evaluate the endpoint of reduction and oxidation reaction.
CO4	IN110.4	Judge the stable end point of complex formation, stable precipitation.
CO5	IN110.5	Determine the pH of compounds, demonstrate copper deposition using electrolysis, demonstrate the working of a galvanic cell.

LEARNING OUTCOMES

1.0 ractice volumetric measurements (using pipettes, measuring jars, volumetric flask, burettes) and gravimetric measurements (using different types of balances), making dilutions, etc.

2.0 Identify the chemical compounds and solutions by senses.

3.0 Practice making standard Na_2CO_3 solutions.

4.0 Conduct titrations adopting standard procedures and using standard NaOH solution for estimation of HCl.

5.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water (one ground water and one surface / tap water) using standard H_2SO_4 solution.

6.0 Conduct titrations adopting standard procedures and using standard $KMnO_4$ solution for estimation of Mohr's Salt.

7.0 Conduct titrations adopting standard procedures to determine the total hardness of given samples of water (one ground water and one surface / tap water) using standard EDTA solution.

8.0 Conduct titrations adopting standard procedures to determine the chlorides present in the given samples of water (one ground water and one surface / tap water) and waste water by using standard $AgNO_3$ solution.

9.0 Conduct the test on given samples of water / solutions (like soft drinks, sewage etc.,) to determine their pH using pH paper, Universal indicator, digital pH meter.

10.0 Demonstrate the electrolysis process of Copper deposited on an object.

11.0 Understand the construction and working principle of a Galvanic cell and identify how chemical energy is converted into electrical energy through redox reactions.

12.0 Collect water sample from nearby water body and test for any two parameters**.[** Parameters – Alkalinity, Hardness, Chloride and pH]

13.0 Collect water sample from nearby sewage/industrial effluent and test for any two parameters. [Parameters – Alkalinity, Hardness, Chloride and pH]

CO – PO/PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2		1			1			
CO2	3	2		1						
CO3	3	2		1						
CO4	3	2		1	1					
CO5	3	2	1	1	1		1			
Average	3	2	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). Assignments, (ii). Tutorials, (iii). Guest Lectures, (iv). Seminars, (v). Quiz Competitions, (vi). Industrial Visit, (vii). Tech Fest, (viii). Mini Projects, (ix). Group Discussions, (x). Virtual Classes and (xi). Library Visits.

COMPETENCIES AND KEY COMPETENCIES TO BE ACHIEVED BY THE STUDENT

Name of the Experiment (No of Periods)	**Competencies**	**Key Competencies**
Introduction to Fundamentals of Analytical Chemistry. (03)	• Develop a foundational understanding of analytical chemistry principles and demonstrate proficiency in basic laboratory techniques, data analysis, and safety protocols.	• Students will master the foundational principles and laboratory techniques of analytical chemistry.
Chemical Recognition by Sensory Cues. (03)	• Develop skills in conducting simple tests and making accurate observations. • Interpret results to draw conclusions about the nature of chemical compounds.	• Develop skills in conducting simple tests and making accurate observations. • Interpret results to draw conclusions about the nature of chemical compounds.
Preparation of Standard Na_2CO_3 Solution. (03)	• Weighing the salt to the accuracy of 0.01mg • Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette.	• Weighing the salt to the accuracy of 0.01 mg. • Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette.
Estimation of HCl Solution Using Standard NaOH Solution. (03)	• Cleaning the glass ware and rinsing with appropriate solutions. • Making standard solutions • Measuring accurately the standard solutions and titrants. • Filling the burette with titrant.	• Making standard solutions. • Measuring accurately the standard solutions and titrants. • Effectively Controlling the flow of the titrant. • Identifying the endpoint.
Determination of Alkalinity of Water Sample (03)		
Estimation of Mohr's Salt Using Standard		

Determination of Total Hardness of Water Using Standard EDTA Estimation of Chlorides Present in Water Sample by Using Standard $AgNO_3$ Solution. (03)	• Fixing the burette to the stand • Effectively Controlling the flow of the titrant. • Identifying the endpoint. • Making accurate observations. • Calculating the results.	• Making accurate observations.
Analyzing pH of Common Compounds Using Visual and Instrumental Methods. (03)	• Know pH range (0 – 14) and classify substances as acidic, neutral and basic. • Accurately measure pH using pH paper and universal indicator. • Note color changes and interpret pH values correctly. • Perform precise pH tests to ensure reliable results. • Record pH data and observations clearly. • Connect pH results to real-world contexts. • Familiarize with instrument. • Choose appropriate 'Mode' / 'Unit'. • Prepare standard solutions / buffers, etc. • Standardize the instrument with appropriate standard solutions. • Make measurements accurately.	• Accurately measure pH using pH paper and universal indicator. • Perform precise pH tests to ensure reliable results. • Prepare standard solutions/buffers, etc. • Standardize the instrument with appropriate standard solutions. • Make measurements accurately.
Estimation of Amount of Copper Deposited on an Object by Using Electrolysis Process. (03)	• Prepare standard solutions. • Selection of electrodes. • Set up and perform an electrolysis experiment accurately and safely. • Analyze experimental data to calculate deposition of	• Set up and perform an electrolysis experiment accurately and safely. • Analyze experimental data to calculate deposition

Determination of Turbidity of Water Sample by Using Nephelometer. (03)	• Familiarize with instrument. • Choose appropriate 'Mode' / 'Unit'. • Prepare standard solutions / buffers, etc. • Standardize the instrument with appropriate standard solutions. • Make measurements	• Prepare standard solutions etc. • Standardize the instrument with appropriate standard solutions. • Make measurements accurately.
Construction and Working of Galvanic Cell. (03)	• Prepare standard solutions. • Selection of electrodes. • Making of salt bridge. • Construct a simple galvanic cell using appropriate electrodes and electrolyte solutions. • Explain the working principle of a galvanic cell, including electron flow, redox reactions, and the function of the salt bridge.	• Construct a simple galvanic cell using appropriate electrodes and electrolyte solutions. • Explain the working principle of a galvanic cell, including electron flow, redox reactions, and the function of the salt bridge.
Preparation of a Polymer (Bakelite). (03)	• Identify and handle the raw materials (phenol and formaldehyde) used in Bakelite preparation safely. • Perform the polymerization reaction under controlled conditions. • Observe and describe the physical changes during polymer formation. • Develop laboratory skills related to synthesis and handling of polymers.	• Perform the polymerization reaction under controlled conditions. • Develop laboratory skills related to synthesis and handling of polymers.

Open Ended Experiments/ Micro Projects – I. (03)	• Identifies a relevant chemical problem or question based on prior knowledge. • Demonstrates proficiency in basic chemistry lab techniques (e.g., titration, preparation). • Prepares solutions accurately (molarity, dilutions, standardizations). • Handles chemicals safely following MSDS guidelines and standard lab practices. • Uses instruments relevant to the experiment (e.g., pH meter, nephelometer and digital balance) correctly. • Calibrates and maintains instruments when needed. • Interprets instrumental output with understanding of underlying chemical principles. • Makes accurate, timely and detailed observations of chemical reactions (e.g., color changes, precipitate formation). • Records quantitative and qualitative data systematically. • Maintains an organized and complete lab notebook. • Works effectively in pairs or groups; shares responsibilities and discusses findings collaboratively. • Presents results through oral discussion, lab reports, or visual presentations using proper chemical terminology.	
Open Ended Experiments/ Micro Projects – II. (03)		• Prepares solutions accurately (molarity, dilutions, standardizations). • Uses instruments relevant to the experiment (e.g., pH meter, nephelometer and digital balance) correctly. • Calibrates and maintains instruments when needed. • Makes accurate, timely and detailed observations of chemical reactions (e.g., color changes, precipitate formation).

REFERENCES

1. VOGEL's Textbook of Quantitative Analysis, Sixth Edition, Pearson Education Limited.
2. VOGEL's Textbook of Qualitative Analysis, Seventh Edition, Pearson Education Limited.
3. Y. Bharathi Kumari & Jyotsna Cherukuri - Laboratory Manual of Engineering Chemistry for Engineering Students of JNT Universities.
4. Instrumental Methods of Chemical Analysis.
5. NCERT Chemistry Laboratory Manual for Class XII.
6. Practical Chemistry by the Royal Society of Chemistry Education.

SCHEME OF VALUATION FOR END PRACTICAL EXAMINATION

Activity	Marks
Aim, Apparatus, Formulae	6
Tabulations and Readings	12
Calculations	4
Precautions, Results	3
Viva-voce	5
Total marks	**30**

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED

FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From Experiment 1 to 4
Unit Test – 2	From Experiment 5 to 8
Unit Test-3	From Experiment 9 to 13

COMPUTER & DIGITAL SKILLS LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Year	FA Marks	SA Marks	Credits
26IN111L	COMPUTER & DIGITAL SKILLS LAB	3	90	40	60	3

TIME SCHEDULE

Chapter No.	Chapter/Unit Title	No of Periods	CO's Mapped
1.	Computer hardware and Software Basics	3	CO1
2.	Windows Operating System	3	CO1
3.	MS Word	18	CO2
4.	MS Excel	21	CO3
5.	MS Power Point	18	CO4
6.	AI ,ML& Quantum computing Tools	27	CO5
Total periods		90	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able

(i) To familiarize with basics of Computer Hardware and Software
(ii) To familiarize operating systems
(iii) To familiarize with Microsoft word
(iv) To familiarize with Microsoft Excel
(v) To familiarize with Microsoft Power point
(vi) To familiarize with AI ,ML, Quantum Computing Tools

COURSE OUTCOMES

CO1	IN111.1	Identify hardware and software components
CO2	IN111.2	Prepare documents with given specifications using word processing software
CO3	IN111.3	Use Spread sheet software to make calculation and to draw

		various graphs/charts.
CO4	IN111.4	Use Power point software to develop effective presentation for a given theme or topic.
CO5	IN111.5	Use basic AI ,ML& Quantum Computing Tools

LEARNING OUTCOMES

I. Computer Hardware and Software Basics

1. a).To get familiarized with Computer system and hardware connections
   b). To start and Shut down Computer correctly
   c). To explore Windows Desktop
2. To check the software details of the omputer
3. To check the hardware present in your computer

II. Windows's operating system

4. To work with Files and Folders
5. To use Windows Accessories: Calculator –Notepad –WordPad–MS Paint

III. MS-WORD

6. To get familiarized with Ribbon layout of MSWord.
7. To perform basic word processing
8. To use basic formatting techniques
9. To insert a table of required number of row sand 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. MS-EXCEL

13. To get familiarized with MS-EXCEL ribbon 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 Data Formatting
17. To create Excel Functions, use auto fill feature
18. To enter a Formula for automatic calculations
19. To sort and filter data in sheet.
20. To present data using Excel Graphs and Charts.
21. To format a Work sheet in Excel for printing using Page layout
22. To develop lab report formats of respective discipline.

V. Practice with MS-POWERPOINT

23. To get familiarized with Ribbon layout features of Power Point.
24. To create a simple Power Point Presentation
25. To set up a Master Slide in Power Point
26. To insert Text and Objects
27. To insert Flow Charts
28. To insert Tables
29. To insert Charts/Graphs
30. To insert video and audio
31. To animate text, objects and slides.
32. To Review Presentations

VI. AI,ML & Quantum Computing Tools

33. To get familiarized with AI Tools
34. To get familiarized with working of Chat GPT
35. Identify Objects using AI Tools based on CNN, YOLO, SSD,R-CNN

36. To paraphrase text using AI Tools (PEGASUS,GPT, T5)
37. To use text-to-Image Generation AI Tools (DALL-E,MID JOURNEY)
38. To use voice command simulation AI Tools (SPEECH-TO-TEXT)
39. To get familiarized with ML Tools
40. To get familiarized with Quantum Computing Tools
41. To familiarize with quantum bits (qubits) using Dirac notation
42. To familiarize the behavior of single and multiple qubit gates.
43. To familiarize with Qubit as a Coin / Spin Analogy

KEY COMPETENCIES

Exp / Task / Ex No	Name of Experiment /Task /Exercise	Objectives	Key competencies
1 (a).	To get familiarized with Computer system and hardware connections	a. Connect cables to external hardware and operate the computer	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 viii)RAM ix)SSD /HDD b. Identify and connect various peripherals c. Identify and connect the cables used with computer system d. Identify various ports on CPU cabinet and connect Keyboard, Mouse and peripherals
1(b).	Start and Shut down Computer correctly	a. Login and logout as per the standard procedure b. Operate mouse & Key Board	a. Login using the password b. Start and shut down the computer c. Use Mouse and Key Board
1 (c).	Explore Windows Desktop	a. Access application programs using Start menu b. Use taskbar and Task manager	a. Familiarity with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support
2.	Check the software details of the computer System	a. Access the properties of computer and to find the details	a. Finding the details of operating system being used b. Finding the details of edition/version Service Pack installed

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

7.	Perform basic Word Processing	a. Use key board and mouse to enter/edit text in the document. b. Use short cuts b. use Spell /Grammar Check features for auto corrections	a. Typing text b. Keyboard usage c. Mouse Usage (Left click/Right click/Scroll) d. Using Keyboard shortcuts e. Using Find and Replace features in MS-word f. Use Undo and Redo Features d. Use spell check to correct Spellings and Grammar
8.	Use basic formatting techniques	a. Format Text and paragraphs and using various text styles. b. Use bullets and numbers to create lists. c. Use Templates/Themes c. Insert page numbers, date, headers and footers	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. Use various Font Styles f. Insert bullets and numbers g. Using Themes and Templates g. Insert page numbers, header and footer
9.	Insert a table of required number of rows and columns	a. Insert table in the word document and edit d. Use sort option for arranging data.	a. Editing 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 back ground color of the table c. Using table design tools d. Using auto fit – fixed row/column height/length – Even distribution of rows /columns feature e. Converting Text to table and Table to Text h. Use Sort feature of the Table to arrange data in ascending/descending order
10.	Insert objects, clipart and Hyperlinks	a. Insert hyperlinks & Bookmarks b. Create organization charts/flow charts	a. Creating a 2-page document and Insert hyperlinks and Bookmarks. b. Creating an organization chart f. Preparing an Examination schedule

			notice with a hyper link to Exam schedule table.
11.	Use Mail merge feature of MSWord	b. Using Mail merge feature	a. Using mail merge to prepare individually addressed letters c. Using mail merge to print envelopes.
12.	Use Equations and symbols features.	c. Enter Mathematical symbols and Equations in the word document	a. Exploring various symbols available b. Inserting a symbol in the text d. Inserting mathematical equations in the document
13.	Get familiarized with MS Excel Ribbon layout	a. Get familiarized with excel layout d. Use various features available in toolbar	a. Open /create an MS Excel spread sheet and familiarity with MS Excel layout e. Use Quick Access Tool bar, Title Bar, Worksheets, Formula Bar, Status Bar
14.	Access and Enter data in the cells	a. Access and select the required cells by various addressing methods e. Enter and edit data	a. Moving around a Work sheets using Quick access toolbar f. Selecting Cells, Entering Data-Editing a Cell, Wrapping of Text-Deleting a Cell Entry, Saving a File, Closing Excel
15.	Edit spread sheet select, Copy, Cut, Paste	Format the excel f. sheet	a. Inserting and Deleting Columns and Rows b. Creating Borders c. Merging and aligning center d. Adding back ground Color Changing the Font, Font Size, and Font Color e. Formatting text with Bold, Italicize, and Underline g. Working with Long Text, Change a Column's Width

16.	Use built in functions and Format Data	Use built in functions in Excel	a. Performing Mathematical Calculations b. Verification AutoSum c. Perform Automatic Calculations f. Aligning CellEntries
17.	Enter a Formula for automatic calculations	Enter formula for automatic calculations	a. Entering formulae b. Using Cell References in Formulae c. Using Automatic updating function of Excel Formulae d. Using Mathematical Operators in Formulae g. Using Excel Error Message and Help
18.	Create Excel Functions, Fill Cells	a. To Create Excel sheets involving cross references and equations Using the advanced functions for conditional calculations	a. Using Reference Operators b. Working with sum, Sum if ,Count and Count If Functions h. c. Filling Cells Automatically
19.	Sort and filter data in sheet.	a. Refine the data in a worksheet and keep it organized Narrow a worksheet by selecting specific choice	a. Sorting data in multiple columns b. Sorting data in a row c. Sorting data using Custom order i. Filter data in work sheet
20.	Practice Excel Graphs And Charts	a. Use data in Excel sheet to Create technical charts and graphs Prepare various graphs from data.	a. Using data in sheets for getting charts. j. Producing various charts.
21.	Format a and print features Work sheet in Excel, use page setup	Format Excel sheet Insert headers &footers and print	a. Shading alternate rows of data b. Adding currency and percentage symbols c. Changing height of a row and width of a column d. Changing data alignment e. Inserting Headers and Footers k. Set Print Options and Printing.

22.	Develop lab report formats of respective discipline	Use Headers/Footers/Page Numbers for preparing reports	l. Creating Lab reports using MS Excel
23.	Get familiarized with Ribbon layout &features Of PowerPoint.	Access required options in the toolbar	Explore and use various options in PowerPoint a. Home b. Insert c. Design d. Animation e. Slideshow f. View m. Review
24.	Create a simple Power Point Presentation	a. Create simple Power Point presentation with photographs /Clip Art and text boxes Use bullets option	a. Inserting a New Slide into Power Point b. Changing the Title of a Power Point Slide c. Using Bullets in PowerPoint d. Adding an Image to a Power Point Slide e. Adding a Text box to a Power Point slide n.
25.	Set up a Master Slide in PowerPoint and add notes	a. Setup Master slide and format b. Add notes to master slide.	a. Creating a PowerPoint Design Template b. Modifying themes c. Switching between Slide master view and Normal view d. Formatting a Design Template for Master Slide e. Adding a Title Slide to a Design Template f. Using the Slide Show f. Adding Notes to a Power Point Presentation slide
26.	Insert Text and Objects	a. Insert Text and Objects b. Use3dfeatures	a. Inserting Text and objects b. Setting Indents and line spacing c. Inserting pictures/clipart d. Formatting pictures e. Inserting shapes and word art f. Using 3d features to g. Arrange objects

27.	Create Flow Charts /Organizational Charts	b. Create organizational charts and flow charts using smart art	a. Creating a Flow Chart in PowerPoint b. Grouping and Ungrouping Shapes g. Use smart art
28.	Insert Tables	c. Insert tables and format	a. Using Tables in PowerPoint b. Formatting the Table Data h. Changing Table Background
29.	Insert Charts/Graphs	d. Create charts and Bar graphs, Pie Charts and format.	a. Creating 3D Bar Graphs in PowerPoint b. Working with the Power Point Datasheet c. Formatting a PowerPoint Chart Axis d. Formatting the Bars of a Chart e. Creating Power Point Pie Charts f. Using Pie Chart Segments g. Creating 2D Bar Charts in Power Point h. Formattingthe2DChart i. Formatting a Chart Back ground
30.	Insert audio & video, Hyperlinks in a slide and Add narration to the slide	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide e. Use hyperlinks to switch to different slides and files	a. Inserting sounds in the slide and hide the audio symbol b. Adjusting the volume in the settings c. Inserting video file in the format supported by PowerPoint in a slide d. Using automatic and on click options e. Adding narration to the slide j. Insert Hyperlinks

31.	Create Animation effects	a. Add animation effects	a. Applying transitions to slides b. Using special animation effects like Entrance, Emphasis, Motion Paths &Exit as per requirement.

32.	Reviewing presentation	a. Use Spell and Grammar check feature b. Setup slideshow c. Add timing to the slides d. Setup automatic slide show	a. Checking spelling and grammar b. Previewing presentation c. Setting up slideshow d. Setting up resolution e. Using Rehearse Timing feature in PowerPoint f. Using PowerPoint Pen Tool During slideshow g. Saving h. Printing presentation Slides as Hand-out
33	Familiarizing with AI Tools	Introductions of AI tools and their applications. Understand the basic use cases and functionality of AI tools (like Chat GPT, Google Gemini, Teachable Machine, etc.).	a) Grasping the concept of Artificial Intelligence and how tools mimic human thinking or behavior. b) Identifying and interacting with AI tools such as: Chat GPT (natural language processing), Google Teachable Machine (image/audio classification), DALL·E / Bing Image Creator (AI art), Grammarly / Quillbot (AI-based writing assistants).
34	Usage of ChatGPT	a) Introduction to ChatGPT, an AI-powered conversational assistant. b) To explore ChatGPT's capabilities in answering questions, generating content, and solving problems.	a) Operating the ChatGPT interface (web or app), input prompts, and interpret outputs. b) Using ChatGPT to generate summaries, ideas, code snippets, explanations, emails, etc. c) Evaluating the relevance and accuracy of ChatGPT's responses.

35	Object identification using AI Tools based on CNN,YOLO,SSD,R-CNN	a. Get awareness about object detection techniques using AI. b. To explore how AI tools based onCNN, YOLO, SSD, and R-CNN detect and classify objects in images/videos.	a) Differentiating object detection from image classification. b) Using web-based AI tools or platforms that demonstrate object detection (e.g., Teachable Machine, Roboflow, Edge Impulse, Hugging Face Demos). c) Observing and comparing the speed, accuracy, and bounding box behavior of different models.
36	Paraphrase text using AI Tools(PEGASUS,GPT,T5)	a. Get awareness about AI-powered text paraphrasing techniques. b. To explore the usage and functioning of transformer-based models like PEGASUS, GPT, and T5	a) Recognizing of Natural Language Processing (NLP) tasks and how transformer models like PEGASUS, GPT, and T5 can be used. b) Using AI tools to generate reworded versions of sentences or paragraphs while retaining the original meaning. c) Interacting with user-friendly interfaces like: • Hugging Face demos • ChatGPT • Quillbot • Parrot.ai
37	Text-to-Image Generation using AI Tools (DALL-E,MIDJOURNEY)	a) Get awareness abouttext-to-image generation using advanced AI models. b) To explore the usage of tools like DALL·E and Mid journey convert text prompts into realistic or artistic images.	a. Learning usage of how AI models generate visual content from natural language prompts. b. Formulating effective, clear, and creative text prompts to generate meaningful images. c. Enhancing creative thinking by translating ideas into visual representations using AI. d. Analyzing and comparing output quality, style, and relevance between DALL·E and Mid journey.

38	Voice Command Simulation using AI Tools (SPEECH-TO-TEXT)	a) Get aware ness about Speech -to- Text (STT) techno logy and its role in AI- powere d voice recogni tion system s.	a. Using AI tools to generate text from speech. b. Reading prompts and commands to analyze how accurately the tool transcribes voice. c. Using voice to simulate commands such as opening files, dictating emails, or interacting with virtual assistants.
39	Usage of ML Tools	a) To use ML tools for suitable real-world applications b) To use popular ML tools and platforms through simple, hands-on demonstrations.	a. Understanding key ML terms like dataset, training, testing, classification, prediction, and accuracy. b. Learning to use beginner-friendly ML tools such as: • Teachable Machine by Google (image/audio recognition) • Microsoft Lobe (no-code image classification) • Weka (GUI-based ML toolkit) • IBM Watson Studio (visual data workflows)
40	Usage of Quantum Computing Tools	a. To explore and interact with quantum computing simulation tools and platforms.	a. Understanding key terms: Qubit, Superposition, Entanglement, Quantum Gate, Quantum Circuit. b. Navigate and use beginner-friendly quantum computing tools: • IBM Quantum Experience (IBM Q / Qiskit) • Microsoft Quantum Development Kit • Quirk (online quantum circuit simulator) • Quantum Playground by Google

41	To familiarize with quantum bits (qubits) using Dirac notation	a) To introduce the concept of a qubit as the fundamental unit of quantum information. b) To understand the representation of qubits using Dirac (bra-ket) notation.	• Identify and interpret the basic qubit states: • $\|0\rangle = \begin{bmatrix}1\\0\end{bmatrix}$ • $\|1\rangle = \begin{bmatrix}0\\1\end{bmatrix}$ • Understand that a qubit can exist in a **superposition**: • $\|\psi\rangle = \alpha\|0\rangle + \beta\|1\rangle$, where α and β are complex numbers and $\|\alpha\|^2 + \|\beta\|^2 =$ a) Learn how to write and read quantum states using the ket ($\|\rangle$) and bra ($\langle\|$) notations. b) Understand the purpose of $\langle\psi\|$ and how it represents a dual vector in quantum mechanics.
42	To familiarize the behavior of single and multiple qubit gates.	a) To understand the concept of quantum gates and their role in quantum circuits.	a) Recognize the function and matrix representation of: • Single-qubit gates: ○ Pauli-X (NOT): flips $\|0\rangle \leftrightarrow \|1\rangle$ ○ Hadamard (H): creates superposition ○ Pauli-Z: applies a phase flip • Multi-qubit gates: ○ CNOT: flips target qubit based on control ○ Toffoli (CCNOT): controlled-controlled NOT ○ SWAP: exchanges the states of two qubits
43	To familiarize with Qubit as a Coin / Spin Analogy	a) To introduce the concept of a qubit using intuitive physical analogies. b) To help students understand quantum superposition through the coin toss or spIN½ particle analogy.	a. Relate a qubit in superposition to a coin spinning in the air: • Classical coin: heads (0) or tails (1) • Spinning coin: both until observed ($\|0\rangle$ and $\|1\rangle$ at once) b.Use spin analogy: a particle with spin "up" ($\|0\rangle$) or "down" ($\|1\rangle$), or in between (superposition)

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1.Fundamentals of computers --V. Rajaraman, Niharika Adabala, 7th Edition, PHI Publication.

2. Introduction to computers -- Peter Norton, 7th Edition, McGrawHill.

3. Microsoft Office (Office 2021 & Microsoft 365) – Joan Lambert, Curis Frye by Pearson Publication.

4. Introduction to MS office by Indira Gandhi National University.

5. Emerging technologies for engineers .Reema Thareja, Wiley Emerging Technology series.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning outcome to be covered
Unit test-1	From 1 to 12
Unit test-2	From 13 to 32
Unit test-3	From 33 to 43

THIRD SEMESTER

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III SEMESTER

Course Code	Course Title	No. of Periods / Week		Practicum (Y/N)	Total No. of Periods /Semester	Credits	Scheme of Examination			
		Theory	Practical/ Tutorial				Duration (hours)	FA Marks	SA Marks	Total Marks
THEORY COURSES										
26IN301T	Basic Electrical Engineering & Electronic Measuring Instruments	6	-	N	90	4	3	30	70	100
26IN302T	Digital Electronics	6	-	N	90	4	3	30	70	100
26IN303T	Process Instrumentation	6	-	N	90	4	3	30	70	100
ELECTIVE COURSES										
26IN304E	Engineering Mathematics-II	3	-	N	45	2	3	30	70	100
26IN305E	Python Programming			Y						
AUDIT COURSE										
26IN306A	Solar Energy Systems	2	-	N	30	-	-	-	-	-
PRACTICAL COURSES										
26IN307L	Electronic Measuring Instruments Lab	-	6	N	90	2	3	40	60	100
26IN308L	Digital Electronics Lab	-	4	N	60	1.5	3	40	60	100
26IN309L	Process Instrumentation Lab	-	6	N	90	2	3	40	60	100
26IN310C	Student Centric Activities	-	3	N	45	0.5	-	-	-	-
	TOTAL	**23**	**19**	**-**	**630**	**20**	**-**	**240**	**460**	**700**
Note: 0.5 Credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NSS Clean and Green or Sports / Games.										

Note 2: 26IN304E is common elective to all programmes.

BASIC ELECTRICAL ENGINEERING & ELECTRONIC MEASURING INSTRUMENTS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN301T	BASIC ELECTRICAL ENGINEERING & ELECTRONIC MEASURING INSTRUMENTS	6	90	30	70	4

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	DC Circuits and Network Theorems	12	14	2	1	CO1
2	A.C. circuits	14	14	2	1	CO2
3	Electrical Machines	12	11	1	1	CO3
4	Analog Instruments	15	14	2	1	CO4
5	Digital Instruments	11	11	1	1	CO5
6	Cathode Ray Oscilloscope	13	14	2	1	CO6
7	Signal generators	06	11	1	1	CO7
8	Test Instruments	07	11	1	1	CO8
TOTAL		90	100	12	08	

COURSE OBJECTIVES

(i)	Familiarise with basics of electrical circuits like D.C Circuits, Network Theorems, Single phase A.C. circuits, and principles & their working of Electrical Machines.
(ii)	Familiarize with Analog and digital instruments.
(iii)	Explain the working of cathode ray oscilloscope.
(iv)	Explain the working of signal generators.
(v)	Explain the working of test instruments.

COURSE OUTCOMES

CO1	IN301.1	Understand the basics of D.C circuits and network theorems, analyze single-phase A.C circuits and principles of electrical machines.
CO2	IN301.2	Explain the working of Analog and Digital instruments
CO3	IN301.3	Explain the working of cathode ray oscilloscope.
CO4	IN301.4	Explain the working of AF and RF signal generators.
CO5	IN301.5	Explain the working principles of test instruments.

LEARNING OUTCOMES

1.0 DC Circuits and Network Theorems

1.1 Define the terms junction, branch, loop, node and mesh of a network.

1.2 Define Active element, Passive element, Active circuit and Passive circuit.

1.3 State and Explain Kirchhoff's laws.

1.4 Solve simple problems (2 mesh circuits only) using Kirchhoff's laws.

1.5 State star and delta networks.

1.6 Explain star to delta & delta to star transformation.

1.7 Solve simple problems on star to delta and delta to star transformations.

1.8 Define ideal and practical Voltage & Current Sources.

1.9 Convert voltage source to current source and vice versa.

1.10 Solve simple problems on source conversion.

1.11 State and explain super position theorem.

1.12 Solve simple problems (2 mesh circuits only) using superposition theorem.

1.13 State Thevenin's, Norton's and Maximum power transfer theorems.

2.0 A.C. circuits

2.1 Define A.C. fundamentals like Alternating quantity, Time period, Frequency, Instantaneous value, Maximum value.

2.2 Define the term Phase and Phase difference.

2.3 Derive the relationship between Voltage and Current in pure Resistive, Inductive and Capacitive circuits.

2.4 Draw the Phasor diagrams and wave forms of pure Resistive, Inductive and Capacitive circuits.

2.5 Write the equation for Impedance, Current, and Phase angle in R-L, R-C, &

R- L-C Series circuits.

2.6 Define Power & Power Factor in A.C. circuits

2.7 Solve simple Problems to calculate Impedance & Current in A.C. Series Circuits.

2.8 Define Resonance in A.C. series circuits.

2.9 Derive the equation for resonant frequency in series R-L-C circuit.

2.10 Explain the method of solving parallel circuits by Vector method.

2.11 Define resonance in parallel electric circuits.

2.12 State the expression for resonant frequency in parallel R-L-C circuit.

2.13 Differentiate between series resonant circuit and parallel resonant circuit.

2.14 Define Q-factor of a coil. State its importance.

3.0 Electrical Machines

3.1 Explain the working principle of a Transformer

3.2 Explain the construction of transformers (core type, shell type).

3.3 Differentiate between core type and shell type transformers.

3.4 State the EMF equation of transformer.

3.5 Solve simple problems on EMF equation of transformer.

3.6 Define efficiency of a Transformer

3.7 State the use of Auto transformer and list their advantages.

3.8 Explain the working of Current transformer and Potential transformer with diagrams.

3.9 State the function of a) Impedance matching Transformer b) Isolation Transformer.

3.10 State the need for cooling in transformers.

3.11 Explain the working principle of Alternator.

3.12 Explain the constructional features of alternator. i) Salient pole type ii) Smooth cylindrical type.

4.0 Analog instruments

4.1 Classify the analog measuring instruments.

4.2 List the different torques needed for driving analog instruments.

4.3 Explain the construction and principle of operation of PMMC instrument.

4.4 Explain the principle of operation of extending the range of DC ammeter.

4.5 Explain the principle of operation of extending the range of DC voltmeter.

4.6 Explain the construction and principle of operation of Moving Iron instrument.

4.7 Explain the principle and working of rectifier type voltmeters.

4.8 Explain the construction and principle of operation of series and shunt-type ohmmeters.

4.9 State the need for high input impedance for a voltmeter.

4.10 Explain the working of FET input voltmeter with necessary circuit (DC/AC).

4.11 State the use of differential voltmeters.

4.12 Define sensitivity of voltmeter and loading effect.

4.13 Solve problems on sensitivity of voltmeter.

4.14 State the use of Megger for insulation measurement.

4.15 Give the classification of bridge circuits.

4.16 Mention the balancing conditions of bridges (AC and DC).

4.17 Explain the resistance measurement using Wheatstone bridge.

4.18 Explain the inductance measurement using Maxwell's bridge.

4.19 Explain the capacitance measurement using Schering bridge.

5.0 Digital instruments

5.1 List the advantages of digital instruments over analog instruments.

5.2 Explain the working of digital voltmeters (RAMP type, successive approximation type) with block diagrams.

5.3 List the specifications of digital voltmeters.

5.4 Explain the working of Digital Multimeter with block diagram.

5.5 List the specifications of Digital Multimeter.

5.6 Explain the working of Digital frequency meter with block diagram.

5.7 List the specifications of Digital frequency meter.

5.8 Explain the working of Digital LCR meter with block diagram.

5.9 List the specifications of Digital LCR meter.

6.0 Cathode Ray Oscilloscope

6.1 Draw the block diagram of general purpose CRO and describe the function of each block.

6.2 Sketch CRT and describe the function of each block.

6.3 State the necessity of time base generator.

6.4 Write the expression for deflection sensitivity.

6.5 List the conditions for stationary and flicker free waveforms.

6.6 Explain triggered sweep with necessary circuit, and mention its advantages.

6.7 List the front panel controls of CRO and state their function.

6.8 List its specifications of CRO.

6.9 List the applications of CRO.

6.10 Explain the procedure for measurement of voltage (DC and AC), frequency and phase using CRO.

6.11 Explain the Dual Trace Oscilloscope with block diagram.

6.12 Explain the principle of operation of Digital storage oscilloscope with block diagram.

7.0 Signal generators

7.1 Explain the working of AF Oscillator (sine and square) with block diagram.

7.2 List the front panel controls of AF Oscillator and state their function.

7.3 List specifications of AF Oscillator.

7.4 Explain the working of Function generator with block diagram.

7.5 List the applications of AF oscillators and function generators.

7.6 Explain the working of RF signal generator.

7.7 List specifications and applications of RF signal generator.

7.8 State the importance of shielding in RF generators.

8.0 Test Instruments

8.1 Define Q-Meter.

8.2 Explain the working of Q-meter with diagram.

8.3 Explain the working of Digital IC tester with block diagram.

8.4 Explain the working of Logic analyzer with block diagram.

8.5 State the necessity of Plotter and Recorders.

8.6 List the different Recorders.

8.7 Explain the working of XY recorders.

8.8 Explain the working of Plotter.

CO-PO/PSO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	3	3	3	3	3
CO2	3	3	3	-	3	3	3	3	3	3
CO3	2	2	2	-	2	2	2	3	3	3
CO4	3	3	3	1	3	2	3	3	3	3
CO5	3	3	3	-	3	2	3	3	3	3
Average	2.8	2.8	2.8	1	2.8	2.4	2.8	3	3	3

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

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 DC Circuits and Network Theorems:

Network terminology - Kirchhoff's laws - Star - Delta configurations, Concept of transformation - Ideal Voltage, Ideal current source-Source conversion - Super position theorem, Thevenin's Theorem -Norton's Theorem, Maximum power transfer theorem with reference to D.C.

2.0 A.C. Circuits:

Voltage and current relations in pure resistive, Inductive and capacitive circuits including wave forms and phasor diagrams - equation for Impedance, Current, Phase angle in R-L, R-C, R-L-C series circuits -Problems on series circuits – Problems on Parallel circuits by vector method– Series and parallel resonance - Resonant frequency - comparison between series & parallel resonance - `Q' factor of coil.

3.0 Electrical Machines:

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- Transformer cooling- Principle and construction of alternator.

4.0 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.

5.0 Digital Instruments:

Digital voltmeter (Ramp Type, Successive Approximation Type) Digital Multimeter. Digital frequency meter, Digital LCR Meter.

6.0 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 and Digital Storage CRO.

7.0 Signal generators:

AF oscillator-specifications, function generator, RF signal generator-specifications.

8.0 Test instruments:

Q meter, Plotter and Recorders. Digital IC tester, Logic analyser.

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4. Electronic Instrumentation by H S Khalsi,TMH
5. Electronic measurements by A K Shaurky
6. Electronic Measurements & Instruments by Cooper PHI
7. Modern Electronic Equipment by Khandpur .
8. Electronic Measurements and Instruments by Sawhney.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be covered
Unit Test-I	1.1 TO 4.8
Unit Test-II	4.9 TO 8.8

DIGITAL ELECTRONICS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN302T	DIGITAL ELECTRONICS	06	90	30	70	4

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Questions	No. of Essay Questions	COs Mapped
1	Basics of Digital Electronics & Logic Families	20	25	3	2	CO1
2	Combinational Logic circuits	20	22	2	2	CO2
3	Sequential Logic Circuits	30	25	3	2	CO3
4	Semiconductor memories	10	14	2	1	CO4
5	A/D & D/A Converters	10	14	2	1	CO5
TOTAL		90	100	12	08	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able

(i)	To familiarize with various number systems, postulates of Boolean algebra, logic gates, logic circuits and Logic families
(ii)	To analyse the working of logic gates, combinational and sequential circuits and memories
(iii)	To learn the practical importance and applications of digital electronic circuits, A/D and D/A converters

COURSE OUTCOMES

CO1	IN302.1	Convert a number from one system to another system, implement logic circuits, analyse logic expressions and logic families.
CO2	IN302.2	Design combinational logic circuits

CO3	IN302.3	Construct different sequential logic circuits
CO4	IN302.4	Describe different semiconductor memories
CO5	IN302.5	Describe Analog to Digital and Digital to Analog converters.

LEARNING OUTCOMES

1.0 Basics of Digital Electronics and Logic families

1.1 i) Explain Binary, Octal, Hexadecimal number systems.
ii) Convert a given decimal number into Binary, Octal, and Hexadecimal number and vice versa.
iii) Convert a given binary number into octal and hexadecimal number and vice versa.
1.2 Perform binary addition, subtraction, multiplication and division.
1.3 i) Write 1's complement and 2's complement numbers for a given binary number.
ii) Perform subtraction of binary numbers in 2's complement method.
1.4 Compare weighted and Un-weighted codes.
1.5 Write Binary equivalent number for a number in Excess-3 and Gray Code and vice-versa.
1.6 State different postulates in Boolean algebra.
1.7 Explain the basic logic gates AND, OR, NOT gates with their truth tables.
1.8 Explain the working of universal logic gates (NAND, NOR gates) with truth tables.
1.9 Explain the working of an Exclusive–OR gate with truth table.
1.10 State and explain the De-Morgan's theorems.
1.11 Realize AND, OR, NOT operations using NAND, NOR gates.
1.12 Explain standard representations for logical functions (SOP and POS form).
1.13 Write Boolean expressions from the given truth table.
1.14 Simplify Boolean Expression using Karnaugh map (up to 4 variables)
1.15 Classify logic families.
1.16 List the important characteristics of Digital ICs of different logic families.
1.17 Define the terms: propagation delay, Noise margin, Fan-in, Fan-out and Power dissipation of digital ICs.
1.18 Explain the working principle of CMOS Technology with diagram
1.19 Explain the working of CMOS NAND and CMOS NOR Gates with circuit diagram.

2.0 Combinational logic circuits

2.1 State the concept of combinational logic circuit.
2.2 i) Explain Half adder circuit using Ex-OR and AND gates.
ii) Realize Half-adder using only NAND gates.
iii) Realize Half-adder using only NOR gates.
2.3 i) Explain the operation of Full adder circuit with truth table using Ex-OR gate and basic gates.
ii)Realize full-adder using two Half-adders and an OR gate
2.4 Explain the working of 4- Bit parallel adder using full adders.

2.5 Explain the logic circuit of 4-bit 2's compliment adder/subtractor.
2.6 Explain 4x1 Multiplexer with logic circuit and its applications.
2.7 Explain 1x4 De-multiplexer with logic circuit and its applications.
2.8 Explain the working of 8x3 encoder.
2.9 Explain the working of 3x8 decoder.
2.10 Explain the working of BCD to decimal decoder.
2.11 State the need for a tri-state buffer.
2.12 Draw the logic symbols of unidirectional/ bi-directional tri-state buffers.
2.13 Realize one-bit magnitude comparator.

3.0 Sequential logic circuits

3.1 State the concept of Sequential logic circuits.
3.2 Distinguish between combinational and sequential logic circuits.
3.3 Explain NAND and NOR latches with truth tables.
3.4 i) State the necessity of clock in digital circuits
ii) Differentiate between level triggering and edge triggering
3.5 Explain clocked SR flip flop using NAND gates.
3.6 State the need for preset and clear inputs.
3.7 i) Explain level clocked JK flip flop (using S-R flip-flops) with truth table.
ii) State race around condition in JK flipflops.
3.8 Explain the logic circuits of D-Flipflop and T-Flipflops with truth tables.
3.9 Explain the master slave JK flip flop with necessary diagrams.
3.10 i) Give the concept of edge triggering.
ii) Draw the symbols of edge triggered D and T flip flops.
3.11 List the applications of flip flops.
3.12 Define the term modulus of a counter.
3.13 i) Explain the working of 4-bit asynchronous counter with circuit diagram and timing diagram.
ii) Explain the working of asynchronous decade counter with circuit diagram and Timing diagram.
iii) Explain the working of asynchronous 3 bit up-down counter with circuit diagram.
3.14 Explain the working of 4-bit synchronous counter with circuit diagram.
3.15 Distinguish between synchronous and asynchronous counters.
3.16 i) State the necessity of Registers and classify registers based on data i/o operations.
ii) Explain the working of 4-bit shift left register with Circuit diagram.
iii) Explain the working of 4-bit shift right register with Circuit diagram.
iv) List any four common applications of shift registers.

4.0 Semiconductor memories

4.1 Classify different types of semiconductor memories.
4.2 Define the terms: i) memory read operation; ii) memory write operation; iii) access time; iv) memory capacity; v) address lines; vi) word length related to memories
4.3 Differentiate:
i) Read Only Memory & Read write memory.
ii) Sequential access memory & Random Access Memory.
4.4 Explain working of diode ROM with suitable circuit diagram.

4.5 Distinguish between EEPROM and UVEPROM.
4.6 Explain the working of basic dynamic MOS RAM cell with suitable circuit diagram
4.7 Compare static RAM and dynamic RAM.
4.8 State the difference between Flash ROM and NV RAM.
4.9 State the use of pen drive, SD Card and solid state hard disk.

5.0 A/D & D/A Converters.

5.1 State the need for A/D and D/A conversion.
5.2 Define the terms Resolution, Accuracy, Monotonicity and Settling time of D/A converter.
5.3 Explain D/A conversion using R-2R ladder network.
5.4 Explain A/D conversion using counter method.
5.5 Explain A/D conversion using successive approximation method.
5.6 List IC numbers of ADCs.
5.7 List IC numbers of DACs.

CO-PO/PSO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1	1	1		1	3	1	
CO2	3	3	3	1	1			3	1	1
CO3	3	3	3	1	1			3	1	1
CO4	3	3			1		1	3	1	1
CO5	3	3	3	3	3		1	3	3	3
Average	3	3	2.5	1.5	1.4		1	3	1.4	1.5

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

The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 Basics of Digital Electronics and Logic families

Number systems- Conversion from one number system to another number system-Binary Arithmetic-Weighted and un-weighted codes - parity Bit-Boolean algebra – Basic gates- Universal gates - De-Morgan's theorems-Realize AND, OR, NOT operations using NAND, NOR gates-SOP and POS forms-Write Boolean expressions from the given truth table-Karnaugh map (up to 4

variables)-Logic family-Classification logic families- characteristics of logic families- CMOS working Principle- NAND/NOR Logic gates using CMOS Technology

2.0 Combinational logic circuits

Concept of combinational logic circuits- Half adder circuit - Full adder circuit - a 4 Bit parallel adder using full adders- 2's compliment parallel adder/ Subtractor circuit- Serial adder -Performance of serial and parallel adder- Operation of 4x1 Multiplexers- Operation of 1 to 4 de-multiplexer- applications- 8x3 Encoder - 3x8 decoder- Applications - Tri-state buffer- working of simple tri state buffer -Types of tri-state buffers- 1bit magnitude comparator.

3.0 Sequential logic circuits

Concept of Sequential logic circuits- NAND and NOR latches - Necessity of clock - Concept of level and edge triggering - Clocked SR flip flop circuit using NAND gates- Need for preset and clear inputs - Circuit of level Clocked JK flip flop (using S-R flip-flops) -Race around condition- Master slave JK flip flop circuit - edge triggered clocked D and T flip flops - Truth table, Circuit diagram - Symbols of above Flip Flops- Applications of flip flops-Modulus of a counter- 4-bit asynchronous counter - Asynchronous decade counter with a circuit - 4-bit synchronous counter –differences between synchronous and asynchronous counters- asynchronous 3 bit up-down counter – Need for a Register - Types of registers- 4 bit shift left and shift right registers - Applications of shift registers.

4.0 Semiconductor memories

Types of memories -Memory read operation, write operation, access time, memory capacity, address lines and word length- ROM and RAM- Diode ROM- EEPROM and UVEPROM- Dynamic MOS RAM cell- static RAM and dynamic RAM- Differences between Flash ROM and NV RAM – use of pen drive, SD card, solid state disk

5.0 A/D & D/A Converters.

Need for A/D and D/A conversion -Resolution, Accuracy, Monotonicity and settling time of D/A converter - D/A conversion using R-2R ladder network - A/D conversion using counter method and successive approximation method - IC numbers of any three ADCs, DACs

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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 3.4
Unit Test-II	From 3.5 to 5.7

PROCESS INSTRUMENTATION

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN303T	PROCESS INSTRUMENTATION	06	90	30	70	4

TIME SCHEDULE

S.No.	Chapter/Unit Title	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Fundamentals of Instrumentation	12	17	3	1	CO1
o	Displacement and position Measurement	13	11	1	1	CO2
3	Temperature measurement	13	14	2	1	CO3
4	Pressure Measurement	12	11	1	1	CO3
5	Flow measurement	16	14	2	1	CO3
6	Level measurement	08	11	1	1	CO4
7	Miscellaneous measurements	16	22	2	2	CO5
	TOTAL	90	100	12	8	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able

(i)	Understand the importance of instrumentation fundamentals.
(ii)	Understand the various measurement techniques used for the measurement of displacement, position, temperature, pressure, flow, level, density, viscosity, weight and humidity.

COURSE OUTCOMES

CO1	IN303.1	Understand the terminology related to Instrumentation.
CO2	IN303.2	Explain the principles of displacement and position measurement using different transducers.

CO3	IN303.3	Explain the principles of temperature, pressure and flow measurement using different transducers.
CO4	IN303.4	Explain the principles of level measurement.
CO5	IN303.5	Explain principles of miscellaneous measurements.

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 a 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 potentiometer.
- 2.1.2 Linear variable differential transformer (LVDT).
- 2.1.3 Linear variable Reluctance transducer (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 Explain the principle of operation of Rotary variable differential transformer (RVDT).
2.5 State the importance of vibration monitoring.
2.6 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 generator
- 2.8.2 Photo electric Tachometer
- 2.8.3 Toothed rotor variable reluctance Tachometer.

3.0 Temperature measurement

3.1 Define the term temperature.

3.2 State the necessity of measurement of temperature.
3.3 Classify the temperature transducers:
(a). on the basis of contact and non-contact
(b). on the basis of operating principle (Resistive and Thermoelectric).
(c). on the basis of Semiconductor technology.
3.4. Explain the principle of operation the following:
(a). Liquid-INglass thermometer.
(b). Bimetallic strip.
(c). Resistance Temperature Detector (RTD).
(d). Thermistor.
(e). Thermocouple.
(f). Radiation pyrometer.
(g). Optical pyrometer.
(h). Solid state sensor.

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 capsule
4.1.5 Double capsule
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 transducer
4.2.4 Piezo resistive pressure transducer
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. State the necessity and principle of pressure multiplexer.
4.4. Explain the procedure for pressure calibration using dead weight tester.

5.0 Flow measurement

Explain the description, principle of operation and application of the following:
5.1 Head type flow meters based on differential pressure measurement such as:
5.1.1. Orifice plate
5.1.2. Venturi tube
5.1.3. Pitot tube
5.2 Electromagnetic flow meter.
5.3 Rotameter (variable – area meters)
5.4 Mechanical flow meter.
5.5 Positive displacement type
5.6 Turbine flow meters.
5.7 Anemometers:

5.7.1 Cup type Anemometer.
5.7.2 Hot wire/hot film type Anemometer.
5.7.3 Laser anemometer.

5.8 Ultrasonic flow meter.

5.9 Thermal flow meter.

6.0 Level measurement

Explain the principle of operation and applications of the following:

6.1 Liquid level sight glass

6.2 Float Actuated level indicator

6.3 Resistive type level indicator.

6.4 Inductive type level indicator.

6.5 Capacitance type level indicator

6.6 Nucleonic level gauge.

6.7 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.

7.4 Explain the principle of operation of the following:
7.4.1 Capillary viscometer
7.4.2 Falling ball viscometer
7.4.3 Rotating viscometer

7.5 Explain the principle of operation of the following for weight measurement and list their applications:
7.5.1 Hydraulic load cell
7.5.2 Pneumatic load cell
7.5.3 Strain gauge load cell

7.6 Define Humidity and relative Humidity.

7.7 Explain the description and principle of operation of the following:
7.7.1 Condensation type Hygrometer.
7.7.2 Electrolytic Hygrometer.

7.8 Explain the principle of operation, applications of Flame Sensor.

7.9 Explain the principle of operation, applications of Leak Detector.

7.10 Explain the principle of operation, applications of Noise Sensor.

CO-PO/PSO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2		1	2		1	3	2	1
CO2	3	2		1	2		1	3	2	1
CO3	3	2		1	2		1	3	2	1

CO4	3	2		1	2		1	3	2	1
CO5	3	2		1	2		1	3	2	1
Average	3	2		1	2		1	3	2	1

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

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 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.

2.0 Displacement and Position Measurements

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

3.0 Temperature measurement

Bimetallic strip, liquid filled thermometer. Resistance temperature Detector, thermocouple, Thermistor, Pyrometer, IC temperature sensors

4.0 Pressure measurement

Elastic elements used for pressure measurement and principle of pressure transducers, principle of pressure multiplexer, pressure calibration

5.0 Flow measurement

Head type of flow meters, electromagnetic flow meter, rotameter, mechanical flowmeters, Anemometers, Ultra sonic flow meter, thermal flowmeter, Pneumatic transmitter. Orifice plate, Electromagnetic flow meter and Turbine flow meter.

6.0 Level measurement

Liquid level sight glass , float actuated level indicator, resistance, inductance, capacitance type level indicators, nucleonic, Ultrasonic level gauges.

7.0 Miscellaneous measurements

Displacement type, Fluid dynamic type, Capacitance type densitometers. Capillary viscometer, Falling ball viscometer, Rotating viscometer, Hydraulic load cell, Pneumatic load cell, Strain gauge load cell, Humidity, Relative humidity, Condensation type Hygrometer, Electrolytic hydrometer,Flame sensor, Leak detector, noise sensor.

REFERENCES

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 Liptak.
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 THE SCOPE OF 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 7.10

ENGINEERING MATHEMATICS-II

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN304E	Engineering Mathematics-II	3	45	30	70	2

TIME SCHEDULE

S.No.	Chapter/Unit title	No. of Periods	Weightage Marks Allotted	No. of Short Questions	No. of Essay Questions	COs mapped
Unit – I: Applications of Definite Integrals						
1	Area of curves	4	7	1	½	CO1
2	Volumes of Solids of Revolution	3	4	0	½	CO1
3	Mean and RMS values	4	11	1	1	CO1
4	Numerical Integration	4	8	0	1	CO1
Unit – II: Differential Equations						
5	Introduction to Differential Equations	4	6	2	0	CO2
6	Solution of first order differential equations	6	14	2	1	CO2
7	Solution of second order homogeneous and non-homogeneous linear differential equations	5	14	2	1	CO2
Unit – III: Probability and Statistics						
8	Probability	5	14	2	1	CO3
9	Measures of Dispersion	6	14	2	1	CO3
10	Correlation	4	8	0	1	CO3
	Total	45	100	12	8	
			Marks	36	64	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able

(i)	To apply integral techniques to solve various engineering problems.
(ii)	To solve first-order and first-degree differential equations and second-order homogeneous and non-homogeneous linear differential equations.
(iii)	To analyse data using the concepts of probability and statistical techniques.

COURSE OUTCOMES

CO1	IN304.1	Apply definite integrals in engineering applications.
CO2	IN304.2	Solve first-order and first-degree differential equations and second-order homogeneous and non-homogeneous linear differential equations.
CO3	IN304.3	Apply various probability and statistical techniques for data analysis.

LEARNING OUTCOMES

C.O.1 Apply definite integrals in engineering applications.

L.O.1.1 Find the area bounded by a curve and axes.
1.2 Determine the volumes of solids of revolution along the x-axis.
1.3 Obtain the Mean and R.M.S values of simple functions.
1.4 Solve the problems of areas using Numerical Integration.

C.O.2 Solve first-order and first- degree differential equations and second-order homogeneous and non-homogeneous linear differential equations.

L.O.2.1 Define a Differential equation, its order and degree.
2.2 Find order and degree of a given differential equation.
2.3 Form a differential equation by eliminating arbitrary constants.
2.4 Solve the first order and first degree differential equations by variables separable method.
2.5 Solve linear differential equation of the form $\frac{dy}{dx} + Py = Q$, where P and Q are functions of x only or constants.
2.6 Solve Differential equations of the type $(aD^2 + bD + c)\, y = 0$ where $a (\neq 0)$, b, and c are real numbers.
2.7 Define complementary function, particular integral and general solution of a non-homogeneous linear differential equation of second order with constant coefficients.
2.8 Describe the method of solving $f(D)y = e^{ax}$, where f(D) is a polynomial of second order.

C.O. 3 Apply various probability and statistical techniques for data analysis.

L.O.3.1 Recall the basic probability principles.
3.2 State addition theorem of probability for two mutually exclusive and exhaustive events.
3.3 Solve simple problems on addition theorem.
3.4 Explain conditional event and conditional probability.
3.5 Solve simple problems on conditional probability.
3.6 Explain dependent, independent events and state multiplication theorem.
3.7 Solve simple problems on multiplication theorem.
3.8 Recall the measures of central tendency.
3.9 Explain the significance of measures of dispersion to determine the degree of heterogeneity of the data.
3.10 Find the measures of dispersion, Range, Mean Deviation and Standard Deviation for ungrouped data.

3.11 Explain the merits and demerits of these measures of dispersion.
3.12 Explain bivariate data.
3.13 Explain the concept of covariance and correlation between two variables.
3.14 Find Spearman's rank correlation coefficient.

CO/PO – MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	3				3	3	1
CO2	3	1	1	1				3	1	1
CO3	3	3	3	3				3	3	3
Avg.	3	2.33	2.33	2.33				3	2.33	1.66

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.

COURSE CONTENT

Unit-I: Applications of Definite Integrals

Area bounded by a curve and axes. Volume of Solids of Revolutions. Mean and RMS values of a function on a given interval. Numerical Integration.

Unit -II: Differential Equations

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 and non-homogeneous linear differential equations of second order with constant coefficients.

Unit III: Probability & Statistics

Addition theorem of probability, conditional probability, dependent and independent events with multiplication theorem. Measures of dispersion, range, mean deviation and standard deviation of ungrouped data, merits and demerits. Bivariate data, correlation, Spearman's rank correlation coefficient.

TEXT BOOK

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

REFERENCES

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Schaum's Outlines Differential Equations, Richard Bronson & Gabriel B. Costa
3. Schaum's Outline: Introduction to Probability and Statistics, Seymour Lipschutz & John J. Schiller.
4. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

E-LEARNING REFERENCES

1. https://www.khanacademy.org/
2. https://www.wolframalpha.com/
3. https://onlinecourses.nptel.ac.in/
4. http://tutorial.math.lamar.edu/

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 2.5
Unit Test-II	From 2.6 to 3.14

PYTHON PROGRAMMING (PRACTIUM -THEORY)

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN305E	PYTHON PROGRAMMING	3	45	30	70	2

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Type Questions	COs Mapped
1.	Introduction to Python & Programming Fundamentals	10	25	03	02	CO1
2.	Flow of Control	8	14	02	01	CO2
3.	Python Data Structures	10	25	03	02	CO3
4.	Functions, Modules and Data Visualization	10	22	02	02	CO4
5.	File Handling	7	14	02	01	CO5
	Total	45	100	12	08	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able

(i)	To introduce the fundamentals of Python programming language and its features.
(ii)	To develop problem-solving skills using Python constructs such as decision-making, loops, and operators.
(iii)	To provide knowledge of Python data structures for efficient data storage and manipulation.
(iv)	To enable students to design modular programs using functions, modules, and data visualization tools.

(v)	To familiarize students with file handling concepts for managing and processing data.

COURSE OUTCOMES

CO1	IN305.1	Describe Python features, syntax, variables, data types, and operators.
CO2	IN305.2	Apply decision-making and looping constructs to solve computational problems.
CO3	IN305.3	Utilize Python data structures such as lists, tuples, and dictionaries for data organization and manipulation.
CO4	IN305.4	Develop modular and reusable programs using functions, modules, and visualization techniques.
CO5	IN305.5	Develop modular and reusable programs using functions, modules, and visualization techniques.

LEARNING OUTCOMES

1.0 Introduction to Python & Programming Fundamentals

THEORY

1.1. List features of Python
1.2. Explain the fundamental concepts of Python including identifiers, keywords, indentation, and variables.
1.3. List and explain the various data types in Python.
1.4. Use the type( ) function to check the data type of variables.
1.5. Explain type conversion functions in Python such as int( ), float( ), and str( ) for converting data between different types.
1.6. Explain the use of arithmetic, relational, logical, and assignment operators in Python with suitable examples.
1.7. Explain input and output operations in Python using input( ) and print( ) functions to interact with users.

LABORATORY

1.8. Demonstrate installation of Python using IDLE or an online interpreter for a ready to use environment.
1.9. Write and execute a simple “Hello, World!” program to verify correct setup.

2.0 Flow of Control

THEORY

2.1 Explain decision-making statements in Python, including if, if–else, if–elif–else, and nested if constructs, with example programs.
2.2 Explain repetition in Python using while and for loops with example programs.
2.3 Explain loop control statements in Python, including break and continue, with example programs.

LABORATORY

2.4 Develop Python programs to solve problems such as finding the maximum of three numbers, calculating factorial, generating the Fibonacci sequence, and checking whether a number is prime or not.

3.0 Python Data Structures

THEORY

3.1 Explain the importance of data structures in Python for organizing and managing data, with emphasis on List, Tuple, and Dictionary.
3.2 Create and manipulate lists in Python through operations such as accessing, slicing, traversing, concatenation, repetition, and membership testing.
3.3 Create and manipulate tuples in Python through operations such as accessing, slicing, traversing, concatenation, repetition, and membership testing.
3.4 Differentiate between lists and tuples.
3.5 Explain dictionaries in Python as collections of key value mappings with examples.
3.6 Explain and demonstrate dictionary operations in Python including creation, accessing, adding, modifying, and deleting elements.

LABORATORY

3.7 Develop Python programs to perform sorting operations on lists and to store simple tabular data using dictionaries.

4.0. Functions, Modules and Data Visualization

THEORY

4.0 State the purpose of functions in modular programming.
4.1 Explain the concept of user defined functions in Python and demonstrate their use with an example program.
4.2 State the purpose of return statement in Python.
4.3 Define module and state it's importance.
4.4 Explain how to import and use the math module to perform basic mathematical operations such as math.sqrt( ), math.ceil( ), math.floor( ), math.factorial( ), math.log( ), math.pow( ).
4.5 Explain data visualization in Python using the Matplotlib library and demonstrate the use of functions such as plt.plot( ) and plt.bar( ) to create line and bar charts.

LABORATORY

4.6 Develop Python programs using Matplotlib to create line and bar charts for visualizing data stored in lists and dictionaries.

5.0 File Handling

THEORY

5.1 Differentiate between text files and binary files in terms of content and usage.
5.2 Open and close files using various modes: read, write, and append.

5.3 Perform file reading operations using read( ), readline( ), and readlines( ) methods.
5.4 Perform file writing operations using write( ) and writelines( ) methods.
5.5 Use the with statement to manage files efficiently and ensure automatic closing.

LABORATORY

5.6 Develop program to read data from a text file and write results into another file.

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO 3
CO1	3	3	3	2	2	2	1	3	3	3
CO2	3	3	3	2	2	2	1	3	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	3	3	2	2	2	1	3	3	3
CO5	3	3	3	2	2	2	1	3	3	3
Average	3	3	3	2	2	2	1	3	3	3

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

Note:

The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 Introduction to Python & Programming Fundamentals

Introduction to Python, features, installation using IDLE/online interpreter, writing first program. Identifiers, keywords, indentation, variables, data types, use of type() function. Type conversion functions (int(), float(), str()). Operators – arithmetic, relational, logical, assignment; expressions, precedence of operators. Input and output operations using input() and print().

2.0 Flow of Control

Decision-making statements: if, if–else, if–elif–else, nested if. Looping constructs: while, for. Loop control statements: break, continue. Programs: maximum of three numbers, factorial, Fibonacci sequence, prime number checking.

3.0 Python Data Structures

Importance of data structures. Lists – creation, accessing, slicing, traversing, concatenation, repetition, membership testing. Tuples – creation, accessing, slicing, traversing, concatenation, repetition, membership testing. Difference between lists and tuples. Dictionaries – concept of key–value pairs, creation, accessing, adding, modifying, deleting elements. Programs on sorting lists and storing tabular data using dictionaries.

4.0 Functions, Modules, and Data Visualization

Functions in modular programming – user-defined functions, return statement. Modules – concept, importance, using math module (sqrt(), ceil(), floor(), factorial(), log(), pow()). Data visualization using Matplotlib – plt.plot(), plt.bar(). Programs to create line and bar charts using lists and dictionaries.

5.0 File Handling

Text files vs. binary files. Opening and closing files – modes: read, write, append. Reading files: read(), readline(), readlines(). Writing files: write(), writelines(). File handling with with statement. Program to read data from a text file and write results into another file.

REFERENCES

1. Guido van Rossum, Fred L. Drake (Editors) – Python Tutorial, Python Software Foundation, latest version.
2. Wesley J. Chun – Core Python Programming, Pearson Education, 2nd Edition.
3. Allen B. Downey – Think Python: How to Think Like a Computer Scientist, O'Reilly Media, 2nd Edition.
4. Mark Lutz – Learning Python, O'Reilly Media, 5th Edition.
5. E. Balagurusamy – Introduction to Computing and Problem Solving using Python, McGraw Hill Education.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning outcomes to be covered
Unit test-1	From 1.1to 3.4
Unit test-2	From 3.5 to 5.6

SOLAR ENERGY SYSTEMS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN306A	SOLAR ENERGY SYSTEMS	02	30	-	-	-

TIME SCHEDULE

S No	Chapter/ Unit Title	No. of Periods	COs Mapped
1	Renewable Energy & Solar PV System Fundamentals	6	CO1
2	Photovoltaic Cells & Panel Principles	8	CO2
3	Solar PV Array Design & Configuration	6	CO3
4	Solar PV System Components & Technology	6	CO4
5	Installation, Maintenance & Troubleshooting	4	CO5
	TOTAL	30	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Explain the fundamental principles of renewable energy and the conversion of solar radiation, including key terminology and measurement techniques.
(ii)	Analyze the operational principles of solar cells and modules, their key parameters, and the factors that affect their performance.
(iii)	Design and configure solar PV arrays using series and parallel connections, and implement solutions to mitigate the effects of partial shading.
(iv)	Identify and describe the function of all major components within a complete solar PV system, including inverters, batteries, and charge controllers**.**
(v)	Perform the correct installation, maintenance, and troubleshooting procedures for a PV system to ensure its safe and efficient operation.

COURSE OUTCOMES

CO1	IN306.1	Explain the fundamental principles of renewable energy and solar radiation.
CO2	IN306.2	Analyze the principles of PV cells and modules, including their characteristics and performance parameters.

CO3	IN306.3	Explain the design and configuration of solar PV arrays using series and parallel connections, and implement solutions for shading effects
CO4	IN306.4	Identify and describe the function of various components within a complete solar PV system.
CO5	IN306.5	Perform the installation, maintenance, and troubleshooting of a PV system to ensure its efficient operation.

LEARNING OUTCOMES

1.0 Renewable Energy & Solar PV System Fundamentals

1.1 Define renewable energy and explain its importance.
1.2 List the renewable energy sources.
1.3 Explain the basic solar energy conversion process.
1.4 List the advantages and disadvantages of a solar energy system.
1.5 Define key solar terms: solar constant, direct radiation, and diffuse radiation.
1.6 Explain the principles of solar radiation measurement and identify instruments like pyranometers and pyrheliometers.

2.0 Photovoltaic Cells & Panel Principles

2.1 Explain the photovoltaic effect.
2.2 Explain the basic structure of a solar cell.
2.3 Explain the manufacturing process of solar cells.
2.4 Explain the construction and working of a PV panel.
2.5 List the types of PV modules and their characteristics (monocrystalline, polycrystalline, thINfilm).
2.6 Define solar cell parameters, including V_{oc}, I_{sc}, and P_{mpp}.
2.7 Interpret a solar cell's I-V curve to identify its maximum power point.
2.8 Explain the main factors affecting the output of solar photovoltaic modules.
2.9 Analyze how changes in temperature and irradiance affect a solar panel's performance.
2.10 Explain how to measure voltage, current, and power of solar photovoltaic modules.

3.0 Solar PV Array Design & Configuration

3.1 Explain the necessity of connecting solar cells and panels into arrays.
3.2 List the types of connections of solar photovoltaic panels (series and parallel).
3.3 Demonstrate how to connect solar panels in series to increase voltage.
3.4 Demonstrate how to connect solar panels in parallel to increase current.
3.5 Explain the problem of partial shading in a PV array.
3.6 Explain the function and importance of bypass diodes to mitigate the effects of shading.

3.7 Explain the function and importance of blocking diodes to prevent reverse current flow

4.0 Solar PV System Components & Technology

4.1 Explain the components of a PV system.
4.2 Identify types of solar photovoltaic systems (on-grid, off-grid, and hybrid).
4.3 Explain the role of batteries in a PV system and identify the types of batteries used.
4.4 Explain the standard parameters of a battery.
4.5 List the functions of a charge controller and list the types of charge controllers.
4.6 Explain different charge controller technologies, including PWM and MPPT.
4.7 Explain the primary purpose of an inverter and list the types of solar inverters.
4.8 Explain the block diagram of a standalone inverter.
4.9 Explain the block diagram of a grid tie inverter.
4.10 Explain the block diagram of a battery backup grid-tie inverter.
4.11. State the importance for mounting structures and list different types of mounting systems.

5.0 Installation, Maintenance & Troubleshooting

5.1. Explain the installation of solar panel.
5.2. List the facts to be considered while installing solar panels.
5.3. Explain the installation of PV system components.
5.4. Explain the importance of earthing of the PV system.
5.5. Explain the maintenance of PV system.
5.6. Explain the troubleshooting of PV system components to identify and resolve faults.

CO-PO/PSO MAPPING

S. No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	1	1	3	3	-	-
CO2	3	3	-	2	1	-	1	3	-	-
CO3	2	2	3	2	2	1	2	3	3	-
CO4	2	-	1	1	1	1	1	3	2	-
CO5	2	3	1	3	3	2	1	3	2	3
Average	2.4	2.67	1.67	2	1.6	1.25	1.6	3	2.33	3

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

Note:

The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 Renewable Energy & Solar PV System Fundamentals

Renewable Energy Sources-Definition-Importance-Solar Energy Conversion Process-Solar System Advantages - Disadvantages-Key Solar Terms – Solar Constant - Direct Radiation – Diffuse Radiation – Solar Radiation Measurement-Principles – Instruments – Pyranometers – Pyrheliometers.

2.0 Photovoltaic Cells & Panel Principles

Photovoltaic Effect – Solar Cell Basic Structure – Solar Cell Manufacturing Process – PV Panel – Construction – Working – PV Module – Types – Characteristics – Monocrystalline – Polycrystalline – Thin Film Solar Cell – Parameters - V_{oc}- I_{sc} - P_{mpp} - I-V Curve – Maximum Power Point – Factors Affecting – Output Temperature – Irradiance Effects – Voltage, Current, Power and Measurements

3.0 Solar PV Array Design & Configuration

Solar Panel – Connections – Series Parallel Connections – Increasing Voltage – Increasing Current – Partial Shading Problem – Bypass Diodes Function Importance – Blocking Diodes Function Importance

4.0 Solar PV System Components & Technology

PV System – Components Types – On Grid, Off-Grid – Hybrid Systems – Batteries Role – Types – Standard Parameters – Charge Controller Functions – Types – Technologies – PWM – MPPT – Inverter – Purpose – Types – Block Diagrams – Standalone - Grid-Tie – Battery Backup - Grid-Tie – Mounting Structures – Importance – Types.

5.0 Installation, Maintenance & Troubleshooting

Solar Panel – Installation Considerations – PV System – Component Installation – Earthing – Importance – PV System Maintenance – PV System Troubleshooting – Component Faults – Common Faults.

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4. Solar Energy-Principles of thermal energy collection & storage, S.P. Sukhatme, Tata McGraw Hill Publishers, 1999.S
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6. Science and Technology of Photovoltaics, P. Jayarama Reddy, BS Publications, 2004.
7. Renewable Energy Engineering and Technology: Principles and Practice - V.V.N. Kishore
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ELECTRONIC MEASURING INSTRUMENTS LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN307L	ELECTRONIC MEASURING INSTRUMENTS LAB	6	90	40	60	2

TIME SCHEDULE

S. No	Chapter/ Unit Title	No. of Periods	COs Mapped
1	Analog instruments	30	CO1
2	Digital instruments	30	CO2
3	Signal generator & CRO	30	CO3
TOTAL		90	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Gain knowledge on usage of various electronic measuring Instruments.

COURSE OUTCOMES

CO1	IN307.1	Familiarize with the use of analog instruments.
CO2	IN307.2	Familiarize with the use of digital instruments for the measurements of various parameters.
CO3	IN307.3	Handle the signal generator & CRO for measurement of unknown frequency.

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 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 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 MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	2	2	2
CO2	3	3	3	2	2	2	1	2	2	2
CO3	3	3	3	2	2	2	1	2	2	2
Average	3	3	3	2	2	2	1	2	2	2

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

Note:

The gaps in CO and PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

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 6
Unit Test-2	From 7 to 12

DIGITAL ELECTRONICS LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN308L	DIGITAL ELECTRONICS LAB	4	60	40	60	1.5

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	COs Mapped
1	Combinational Logic circuits	24	CO1
2	Sequential Logic Circuits	26	CO2
3	A/D and D/A converters	10	CO3
	TOTAL	60	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Implement different combinational, sequential logic circuits and obtain truth tables.
ii)	Demonstrate working of A/D and D/A converters.

COURSE OUTCOMES

CO1	IN308.1	Implement combinational logic circuits and verify truth tables.
CO2	IN308.2	Implement Sequential logic circuits and verify truth tables.
CO3	IN308.3	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
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, JK and Master - Slave JK Flip-flops.
9. Verify function of counter (ICs like 7490, 7492, 7493, 74C93, 74160
10. Verify function of shift register (ICs like 74104, 74185, 74C164, 7495, 74194 etc.)
11. Construct one bit comparator circuit using gates.

III. A/D and D/A converters

12. Verify the working of Successive Approximation type A/D converter
13. Verify the working of R-2R D/A converter.

CO-PO/PSO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3			1			3	2	
CO2	3	3			1			3	2	
CO3	1	3			1			3	2	
Average	2	3			1			3	2	

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

Note:

The gaps in CO and PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1 to 6
Unit Test-II	From 7 to 13

PROCESS INSTRUMENTATION LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN309L	PROCESS INSTRUMENTATION LAB	6	90	40	60	2

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	COs Mapped
1	Displacement measurement	18	CO1
2	Velocity measurement	6	CO2
3	Temperature measurement	18	CO3
4	Pressure measurement	6	CO4
5	Flow measurement	6	CO5
6	Level measurement	12	CO5
7	Density and Viscosity measurement	12	CO5
8	Weight & Humidity measurement	12	CO5
	TOTAL	90	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Practice various measurement techniques used for the measurement of displacement, Velocity, temperature, humidity and moisture in process industries.

COURSE OUTCOMES

CO1	IN309.1	Measure the linear displacement, angular displacement using different transducers
CO2	IN309.2	Measure the velocity using tachometer
CO3	IN309.3	Measure the temperature using RTD, Thermocouple, Thermistor
CO4	IN309.4	Measure the pressure and flow using transducers.
CO5	IN309.5	Measure the level, density, weight and relative humidity using different transducers.

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 Thermistor 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 MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	*PO6*	*PO7*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3		1			3	2	1
CO2	3	3	3		1			3	2	1
CO3	3	3	3		1			3	2	1
CO4	3	3	3		1			3	2	1
CO5	3	3	3		1			3	2	1
Average	3	3	3		1			3	2	1

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

Note:

The gaps in CO and PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	**Learning outcomes to be covered**
Unit Test-I	From 1 to 8
Unit Test-II	From 9 to 15

FOURTH SEMESTER

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV SEMESTER

Course Code	Course Title	No. of Periods / Week		Practicum (Y/N)	Total No. of Periods /Semester	Credits	Scheme of Examination			
		Theory	Practical/ Tutorial				Duration (hours)	FA Marks	SA Marks	Total Marks
THEORY COURSES										
26IN401T	Linear Integrated Circuits	6	-	N	90	4	3	30	70	100
26IN402T	Industrial Electronics & Control Engineering	6	-	N	90	4	3	30	70	100
26IN403T	Process Control	6	-	N	90	4	3	30	70	100
ELECTIVE COURSES										
26IN404E	Data Communication and Computer Networking	3	-	N	45	2	3	30	70	100
26IN405E	Instrumentation in Process Industries									
AUDIT COURSE										
26IN406A	Drone Technology	2	-	N	30	-	-	-	-	-
PRACTICAL COURSES										
26IN407L	Linear IC Applications and E-Cad Lab	-	6	N	90	2	3	40	60	100
26IN408L	Communication & Employability Skills	-	4	N	60	2	3	40	60	100
26IN409L	Process Control Lab	-	6	N	90	1.5	3	40	60	100
26IN410C	Student Centric Activities	-	3	N	45	0.5	-	-	-	-
	TOTAL	**23**	**19**	**-**	**630**	**20**	**-**	**240**	**460**	**700**

Note 1: 0.5 Credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NSS Clean and Green or Sports / Games.

Note 2: 26IN408L is common laboratory to all programmes.

LINEAR INTEGRATED CIRCUITS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN401T	LINEAR INTEGRATED CIRCUITS	06	90	30	70	4

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Weightage of marks	No.of Short Questions	No.of Essay Questions	COs Mapped
1	Introduction to Operational amplifiers	15	17	3	1	CO1
2	Linear applications of Operational amplifiers	20	22	2	2	CO2
3	Active filters	20	22	2	2	CO3
4	555 Timer IC	20	22	2	2	CO4
5	Nonlinear applications of Operational amplifiers	15	17	3	1	CO5
	TOTAL	90	100	12	8	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Familiarize with the characteristics of operational amplifiers.
(ii)	Know the applications of operational amplifiers.the operation of LPF,HPF,BPF and BSF using OP Amp.
(iii)	Know and describe the operation of 555 timer and its applications.

COURSE OUTCOMES

CO1	IN401.1	Familiarize with the characteristics of operational amplifiers.
CO2	IN401.2	Explain the operation of different applications of operational amplifiers.
CO3	IN401.3	Describe the operation of LPF,HPF,BPF and BSF using OP Amp.
CO4	IN401.4	Describe the operation of 555timer and its applications.
CO5	IN401.5	Describe the operation of non linear applications.

LEARNING OUTCOMES

1. 0 INTRODUCTION TO OPERATIONAL AMPLIFIERS

1.1 State the requirements of an operational amplifier.
1.2 Draw the circuit of differential amplifier.
1.3 Explain the operation of differential amplifier.
1.4 Draw and explain the block diagram of a typical integrated circuit operational amplifier.
1.5 Draw the schematic symbol of operational amplifier.
1.6 List and sketch different package styles of analog ICs.
1.7 Draw the pin diagrams of metal can package and dual-INline package for a typical IC 741.
1.8 List the basic specifications of ideal operational amplifier.
1.9 Define Voltage gain $\mathbf{A_V}$, input impedance $\mathbf{Z_i}$, output impedance $\mathbf{Z_o}$, 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 operational amplifier.
2.3 Draw and explain the operation of inverting and non-inverting operational amplifiers.
2.4 Draw and explain the operation of Voltage follower circuit using operational amplifier.
2.5 Draw and explain the operation of summing amplifier 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 using OP-amp.
2.8 Draw and explain the operation of current to voltage converter using Op-amp. (I to V)
2.9 Draw and explain the operation of voltage to current converter using OP-amp. (VtoI)
2.10 Draw and explain the operation of Instrumentation amplifier using Op-amp.

3.0 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 LPF,HPF,BPF,BSF and All Pass Filter.
3.6 Define Pass band and Stop band.
3.7 Draw and explain the operations of first order LPF and HPF using operational amplifier with its frequency responses.
3.8 Draw and explain the operations of first order BPF (narrow & wide) and BSF (narrow & wide) using operational amplifiers with its frequency responses.
3.9 List the disadvantages of active filters.

4.0 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 monostable 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 using Op-amp.
5.2 Draw and explain the operation of Wien bridge oscillator using Op-amp.
5.3 Draw and explain the operation of Triangular wave generator using Op-amp.
5.4 Draw and explain the operation of basic comparator circuit using Op-amp.
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 (PLL) with the help of block diagram.
5.7 List the applications of PLL.

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2				3	2	1
CO2	3	3	2	2				3	2	1
CO3	3	3	2	2				3	2	1
CO4	3	3	2	2				3	2	1
CO5	3	3	2	2				3	2	1
Average	3	3	2	2				3	2	1

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

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

(i)Assignments (ii)Tutorials (iii)Seminars (iv)Guest Lectures (v)Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

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 impedances, 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.

REFERENCES

1. OpAmps & Linear Integrated Circuits—Ramakanth Gaykwad
2. Linear Integrated Circuits --Roy Chowdary
3. Integrated Circuits --Botkar

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be covered
Unit Test-1	From 1.1 to 3.4
Unit Test-2	From 3.5 to 5.7

INDUSTRIAL ELECTRONICS AND CONTROL ENGINEERING

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN402T	INDUSTRIAL ELECTRONICS AND CONTROL ENGINEERING	06	90	30	70	4

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	Weightage of Marks	No. of Short Questions	No. of Essay Questions	Cos Mapped
1	Power and opto-Electronic Devices	25	25	3	2	CO1
2	Industrial Heating and welding	10	14	2	1	CO2
3	Basic Concepts of Control Systems and Transfer functions	10	14	2	1	CO3
4	Block diagram algebra and signal Flow graphs	20	22	2	2	CO4
5	Time Domain and frequency domain Analysis	25	25	3	2	CO5
	TOTAL	90	100	12	8	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Learn the principles and working of power Electronic devices, opto-electronic devices, Industrial heating and welding.
(ii)	Understand the importance of Control System Engineering in industry
(iii)	Evaluate the transfer Functions of system using block diagram algebra and signal flow graphs
(iv)	Analyze the system in Time & Frequency Domains and To evaluate its stability

COURSE OUTCOMES

CO1	IN402.1	Describe Various Power Electronic Devices like SCR, DIAC, TRIAC etc. and Various Opto-electronic Devices like Photo diode, Photo Transistor, LED etc.
CO2	IN402.2	Explain Industrial Heating and welding.
CO3	IN402.3	Understand the importance of Control System Engineering in industry and transfer Functions of system.
CO4	IN402.4	Evaluate the system transfer function using block diagram algebra and signal flow graphs
CO5	IN402.5	Analyze the system in Time and frequency Domains.

LEARNING OUTCOMES

1.0. POWER AND OPTO-ELECTRONIC DEVICES

1.1 List different power electronic devices.
1.2 List different opto electronic devices.
1.3 List different thyristor family devices.
1.4 Sketch the ISI circuit symbols of SCR,SCS,SBS,SUS,DIAC,TRIAC and GTOSCR.
1.5 Explain the construction and working of SCR.
1.6 Draw and Explain V-I Characteristics of SCR.
1.7 List the ratings of SCR.
1.8 Explain the working of DIAC & TRIAC with VI characteristics.
1.9 Explain the construction and working of UJT with VI characteristics.
1.10 List the applications of DIAC,TRIAC & SCR.
1.11 Draw the circuit symbols of photodiode, phototransistor, LDR, LED.
1.12 Explain the working of photodiode with V-I characteristics.
1.13 Explain the working of photo transistor with V-I characteristics.
1.14 Explain the working of photomultiplier.
1.15 List the applications of photodiode, photo transistor and photo multiplier.
1.16 Explain the working of LDR.
1.17 Explain the working of photovoltaic cell.
1.18 Explain the working of LED.
1.19 Explain the working of LCD.
1.20 Explain the working of opto-coupler.
1.21 Explain the working of discrete displays-Dot matrix, Bar matrix, Bar graph and Seven segment display.

2.0. INDUSTRIAL HEATING AND RESISTANCE WELDING

2.1 List different industrial heating methods.
2.2 Explain the principle of Induction Heating and list 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

i. Linear and Non-linear control system.
ii. Time variant and time invariant system.
iii. Continuous data and discrete data system.
iv. Digital control system.

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 of signal flow graph 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 used in control system.
5.3 Define Order of a control system.
5.4 Obtain the time response of first order system for a unit step and unit impulse

input.

5.5 Obtain the time response of second order undamped system for a unit step input.

5.6 List the time domain specifications of second order system and define them.

5.7 Define Type of a control systems.

5.8 Define absolute and relative stability.

5.9 State and explain Routh Hurwitz criterion for stability of a system.

5.10 Solve problems on Routh Hurwitz criterion of stability.

5.11 Define frequency response of a system.

5.12 List the frequency response plots.

5.13 Define Bode plot.

5.14 Explain the procedure for magnitude plot of Bode plot.

5.15 Explain the procedure for phase plot of Bode plot.

5.16 Define Gain margin and Phase margin.

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	2			3	2	1
CO2	3	3		2	2	2		3	2	1
CO3	3	3		2	2			3	2	1
CO4	3	3	2	2	2			3	2	1
CO5	3	3	2	2	2		1	3	2	1
Average	3	3	2	2	2	2	1	3	2	1

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

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

(i)Assignments(ii)Tutorials(iii)Seminars(iv)GuestLectures(v)GroupDiscussions(vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 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 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 ,bar matrix ,bar graph and seven segment displays.

2.0 INDUSTRIAL HEATING AND WELDING

Induction heating, Dielectric heating, Resistance welding

3.0 BASIC CONCEPTS OF CONTROL SYSTEMS AND TRANSFER FUNCTIONS

Different types of control systems, Definition of transfer function and it properties

4.0 BLOCK DIAGRAM ALGEBRA AND SIGNAL FLOWGRAPH

Block diagram reduction rules for block diagram reduction, signal flow graphs and Mason's gain formula

5.0 TIME AND FREQUENCY RESPONSE ANALYSIS:

Transient response of first order system for step input,Impulse input-step response of second order undamped systemand 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.

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5. B.S.Manke,2005,Linear Control Systems,Khanna Publishers
6. Nagrath,I.J.,andMadanGopal,2008,Controlsystems,New Age International
7. Nagoor&Khani, 2016,Control system Engineering, RBA Publication

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be covered
Unit Test-1	From 1.1to 3.3
Unit Test-2	From 3.4 to 5.16

PROCESS CONTROL

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN403T	PROCESS CONTROL	06	90	30	70	4

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	Weightage of Marks	No. of Short Questions	No. of Essay Questions	Cos Mapped
1	Introduction to process control	13	14	2	1	CO1
2	Controller principles	18	25	3	2	CO2
3	Final control operation	23	22	2	2	CO3
4	Advanced process Control systems	18	22	2	2	CO4
5	Process instrument diagrams and standards	18	17	3	1	CO5
	TOTAL	90	100	12	8	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Familiarize with the knowledge of a process control loop, controller principles, tuning, final control operations and advanced process control systems.
(ii)	Familiarize with the knowledge of process instrument diagrams and standards.

COURSE OUTCOMES

CO1	IN403.1	Familiarise with terms related to process control.
CO2	IN403.2	Understand the controller principles
CO3	IN403.3	Explain the principle of operation of final controller elements
CO4	IN403.4	Explain the principle of operation of advanced process control system
CO5	IN403.5	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 Define tuning of controller.
2.22 State the need for tuning of PID controllers.
2.23 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 Define actuator.
3.8 List the different types of Actuators.
3.9 Explain the principle of Pneumatic Actuator with diagram.
3.10 Explain the principle of Hydraulic Actuator with diagram.
3.11 Explain the principle of Electro Pneumatic Actuator with diagram.
3.12 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.
   b. Independent single variable control system
   c. Interactive single variable control system
   d. Compound variable control system and
   e. 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 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 Explain the following standards used in Instrumentation:
a) ISI
b) ANSI
c) BS
d) ISA
e) DIN

CO-PO/PSO Mapping

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

CO4	1	1			1			2	2	1
CO5	1	1			1			3	3	1
Average	1.2	1			1			2.6	2.2	1

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped
Note:

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

(i)Assignments(ii)Tutorials(iii)Seminars(iv)GuestLectures(v)GroupDiscussions(vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 INTRODUCTION TO PROCESS CONTROL:

Process control principle-process control block diagram –typical control variables-controlled variable, manipulated variable- Continuous and Batch process

2.0 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.

3.0 **FINAL CONTROL OPERATION:**

Different types of the Actuators: - Pneumatic, Hydraulic, Electrical Actuators-different types of control valves.

4.0 ADVANCED PROCESS CONTROL SYSTEMS:

Single variable – compound variable. Multivariable control systems–cascade control–feed forward control-ratio controls– adaptive control systems.

5.0 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.

REFERENCES

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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

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	**Learning Outcomes to be covered**
Unit Test-1	From 1.1 to 3.6
Unit Test-2	From 3.7 to 5.7

DATA COMMUNICATION AND COMPUTER NETWORKS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN404E	DATA COMMUNICATION AND COMPUTER NETWORKS	03	45	30	70	2

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Questions	No. of Essay Questions	COs Mapped
1	Basics of Data communication& OSI Layer	8	14	2	1	CO1
2	LAN and DLL protocols	11	25	3	2	CO2
3	IP addressing and Network layer protocols	10	22	2	2	CO3
4	WAN protocols	6	11	1	1	CO4
5	Network security	6	17	3	1	CO5
6	Web Applications	4	11	1	1	CO6
	TOTAL	45	100	12	8	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Understand the concept of data communication.
(ii)	Understand the various computer network layers and protocols.

COURSE OUTCOMES

CO1	IN404.1	Apply physical layer functionality to select suitable media
CO2	IN404.2	Apply MAC layer protocols for various topologies
CO3	IN404.3	Use network layer protocols
CO3	IN404.4	Use transport layer protocols
CO4	IN404.5	Apply knowledge in securing the network
CO5	IN404.6	Use application layer protocols (web applications)

LEARNING OUTCOMES

1.0 BASICS OF DATA COMMUNICATION & OSI LAYER

1.1 Define data communication.
1.2 State the need for data communication networking.
1.3 Distinguish between analog and digital data.
1.4 Define computer network and state its use.
1.5 Draw the ISO:OSI 7 layer architecture and explain the function of each layer.
1.6 List the different types of physical transmission media.
1.7 Define simplex, half-duplex and full-duplex communication.

2.0. LAN AND DLL PROTOCOLS

2.1 Define Local area network and state its use.
2.2 Explain different network topologies (Bus, Star ,Ring).
2.3 List the use of different networking devices such as
   a. Repeater/hub.
   b. Switch.
   c. Bridge.

2.4 State the need for protocols in computer networks.
2.5 State the need for flow control and error control protocols.
2.6 Explain the topology of wireless LAN.
2.7 Explain the Bluetooth technology.
2.8 List 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.
3.4 Classify the two types of Internet Protocol addressing IPv4 and IPv6.
3.5 State the need for IPv6.
3.6 Explain the use of routers in networking

4.0 WAN PROTOCOLS

4.1 Know about WAN architecture.
4.2 List the three commonly used WAN technologies.
4.3 Describe the ARPANET and WWW.
4.4 Explain different layers of TCP/IP.
4.5 Explain the features of TCP.
4.6 Compare 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.
6.3 Explain how email is transferred.
6.4 Discuss POP server and SMTP server.
6.5 Explain file transfer operation using FTP
6.6 Write the role of Web server.
6.7 Write the role of Web browser.

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2		1	1			3	2	1
CO2	3	2		1	1			3	2	1
CO3	3	2		1	1			3	2	1
CO4	3	2		1	1			3	2	1
CO5	3	2		1	1			3	2	1
Average	3	2		1	1			3	2	1

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 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.

2.0 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.

3.0 IP addressing and Network layer protocols

Internet and Intranet- Internet protocol-connection oriented (virtual circuit) and connection less(datagram)services-IPv4addressing-IPv6addressing-routerand routing.

4.0 WAN protocols

WAN architecture-ARPANET and WWW-TCP/IP

5.0 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.

5.0 Web Applications

DNS server-email transfer-POP server-SMTP server-FTP-Web Server-Web browser

REFERENCES

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 THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 3.6
Unit Test – 2	From 4.1 to 6.7

INSTRUMENTATION IN PROCESS INDUSTRIES

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN405E	INSTRUMENTATION IN PROCESS INDUSTRIES	03	45	30	70	2

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Weightage of Marks	No. of Short Questions	No. of Essay Questions	Cos Mapped
1	Methods of power generation in Power Plant	08	19	1	2	CO1
2	Instrumentation and control in power Plant	10	22	2	2	CO2
3	Petro Chemical Plant Instrumentation	08	20	4	1	CO3
4	Iron and Steel Plant Instrumentation	10	22	2	2	CO4
5	Pulp and Paper Plant Instrumentation	09	17	3	1	CO5
Total		45	100	12	08	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Familiarize with the knowledge of methods of power generation in different power plants like thermal, Hydroelectric, Wind, Solar, 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	IN405.1	Explain the process of power generation in thermal, Hydroelectric, Wind, Solar, Nuclear Power Plants.
CO2	IN405.2	Explain the Instrumentation and control in power plant.
CO3	IN405.3	Explain the Instrumentation and control in Petro chemical plant.
CO4	IN405.4	Explain the Instrumentation and control in Iron and steel Plant.
CO5	IN405.5	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 and explain the general layout of thermal power plant .

1.4 Explain the process of power generation with the help of diagrams for the following plants.

a) Hydroelectric power plant
b) Wind power plant
c) Solar power plant
d) Nuclear power plant

2.0 INSTRUMENTATION AND CONTROL IN POWER PLANT

2.1State 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 List the important variables that need to be measured in thermal power plant.

2.4 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

2.5 Explain a method of measurement of flow of feed water with a differential pressure Transducer along with its diagram.

2.6 Explain single element drum level control of boiler with a diagram.

2.7 Explain steam temperature control single-stage diagram.

2.8 Explain steam/header pressure control with a feed forward-plus- Feedback control diagram.

2.9 Explain the measurement of turbine shaft speed with a toothed- wheel transducer with its diagram

3.0 PETRO CHEMICAL PLANT INSTRUMENTATION

3.1Define petroleum refinery.

3.2 Draw and explain the general layout of a Petro chemical plant.

3.3 List basic steps in refinery process (separation, conversion & treatment).

3.4 Define the following unit operations of petro chemical plant.

a) Thermal cracking
b) Catalytic cracking
c)Polymerization
d)Alkalization
e) Isomerization

3.5 List the bi products of crude oil.

3.6 Define the term distillation column.

3.7 Define batch distillation and continuous distillation columns.

3.8 Explain the working of batch distillation column with a diagram.

3.9 Explain the working of continuous distillation column with a diagram.

3.10 List various physical parameters to be measured in distillation

4.0 IRON AND STEEL PLANT INSTRUMENTATION (ISP)

4.1 List raw materials in ISP.

4.2 Draw and explain flow scheme of pig iron production.

4.3 Draw and explain flow scheme of steel production.

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 level of molten metal

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 process.

5.3 Draw and explain the block diagram of mechanical pulping process.

5.4 Draw and explain the block diagram of chemical pulping process.

5.5 Define the term paper.

5.6 List the raw materials for making paper.

5.7 Draw and explain the general layout of paper making process.

5.8 List the various types of paper products.

5.9 List the physical properties of paper.

5.10 List types of control system units used in pulp and paper industry

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1		1		2	3	1	2
CO2	3	2	1		1		2	3	2	2
CO3	3	2	1		1		2	3	3	2
CO4	3	2	1		1		2	2	1	2
CO5	3	2	1		1		2	3	3	2
Average	3	2	1		1		2	2.8	2	2

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

Note:

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

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 powerplant.

2.0 INSTRUMENTATION AND CONTROL IN POWER PLANT:

Block diagram of boiler process in thermal power plant- measurement of flow of feed water - single element drum level control of boiler- steam temperature and pressure control- furnace draft control measurement of turbine shaft speed.

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.

5.0 PULP AND PAPER PLANT INSTRUMENTATION:

Mechanical and Chemical pulping processes -Paper Production-Physical properties of paper-Types of paper products- Control system units.

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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 THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 3.4
Unit Test – 2	From 3.5 to 5.10

DRONE TECHNOLOGY

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN406A	DRONE TECHNOLOGY	02	30	-	-	0

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	Cos Mapped
1	Introduction to Drones	6	CO1
2	Familiarization with Core Drone hardware and operation	18	CO2
3	Applications of Drones	6	CO3
	Total	30	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Understand the fundamental principles of Unmanned Aerial Vehicles (UAVs), including their types, functional block diagrams, and the role of basic electronic controls and sensors in flight.
(ii)	Explain the function and integration of core drone hardware components like frames, motors, ESCs, flight controllers, and power systems.
(iii)	Identify the diverse applications of drone technology across various sectors, including agriculture, surveying, emergency response, and logistics.

COURSE OUTCOMES

CO1	IN406.1	Familiarize with the need, operation and applications of Drones
CO2	IN406.2	Familiarize with core drone hardware and operation of Drones
CO3	IN406.3	Know about the applications of Drones

LEARNING OUTCOMES

1.0 INTRODUCTION TO DRONES

1.1. Define Drone and State the purpose of Drone.
1.2. Explain the evolution of drones.
1.3. Classify different types of drones.
1.4. List the different applications of Drones.

1.5. Draw the basic functional block diagram of a typical Drone and explain the functions of major subsystems found in drones.
1.6. Explain the roles of pitch, yaw, and roll in drone movement using electronic controls.
1.7. List the common sensors used in drones.
1.8. State the working of inertial sensors (IMU) and their integration with the flight controller.
1.9. Explain the working of RF communication systems used in drone control.
1.10. Explain the rules and regulations related to the usage of Drones in India

2.0 FAMILIARIZATION WITH CORE DRONE HARDWARE AND OPERATION

2.1 State the need of drone frame and explain the structure and function of drone frames.
2.2 List different motors used in drones
2.3 Explain the working of drone motors and the role of propellers in generating lift and control.
2.4 Define flight controller used in drones and explain the role of the flight controller in managing drone stability and orientation.
2.5 List different batteries used in drones.
2.6 State the function of power distribution boards (PDB) used in drones.
2.7 Explain the role and electronic integration of Electronic Speed Controllers (ESCs) with motors.
2.8 Explain the function of radio transmitters and receivers as the command-and-control link between the operator and the drone.
2.9 Describe the importance of radio frequency in establishing a reliable connection for control and data transmission.
2.10 Explain the concept of line-of-sight control and common factors that can limit the range of a drone.
2.11 Explain the purpose of failsafe settings as a safety protocol to manage signal loss.
2.12 List different sensors and cameras used in Drones
2.13 State the use of GPS modules in drone navigation.
2.14 Explain the role of the Inertial Measurement Unit (IMU) in stabilizing drone motion.
2.15 Explain the function and application of LiDAR in altitude sensing and obstacle avoidance.
2.16 Explain the differences between FPV, HD, thermal, and multispectral cameras used in drones.

3.0 APPLICATIONS OF DRONE

3.1 State the use of drones in agriculture for crop monitoring, pesticide spraying.
3.2 State the role of drones in aerial photography and cinematography for media, film production, and journalism.
3.3 State about the support of drones in surveying and mapping through photogrammetry and LiDAR for construction and land planning.
3.4 State the application of drones in emergency response such as search and rescue operations, fire detection, and disaster assessment.
3.5 Explain how drones are used in package delivery systems, including last-mile delivery in logistics and e-commerce.

3.6 Explain the military and defence uses of drones in surveillance, reconnaissance, and unmanned combat missions.

3.7 Explain the use of drones in smart cities for traffic monitoring, crowd management, and law enforcement.

3.8 Explain future trends in drone applications, including autonomous drones and swarm technology.

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1	1	1	1			3	2	
CO2	1	1		1	1			3	2	1
CO3	1	1						3	2	
CO4	1	1		1	1			3	2	1
CO5	1	1			2			3	2	
Average	1	1	1	1	1.25			3	2	1

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

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

(i)Assignments(ii)Tutorials(iii)Seminars(iv)GuestLectures(v)GroupDiscussions(vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 INTRODUCTION TO DRONES

Drone and its purpose of Drone - evolution of drones-Classify drones-applications of Drones-basic functional block diagram - functions of different subsystems of drones- roles of pitch, yaw, and roll in drone movement using electronic controls-common sensors used in drones- working of inertial sensors (IMU) and their integration with the flight controller- working of RF communication systems used in drone control-rules and regulations related to the usage of Drones in India

2.0 FAMILIARIZATION WITH CORE DRONE HARDWARE AND OPERATION

Drone frame its structure and function-different motors used in drones and their role in generating lift and control-flight controller and its role- different batteries used in drones- function of power distribution boards (PDB) used in drones- role and electronic integration of Electronic Speed Controllers (ESCs) with motors- function of radio transmitters and receivers in drone operation-

the concept of line-of-sight control and signal range limitations in Drone communication systems-Explain about the working of flight controller and ESC with receiver module- failsafe settings and signal loss handling mechanisms in drone electronics- different sensors and cameras used in Drones-use of GPS modules in drone navigation.- role of the Inertial Measurement Unit (IMU) in stabilizing drone motion- function and application of LiDAR in altitude sensing and obstacle avoidance- differences between FPV, HD, thermal, and multispectral cameras used in drones.

3.0 APPLICATIONS OF DRONES

Use of drones in agriculture for crop monitoring, pesticide spraying-role of drones in aerial photography-support of drones in surveying and mapping-application of drones in emergency response- use of drones in package delivery systems, logistics and e-commerce- military and defence uses of drones- use of drones in smart cities for policing- future trends in drone applications.

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LINEAR IC APPLICATIONS & E-CAD LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN407L	LINEAR IC APPLICATIONS & E-CAD LAB	06	90	40	60	02

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	COs Mapped
1	Operational Amplifier Circuits	35	CO1
2	555 Timers	25	CO2
3	PSpice /Proteus simulation or equivalent	30	CO3
	TOTAL	90	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Implement OP-AMP circuits, timers and observe waveforms.
(ii)	Simulate OP-AMP circuits using simulation software.

COURSE OUTCOMES

CO1	IN407.1	Implement the Circuits using OP-AMP and observe the waveforms.
CO2	IN407.2	Implement Timer circuits using 555 IC timer.
CO3	IN407.3	Simulate OP-AMP circuits using P-spice or equivalent.

LEARNING OUTCOMES

1. Operational Amplifier Circuits

1.1. To Implement and test IC 741 Op-Amp as
   a) Inverting amplifier
   b) Non-Inverting amplifier
   c) Voltage follower (Buffer)
   d) observe the above wave forms.

1.2. To Implement and test 741 Operation amplifier as summer and Subtractor.

1.3. To Implement and test 741 Operation amplifier as Differentiator, and Integrator and observe the wave forms.

1.4. Implement Instrumentation Amplifier using Op-Amp and calculate the gain.

1.5. Implement Schmitt trigger using Op-Amp and observe the waveforms.

2. 555 Timer

2.1. Implement Monostable multi vibrator using 555 timers and observe output waveforms.

2.2. Implement Astable multi vibrator using 555 timers and observe output waveforms.

3. PSpice /Proteus simulation or equivalent

3.1. Simulate inverting and non-inverting amplifiers using op amp and observe the waveforms.

3.2. Simulate summer and Subtractor circuits using op-amp.

3.3. Simulate Differentiator and Integrator circuits using op-amp and observe the waveforms.

3.4. Simulate Astable multivibrator using op amp.

CO-PO/PSO MAPPING

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

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

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 1.5
Unit Test– 2	From 2.1 to 3.4

COMMUNICATION AND EMPLOYABILITY SKILLS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN408L	COMMUNICATION AND EMPLOYABILITY SKILLS	04	60	40	60	02

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	COs Mapped
1.	ABC of Communication	6	CO1
2.	Let's Learn to Listen	6	CO2
3.	I am...	4	CO4
4.	Let's Talk About…	4	CO4
5.	JAM	6	CO4
6	Interpreting Data	6	CO3
7	Your Perfect Profile	4	CO5
8	Group Discussion	8	CO4, CO5
9	Interview Skills	8	CO4, CO5
10	Making Presentations	8	CO3
	Total	60	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able

(i)	To impart verbal and non-verbal communication skills
(ii)	To foster employability skills among the students for career building

COURSE OUTCOMES

CO1	IN408.1	Practice appropriate body language and etiquette
CO2	IN408.2	Listen and comprehend the listening inputs related to different genres effectively
CO3	IN408.3	Interpret data and give oral and written presentations in academic and professional contexts
CO4	IN408.4	Communicate effectively in interpersonal interactions, interviews, and group discussions
CO5	IN408.5	Exhibit employability skills: job hunting, resume writing, attending interviews

LEARNING OUTCOMES

UNIT 1: ABC of Communication

1.1. Identify and practice the process of communication.

1.2. Demonstrate befitting body language traits to enhance communication.

1.3. Apply appropriate strategies to minimize various barriers of communication.

1.4. Communicate effectively in a given situation with a purpose.

UNIT 2: **Let's Learn to Listen**

2.1. Identify and distinguish different phonic sounds in English language.

2.2. Practice active listening in the process of communication.

2.3. Comprehend diverse listening inputs in academic, professional and everyday situation using appropriate strategies.

UNIT 3: I am...

3.1. Prepare an organized self-introduction for formal and informal situations.

3.2. Introduce yourself in job interviews effectively.

3.3. Use appropriate body language while introducing yourself.

UNIT 4: Let's Talk About...

4.1. Describe objects, places, events and people using appropriate adjectives.

4.2. Use appropriate sentences and expressions while describing anything.

4.3. Use suitable adjectives to convey mood or tone.

UNIT 5: JAM

5.1. Generate ideas on a given topic.

5.2. Organize the ideas sequentially for an effective JAM speech.

5.3. Speak spontaneously and fluently on a given topic within the stipulated time.

UNIT 6: Interpreting data

6.1. Identify different forms of graphs, charts, diagrams and tables.

6.2. Analyse and interpret data.

6.3. Present the inferences and findings in spoken and written communication.

UNIT 7: Your Perfect Profile

7.1. Draft a customised professional resume.

7.2. Create a professional Applicant Tracking System (ATS) compliant Resume.

7.3. Draft a cover letter to communicate with prospective employers.

UNIT 8: Group Discussion

8.1. Identify the significance of group discussion and differentiate the various stages involved.

8.2. Practice various roles and skills involved in group discussion.

8.3. Demonstrate appropriate body language for effective participation in group discussion.

UNIT 9: Interview Skills

9.1. Practice proper interview demeanour.

9.2. Respond effectively to frequently asked interview questions (FAQs).

9.3. Demonstrate readiness to job opportunities.

UNIT 10: Making Presentations

10.1. Demonstrate the features of a good presentation.

10.2. Use appropriate presentational aids.

10.3. Prepare and give presentations on various topics effectively.

COURSE CONTENT

Sl. No.	Name of the Unit	Contents
1	ABC of Communication	• Aspects of Communication • Body language: Verbal & Nonverbal Communication • Communication Barriers • Strategies for effective communication
2	Let's Learn to Listen	• Basics of pronunciation: Vowel & Consonant sounds • Active vs Passive listening • Barriers to listening • Types of listening& Techniques for effective listening • Listening Comprehension Activities: Academic, Professional, Social conversations
3	I am…	• Significance of self-introduction in formal and informal contexts • Components and structure of self-introduction • Self-introduction in job interviews • Body language while introducing oneself
4	Let's Talk About…	• Describing objects, people, places and events • Using appropriate adjectives for different kinds of descriptions • Using right Tense and tone
5	JAM	• JAM – Structure and organisation • Generating and organising ideas for JAM speech • Dos and Don'ts of JAM • Strategies and techniques for effective JAM speech • Planning a perfect one-minute speech
6	Interpreting Data	• Presentation of data in Graphs, Charts, diagrams, and tables • Analysing and interpreting non-verbal data • Presenting non-verbal information in verbal form (spoken and written)
7	Your Perfect Profile	• Significance of a resume in career building • Resume, Curriculum Vitae (CV) and Bio-data • Applicant Tracking System (ATS) Resume – components and structure • Video Resume • Drafting a Cover letter

8	Group Discussion	• Significance of Group Discussion (GD) in job hunting • Process of Group Discussion • Sub skills of Group Discussion • GD Roles and Group dynamics • GD body language • Techniques for success in GD
9	Interview Skills	• Significance of Interviews in the Job Selection Process • Stages of Interview Preparation: Pre, While, and Post interview • Right demeanour and body language for interviews • Frequently Asked Questions (FAQs)
10	Making Presentations	• Principles of good presentation • Types of Presentational aids • Presentation etiquette • Giving effective presentations

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PS01	PS02	PS03
CO1	PO's 1 to 5 are not directly applicable for English course.					1	1	Programme Specific Outcomes are Branch specific with technical aspects which are not directly applicable to English Language course.		
CO2						1	1			
CO3						2	2			
CO4						2	2			
CO5						2	2			
Average						1.6	1.6			

3-Strongly Mapped 2- Moderately Mapped 1- Slightly Mapped

Note**:** The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (iv) Library Visits etc.,

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4. Communicative English by E. Suresh Kumar and P. Sreehari

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test– 1	From 1.1 to 5.3
Unit Test– 2	From 6.1 to. 10.3

PROCESS CONTROL LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN409L	PROCESS CONTROL LAB	06	90	40	60	1.5

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	COs Mapped
1	P, PI, PID Control Modes	30	CO1
2	Open loop and Closed loop Response	24	CO2
3	I/P & P/I Converters	24	CO3
4	Control Valves	12	CO4
	TOTAL	90	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(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	IN409.1	Observe the P, PI, PID control actions of pressure, flow, level and temperature processes.
CO2	IN409.2	Obtain open loop and closed loop response of pressure control loops.
CO3	IN409.3	Perform an experiment to convert I/P & P/I and to plot the characteristics
CO4	IN409.4	Plot the flow-lift characteristics of Linear, Quick opening and Equal percentage control valves

LEARNING OUTCOMES

1. P, PI, PID CONTROL MODES

1.1. Observe the action of the following control modes to pressure process
   i) Proportional Control
   ii) Proportional Integral Control
   iii) Proportional Integral & Derivative Control

1.2. Observe the action of the following control modes to flow process
   i) Proportional Control
   ii) Proportional Integral Control
   iii) Proportional Integral & Derivative Control

1.3. Observe the action of the following control modes to level process
   i) Proportional Control
   ii) Proportional Integral Control
   iii) Proportional Integral & Derivative Control

1.4. Observe the action of the following control modes to temperature process
   i) Proportional Control
   ii) Proportional Integral Control
   iii) Proportional Integral & Derivative Control

2. OPEN LOOP AND CLOSED LOOP RESPONSE

2.1. Obtain open loop and closed loop response of pressure control loop.

3. I/P & P/I CONVERTERS

3.1. 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.

3.2. 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.

4. CONTROL VALVES

4.1. 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 MAPPING

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

CO4	1	1			1			3	2	1
AVERAGE	1.5	1			1			3	2	1

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

Note:

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	**Learning Outcomes to be Covered**
Unit Test– 1	From 1.1 to 1.4
Unit Test– 2	From 2.1 to 4.1

FIFTH SEMESTER

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V SEMESTER

Course Code	Course Title	No. of Periods / Week		Practicum (Y/N)	Total No. of Periods /Semester	Credits	Scheme of Examination			
		Theory	Practical/ Tutorial				Duration (hours)	FA Marks	SA Marks	Total Marks
THEORY COURSES										
26IN501T	Analytical and Biomedical Instrumentation	6	-	Y	90	4	3	30	70	100
26IN502T	ARM Microcontrollers	6	-	N	90	4	3	30	70	100
26IN503T	Industrial Automation	6	-	Y	90	4	3	30	70	100
ELECTIVE COURSES										
26IN504E	Industrial Management & Entrepreneurship	3	-	N	45	2	3	30	70	100
26IN505E	Virtual Instrumentation			Y						
AUDIT COURSE										
26IN506A	Artificial Intelligence based Instrumentation	2	-	N	30	-	-	-	-	-
PRACTICAL COURSES										
26IN507L	ARM Microcontrollers Lab	-	6	N	90	2	3	40	60	100
26IN508L	Internet of Things and Industry 4.0 Lab	-	6	Y	90	2	3	40	60	100
26IN509L	Project Work	-	4	N	60	1.5	3	40	60	100
26IN510C	Student Centric Activities	-	3	N	45	0.5	-	-	-	-
	TOTAL	**23**	**19**	**-**	**630**	**20**	**-**	**240**	**460**	**700**

Note: 0.5 Credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NSS Clean and Green or Sports / Games.

ANALYTICAL AND BIOMEDICAL INSTRUMENTATION
(PRACTICUM-THEORY)

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN501T	ANALYTICAL AND BIOMEDICAL INSTRUMENTATION	06	90	30	70	04

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Introduction to Spectrophotometer and Analyzers	20	22	2	2	CO1
2	Mass spectrometry and Chromatography	10	14	2	1	CO2
3	pH , conductivity measurement and Nuclear Instrumentation	15	22	2	2	CO3
4	Introduction to bio- medical Engineering and diagnostic medical Instruments	18	14	2	1	CO4
5	Blood Pressure, flow measurement and Therapeutic Instruments	12	14	2	1	CO5
6	Modern Imaging Systems, Patient monitoring systems and patient safety	15	14	2	1	CO6
	TOTAL	90	100	12	8	

COURSE OBJECTIVES

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

COURSE OUTCOMES

CO1	IN501.1	Familiarize with different analytical and biomedical instruments.
CO2	IN501.2	Explain the principle of operation of different Analyzers, flame photometer, Refractometer, polari meter and Chromatography.
CO3	IN501.3	Explain the measurement of PH and Conductivity using PH meter, conductivity meter and detection methods of Nuclear radiation.
CO4	IN501.4	Explain the different types of electrodes used for ECG, EEG, EMG, electrical activity of heart and working of diagnostic medical instruments.
CO5	IN501.5	Explain the working of blood pressure, blood flow measurements, therapeutic medical instruments, modern image and patient monitoring systems and the safety of the patient

LEARNING OUTCOMES

1.0 INTRODUCTION TO SPECTROPHOTOMETER AND ANALYZERS

THEORY

1.1 Draw and explain the block diagram of Analytical 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 Spectro photo 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 the principle of operation of the following and list their applications

a. Paramagnetic gas analyzer.
b. Electrochemical gas analyzer.
c. Thermal conductivity type analyzer.

LABORATORY

1.9 Demonstrate how to analyze the composition of the given sample using UV Spectrophotometer.
1.10 Demonstrate how to analyze the composition of the given sample Using Visible Spectro photo Meter.
1.11 Demonstrate how to analyze the composition of the given sample using IR Spectro Photo Meter.
1.12 Demonstrate how to use Flame Photo Meter, determine the presence of metal in a given sample.
1.13 Demonstrate how to find the concentration of a given sample using a Polarimeter.
1.14 Demonstrate how to find out the refractive index of the given sample using a Refractometer.

2.0 MASS SPECTROMETRY AND CHROMATOGRAPHY

THEORY

2.1 State the principle of Mass spectrometry.
2.2 Draw and explain the block diagram of a 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

THEORY

3.1 Define P^H.
3.2 Explain the operation of digital P^H meter.
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.

LABORATORY

3.9 Demonstrate how to measure the p^H value of the given solution using p^H meter.
3.10 Demonstrate how to measure the conductivity of a given sample using a conductivity meter

4.0 INTRODUCTION TO BIO-MEDICAL ENGINEERING AND DIAGNOSTIC MEDICAL INSTRUMENTS

THEORY

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 equipment.
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.

LABORATORY

4.14 Demonstrate how to record the EMG waveform with EMG machine.
4.15 Demonstrate how to record the PQRSTU waveform with ECG machine.
4.16 Demonstrate how to record the EEG waveform with EEG machine.

5.0 BLOOD PRESSURE, FLOW MEASUREMENT AND THERAPEUTIC INSTRUMENTS

THEORY

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 a 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 defibrillator.
5.9 Draw and explain the circuit diagram of AC defibrillator.
5.10 Define dialysis.

LABORATORY

5.11 Demonstrate the use of defibrillator.
5.12 Demonstrate how to measure the blood pressure using automated digital blood pressure monitor.
5.13 Demonstrate how to measure the blood pressure i.e systolic and Diastolic blood pressure using a sphygmomanometer.

6.0. MODERN IMAGING SYSTEMS, PATIENT MONITORING SYSTEMS AND PATIENT SAFETY

THEORY

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).

LABORATORY

6.9 Demonstrate the use of the X-ray machine
6.10 Demonstrate the use of CAT scanner.

CO-PO/PSO Mapping

CO No	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1		1			3	2	
CO2	3	2	1		1			3	2	
CO3	3	2	1		1			3	1	
CO4	3	2	1		1			3	2	
CO5	3	2	1		1			2	1	
Average	3	2	1		1			2.8	1.6	

3= Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENTS

1.0 INTRODUCTION TO SPECTROPHOTOMETER 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.

2.0 MASS SPECTROMETRY AND CHROMATOGRAPHY:

Principle of operation Mass spectrometer. Principle of operation of Gas and Liquid chromatography.

3.0 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.

4.0 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, Electrocardiograph (ECG) – Block diagram; ECG waveform, Electroencephalograph (EEG) –Block diagram, EEG wave forms, Electromyography (EMG) –Block diagram, EMG Wave form.

5.0 BLOOD PRESSURE, BLOOD FLOW MEASUREMENT 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, defibrillator, dialysis.

6.0 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

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2. Chatwal & Anand-Instrumental Methods of Chemical Analysis (Himalaya Publishing house)
3. R.S. Khandpur-Hand Book of Analytical Instrumentation
4. Donald P.Eckman-Industrial Instrumentation.
5. S.K.Singh-Industrial Instruments and Control.
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 Biomedical Instrumentation
10. John.G.Webster- Medical Instrumentation
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12. LELE- Computer the Machine, Tata McGraw Hill Co.,
13. Joseph Carr & Joseph Brown- Introduction to Biomedical Equipment Technology.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 1.8, 2.1 to 3.8
Unit Test – 2	From 4.1 to 4.13,5.1 to 5.10, 6.1 to 6.8

ARM MICROCONTROLLERS

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN502T	ARM MICRO CONTROLLERS	06	90	30	70	04

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Weightage of Marks	No. of Short uestions	No. of Essay Questions	Cos Mapped
1	Fundamentals of ARM Processor	20	22	2	2	C01
2	Advanced ARM microcontroller: CORTEX-M3	20	22	2	2	CO2
3	Instruction set of the CORTEX-M3 Microcontroller	20	22	2	2	CO3
4	Embedded System basics, Communication standards and RTOS	15	17	3	1	CO4
5	Concept of Arduino	15	17	3	1	CO5
	TOTAL	90	100	12	08	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	To understand the basic concepts of ARM processor, Embedded Systems, Communication protocols, and Arduino
(ii)	To introduce an advanced microcontroller in MX series: Cortex-M3
(iii)	To know about the instruction set of Cortex-M3 for programming

COURSE OUTCOMES

CO1	IN502.1	Understand the architectural fundamentals of ARM processors, including RISC principles, pipelining, and the register file.
CO2	IN502.2	Explain the architecture and operating modes of the Cortex-M3 microcontroller, including its memory mapping and exception handling.
CO3	IN502.3	Apply the Cortex-M3 instruction set and addressing modes

		to write basic assembly language programs.
CO4	IN502.4	Differentiate between various embedded systems and real-time operating systems (RTOS), and explain common communication protocols.
CO5	IN502.5	Understand Arduino platform.

LEARNING OUTCOMES

1.0. FUNDAMENTALS OF ARM PROCESSOR

1.1. Memorize the features of RISC architecture.
1.2. Compare the features of CISC and RISC architectures.
1.3. Compare Harvard and Von-Neumann architectures.
1.4. Differentiate between a microprocessor and a microcontroller.
1.5. Compare 8051 microcontroller with ARM microcontroller.
1.6. List the features of the ARM processor.
1.7. Explain the architecture of ARM microcontroller.
1.8. Explain the ARM Core data flow model.
1.9. Discuss the register file of the ARM processor with a neat sketch.
1.10. Explain the bits of a CPSR register.
1.11. Explain the concept of Pipelining and its advantages.
1.12. Explain Pipelining in various ARM controllers.

2.0. ADVANCED ARM MICROCONTROLLER: CORTEX-M3

2.1. List the three categories of Cortex family. (Cortex-A, Cortex-M and Cortex-R)
2.2. Mention the applications of various Cortex families.(Cortex-A, Cortex-M and Cortex-R)
2.3. Recite the features of Cortex-M3 microcontroller.
2.4. Explain the Architecture of Cortex-M3 microcontroller with a simplified Block diagram.
2.5. Memorize the operating modes of Cortex-M3 microcontroller and their significance.
2.6. Define memory mapping.
2.7. Explain the Memory Mapping of Cortex-M3 microcontroller.
2.8. List the interrupts of Cortex-M3 microcontroller.
2.9. Explain the Nested Vector Interrupt Controller (NVIC) of Cortex-M3 microcontroller.
2.10. Explain the exception handling mechanism of Cortex-M3 microcontroller.
2.11. List the High-level Languages and Cross-compilers used with Cortex series microcontrollers.
2.12. List the applications of Cortex-M3 microcontroller.

3.0. INSTRUCTION SET OF CORTEX-M3 MICROCONTROLLER

3.1. Define Instruction Set.

3.2. Classify the instruction set of Cortex-M3 ARM microcontroller.
3.3. Explain the arithmetic instructions of the Cortex-M3 microcontroller.
3.4. Discuss in detail the load/store instructions of Cortex-M3 ARM microcontroller.
3.5. Write a short note on multiply and divide instructions of Cortex-M3 microcontroller.
3.6. Explain the addressing Modes of Cortex-M3 microcontroller.

4.0. EMBEDDED SYSTEM BASICS, COMMUNICATION STANDARDS AND RTOS

4.1. Define an embedded system.
4.2. State the need for an embedded system.
4.3. Differentiate between general computing system and embedded computing system.
4.4. Classify embedded systems.
4.5. List the applications of Embedded Systems.
4.6. Define a communication protocol.
4.7. State the need of a communication protocol.
4.8. List serial communication protocols and explain them.
4.9. Define Operating System (OS).
4.10. Explain in detail about Real Time Operating System (RTOS).
4.11. List the features of RTOS.
4.12. Differentiate OS and RTOS.

5.0. CONCEPT OF ARDUINO

5.1. Explain the concept of Arduino processor environment.
5.2. Discuss Arduino family boards (Arduino- Uno, Due & Nano) and their features.
5.3. List the various sensors that can be used with Arduino board.
5.4. List the advantages of Arduino platform.
5.5. Know about various drivers for Arduino.
5.6. Understand the system requirements (hardware & Software) for Arduino.
5.7. Explain how to download and install Arduino Software.
5.8. Discuss the process of developing a real-time application

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	1		2	3	1	2
CO2	3	2	2	1	2		2	3	2	3
CO3	3	3	2	2	2		2	3	3	3
CO4	2	2	1	1	1		2	2	1	2
CO5	2	2	3	2	3	1	3	3	3	3

Average	2.6	2.2	1.8	1.4	1.8	1	2.2	2.8	2	2.6

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

Note:

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 FUNDAMENTALS OF ARM PROCESSOR:

CISC and RISC, Harvard and Von-Neumann architectures, Microprocessors, Comparison of 8051 and ARM microcontrollers. Architecture of ARM Microcontroller, ARM Core data flow model, Registers of the ARM processor, Pipelining.

2.0 ADVANCED ARM MICROCONTROLLER: CORTEX-M3:

Cortex Family Overview, Cortex-M3 – Architecture, operating modes, memory mapping, NVIC, interrupts, exceptions. Development Tools- High-level languages and cross-compilers used with Cortex series microcontrollers.

3.0 INSTRUCTION SET OF CORTEX-M3 MICROCONTROLLER:

Instruction Set and Programming- Basics of instruction set, instruction categories, addressing modes, and simple programs.

4.0 EMBEDDED SYSTEM BASICS, COMMUNICATION STANDARDS AND RTOS:

Embedded Systems Fundamentals, Communication Protocols- SPI, I^2C, or UART, Operating Systems (OS & RTOS).

5.0 CONCEPT OF ARDUINO:

Concept of the Arduino processor environment, Arduino family boards, Arduino Setup- System requirements, How to download and install Arduino Software

REFERENCES

1. A.P. Godse-ARM controller, Technical Publications
2. Steve Furber-ARM System- On- Chip Architecture, Pearson Education
3. Andrew N Sloss, Dominic System, and Chris Wright-ARM System Developers Guide, Elsevier, Morgan Kaufman publisher, 1st Edition, 2008
4. JosephYiu-TheDefinitiveGuidetoARMCortex-M3andCortex-M4Processors, Elsevier, 3rd Edition, 2014
5. Shibu. K.V-Introduction to Embedded Systems, Tata McGraw-Hill, 2009
6. Raj Kamal-Embedded System-Architecture, Programming, Design, 3/e, Tata McGraw-Hill Education,2017
7. Dr.Alexander G. Dean- Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, Arm Education Media.

8. Andrew Sloss, Dominic Symes and Chris Wright-ARM System Developer's Guide, Elsevier India, 1st Edition.
9. Massimo Banzi, Michael Shiloh- Getting Started With Arduino: The Open Source Electronics Prototyping Platform, 2022, Make Community, LLC.
10. John Nussey-Arduino for Dummies, 2018 edition, learning made easy.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 2.12
Unit Test – 2	From 3.1 to 5.8

INDUSTRIAL AUTOMATION (PRACTICUM-THEORY)

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN503T	INDUSTRIAL AUTOMATION	06	90	30	70	04

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Weightage of Marks	No. of Short uestions	No. of Essay Questions	Cos Mapped
1	Introduction to PLC	18	17	3	2	C01
2	PLC Programming	30	30	3	2	CO2
3	SCADA	17	25	3	2	CO3
4	Computer Control	25	28	3	2	CO4
	TOTAL	90	100	12	08	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Familiarize with the knowledge of PLC, programming of PLC, SCADA, Computer Control.
(ii)	Familiarize with the PLC trainer and Ladder diagram programming.
(iii)	Understand the interfacing with the PLC and the use of SCADA software.

COURSE OUTCOMES

CO1	IN503.1	Explain the block diagram of PLC and list the different types of PLCs.
CO2	IN503.2	Draw and explain the ladder diagrams for different logic functions, interfacing with PLC and different applications.
CO3	IN503.3	Familiarization with SCADA.
CO4	IN503.4	Explain the block diagrams of data logger, DAS, DDC, DCS Explain the principle of operation of ROBOT and CNC Machine.

LEARNING OUTCOMES

1.0. INTRODUCTION TO PLC

THEORY

1.1 Define automation.
1.2 State the importance of automation.
1.3 Explain Relay based Control panel.
1.4 Explain PLC based control panel.
1.5 Define Programmable Logic Controller (PLC).
1.6 Explain the basic principle of PLC.
1.7 List the advantages of PLCs.
1.8 Compare Relay based and PLC-based Control panels.
1.9 Explain the block diagram of a PLC.
1.10 List different types of PLCs based on I/O's, memory, and configuration.
1.11 Explain industrial communication standards Modbus, Profibus and canbus.
1.12 Explain the interfacing of the PLC with the PC.
1.13 List the manufacturers of PLCs.
1.14 List the applications of PLC.

LABORATORY

1.15 Familiarization with PLC trainer.

2.0. PLC PROGRAMMING

THEORY

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:
a. DOL starter and STAR-DELTA starter.
b. Sequential control of induction motors.
c. Traffic light controller.
d. Level control controller.
e. Conveyer belt controller

LABORATORY

2.10 Implement the basic logic gates (AND, OR, NOT) using ladder programming.
2.11 Implement the Universal gates (NAND, NOR) using the Ladder program.
2.12 Implement the EX-OR and Ex-NOR gates using PLC.
2.13 Write the program on ON-Delay Timer and OFF-delay Timer using Ladder diagram programming.
2.14 Write the program on Retentive and non-retentive Timer using Ladder diagram programming.

2.15 Write the program on Up counter and Down Counter using Ladder diagram programming.

3.0 SCADA

THEORY

3.1 Define SCADA.
3.2 State the Purpose of SCADA.
3.3 List the features of SCADA.
3.4 Explain the hardware architecture of SCADA.
3.5 List the three main components of a SCADA.
3.6 Explain the Remote Terminal Unit of SCADA.
3.7 Explain the Master Station of SCADA.
3.8 Explain the communication infrastructure of SCADA.
3.9 Explain the creation of graphic symbols using the Graphic Display builder.
3.10 Explain the Interfacing of SCADA with PLC.
3.11 List the applications of SCADA.

LABORATORY

3.12 Implement the Traffic light controller using PLC with Ladder diagram programming.
3.13 Implement the Sequential control of induction motor using PLC with Ladder diagram programming.
3.13 Implement the Conveyer controller using PLC with Ladder programming.
3.14 Implement the Level controller using PLC with Ladder programming.
3.15 Implement the Sequential control of the induction motor using SCADA software.
3.15 Implement the conveyor controller using SCADA software.

4.0 COMPUTER CONTROL

THEORY

4.1 State the role of Computers in Process control.
4.2 Explain the block diagram of the Data Logger.
4.3 List the applications of the Data Logger.
4.4 Explain the block diagram of the Data acquisition system.
4.5 Describe the Direct Digital Control.
4.6 Explain the block diagram of the Direct Digital Control System (DDC)
4.7 List the drawbacks of DDC.
4.8 Explain the block diagram of the Digital Control System (DCS).
4.9 Define a Robot.
4.10 Classify the Robots.
4.11 State Asimov's principles in Robot.
4.12 Explain the operation of a simple robot with a block diagram.
4.13 List the applications of a Robot.
4.14 Explain the CNC Machine with a block diagram.
4.15 List the applications of the CNC Machine.

5.0 LABORATORY

4.16. Demonstrate the functions of a robot.

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1		1	1			3	2	1
CO2	2	2		2	2			3	2	1
CO3	1	1		1	1			2	2	1
CO4	1	1		1	1			3	1	1
Average	1.2	1.2		1.2	1.2			2.7	1.7	1

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

Note:

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

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 diagram using bit instructions for DOL starter, Star-Delta Starter, Traffic light control, level control, conveyor belt 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.

REFERENCES

1. Industrial control engineering- Jacob

2. Industrial automation and process control- Jon Sterenson
3. Programmable Logic Controllers- John W.Webb
4. Introduction to PLC, Delmar Cengage learning- Gary Dunning
5. Computer-based industrial control-Krishna Kanth

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 1.14, 2.1 to 2.9
Unit Test – 2	From 3.1 to 3.11, 4.1 to 4.15

INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN504E	INDUSTRIAL MANAGEMENT & ENTREPRE NEURSHIP	03	45	30	70	02

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Weightage of Marks	No. of Short Questions	No. of Essay Questions	Cos Mapped
1	Basics of Industrial Management	6	14	2	1	CO1
2	Organization structure & Organizational behaviour	10	22	2	2	CO2
3	Production management	08	22	2	2	CO3
4	Maintenance management & Industrial Safety	08	14	2	1	CO4
5	Entrepreneurship Development	08	14	2	1	CO5
6	Total Quality Management	05	14	2	1	CO6
	TOTAL	45	100	12	08	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	To familiarize the concepts of management, ownership styles, organization structures, Industrial safety, and quality control.
(ii)	To get Exposure to organizational behavioural concepts, the basics of Production and maintenance in industries
(iii)	To understand the concept of Entrepreneurship Development in industries.

COURSE OUTCOMES

CO1	IN504.1	Explain the basics of management in industry
CO2	IN504.2	Explain the Organisation structure & organizational behaviour as applied to industry
CO3	IN504.3	Explain production management and total quality management.
CO4	IN504.4	Explain the maintenance management in industries.
CO5	IN504.5	Describe the role of the entrepreneur in economic development and in improving the quality of life

LEARNING OUTCOMES

1.0. Basics of Industrial Management

1.1 Define industry, commerce (Trade), and business.
1.2 Know the need for management.
1.3 Understand the evolution of management.
1.4 Understand the functions of Management.
1.5 Explain the principles of scientific management.
1.6 Explain the principles of management.
1.7 Differentiate between management and administration.
1.8 Understand the nature of management as a profession.
1.9 Differentiate between supervisory, middle, and top-level management.
1.10 Explain the importance of managerial skills (Technical, Human, and Conceptual).

2.0. ORGANISATION STRUCTURE & ORGANISATIONAL BEHAVIOUR

2.1 Understand the philosophy and need of the organisation structure of an industry.
2.2 Understand the line, staff, and Functional organisations.
2.3 Understand the Authority and Responsibility Relationships.
2.4 Understand the differences between Delegation and decentralisation.
2.5 Explain the factors of effective organisation.
2.6 Outline the communication process.
2.7 State motivation theories.
2.8 State Maslow's Hierarchy of Needs.
2.9 List out different leadership models.
2.10 Explain the trait theory of leadership.
2.11 Explain the behavioural theory of Leadership.
2.12 Explain the process of decision-making.
2.13 Assessing Human Resource Requirements.
2.14 Know the concepts of Job analysis, Job description, and specifications.
2.15 Understand the process of recruitment, selection, training, and development.
2.16 Understand types of business ownership.
2.17 Differentiate between the business ownerships.
2.18 Know the objectives of Employee participation.
2.19 Understand the meaning and definition of social responsibilities.

2.20 Corporate social responsibility

3.0 PRODUCTION MANAGEMENT

3.1 Identify the factors of Plant Location.
3.2 Know the objectives of plant Layout.
3.3 Understand the principles of plant Layouts.
3.4 Explain the types of plant Layouts.
3.5 Relate the production department with other departments.
3.6 State the need for planning and it's advantages.
3.7 Explain the stages of Production, planning and control.
3.8 Know the basic methods demand forecasting.
3.9 Explain routing methods.
3.10 Explain scheduling methods.
3.11 Explain dispatching.
3.12 Explain Break Even Analysis
3.13 Define supply chain Management, competitive strategy, Supply chain strategy.
3.14 Draw PERT/CPM networks.
3.15 Identify the critical path

4.0 MAINTENANCE MANAGEMENT & INDUSTRIAL SAFETY

4.1 Explain the importance of maintenance management in the industry.
4.2 Know the Objectives of maintenance management.
4.3 Know the activities of maintenance management.
4.4 Understand the importance of Preventive maintenance.
4.5 Understand the need for scheduled maintenance.
4.6 Differentiate between scheduled and preventive maintenance.
4.7 Know the principles of 5 S for good housekeeping.
4.8 Explain the importance of safety at Work place.
4.9 List out the important provisions related to safety.
4.10 Explain hazard and accident.
4.11 List out different hazards in the industry.
4.12 Explain the causes of accidents.
4.13 Explain the direct and indirect costs of accidents.
4.14 Understand the types of emissions from process Industries, their effects on the environment, and control.
4.15 Understand the principles of solid waste management.

5.0 ENTREPRENEURSHIP DEVELOPMENT

5.1 Define the word entrepreneur.
5.2 Explain the requirements of an entrepreneur.
5.3 Determine the role of entrepreneurs in promoting Small Scale Industries.
5.4 Describe the details of self-employment schemes.
5.5 Explain the characteristics of successful entrepreneurs.
5.6 Explain the method of site selection.
5.7 List the financial assistance programmes.
5.8 List out the organisations that help an entrepreneur.

5.9 Know the use of EDP Programmes.
5.10 Understand the concept of Make in India, zero defect and zero effect.
5.11 State the importance of startups.
5.12 Explain the conduct of demand surveys.
5.13 Explain the conduct of a market survey.
5.14 Evaluate Economic and Technical factors.
5.15 Prepare a feasibility report study.

6.0 TOTAL QUALITY MANAGEMENT

6.1 Explain the concept of quality.
6.2 List the quality systems and elements of quality systems.
6.3 State the principles of quality Assurance.
6.4 Understand the basic concepts of TQM
6.5 Know the Pillars of TQM.
6.6 List the evolution of ISO standards.
6.7 Explain ISO standards and ISO 9000 series of quality systems.
6.8 List the beneficiaries of ISO 9000.
6.9 Explain ISO 14000.
6.10 Explain the Plan-Do-Check-Act (PDCA) cycle.

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	3	3	3	1	1
CO2	3	2	2	2	3	3	3	3	1	1
CO3	3	3	2	3	3	3	3	3	1	1
CO4	3	2	2	2	3	3	3	3	1	1
CO5	3	2	2	2	3	3	3	3	1	1
Average	3	2.2	2	2.2	3	3	3	3	1	1

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 Basics of Industrial Management

Definition of Industry, Commerce and Business; need, evolution and function of management - Principles of scientific management: – Administration and management; Nature of management; levels of management; managerial skills.

2.0 ORGANISATION STRUCTURE & ORGANISATIONAL BEHAVIOUR

Organizing - Process of Organizing; Line/Staff and functional Organizations, Decentralization and Delegation, Effective Organizing; Communication, Motivational Theories; Leadership Models; Human resources development; Forms of Business ownerships: Types – Sole proprietorship, Partnership, Joint Stock Companies, Cooperative types of Organizations; Employee participation in management; Corporate Social responsibility;

3.0 PRODUCTION MANAGEMENT

Definition and importance; Plant location and layout; Types of production -job, batch and mass; production Planning and Control: Demand forecasting, routing, scheduling, dispatching and follow up; Break even analysis; Supply chain Management (Definition, Competitive strategy Vs Supply chain Strategy, Supply chain drivers); Project scheduling; Application of CPM and PERT techniques; simple numerical problems;

4.0 MAINTENANCE MANAGEMENT & INDUSTRIAL SAFETY

Objectives and importance of plant maintenance, Different types of maintenance, Nature of maintenance problems, Range of maintenance activities, Schedules of preventive maintenance, Advantages of preventive maintenance, 5 S principles; Importance of Safety at work places; Causes of accidents-psychological, physiological and other industrial hazards; Domino sequence; methods of promoting safe practices; Pollution control in process industries; Introductory concepts on Solid waste management (General introduction including definitions of solid waste including municipal, hospital and industrial solid waste, Waste reduction at source – municipal and industrial wastes)

5.0 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 programs; Market survey and Demand survey; Preparation of Feasibility study reports.

6.0 TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM)- Concept of quality discussed by B. Crosby, W. Edward, Deming, Joseph M. Juran, Kooru Ishikawa, Genichi Taguchi, Shigco Shingo. Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, Stages of development of ISO 9000 series, ISO-14000, Deming's PDCA

REFERENCES

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_ Book_ Open_Access_2013 pages-54-76.
7. Sunil Chopra and Meindl - Supply Chain Management, PHI publishers
8. David Visco5 -S made easy

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 3.15
Unit Test – 2	From 4.1 to 6.10

VIRTUAL INSTRUMENTATION (PRACTICUM-THEORY)

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN505E	VIRTUAL INSTRUMENTATION	03	45	30	70	02

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Weightage of marks	Short Questions	Essay Questions	COs Mapped
1	Introduction to Virtual Instrumentation (VI)	10	22	2	2	CO1
2	Programming Techniques	15	33	3	3	CO2
3	Analysis tools and applications of Virtual Instrumentation	12	28	4	2	CO3
4	Smart Sensors	8	17	3	1	CO4
	TOTAL	45	100	12	8	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to:	
(i)	To understand the basic components of the Virtual Instrumentation system.
(ii)	To learn to develop VIs based on LabVIEW software.
(iii)	To learn to develop applications based on the Virtual Instrumentation system.
(iv)	To know about various VI Tool sets.

COURSE OUTCOMES:

CO1	IN505.1	Engineering Knowledge on VI
CO2	IN505.2	Understand the Virtual Instruments' basic concepts
CO3	IN505.3	Incorporate various VI Toolsets based on the application.
CO4	IN505.4	Get the knowledge of Smart Sensors.

LEARNING OUTCOMES

1.0 INTRODUCTION TO VIRTUAL INSTRUMENTATION (VI)

THEORY

1.1 Define the term Virtual Instrument (VI).
1.2 Explain the block diagram and architecture of Virtual Instrument.
1.3 Distinguish between the traditional instruments and virtual Instruments.
1.4 List and explain the different dataflow techniques.
1.5 List and explain the different graphical programming techniques in data flow
1.6 Explain various types of VI Debugging techniques.

LABORATORY

1.7 Understanding the Front Panel and Block Diagram of VI, creating basic Virtual Instruments (VIs), and working with controls and indicators.
1.8 Create a VI that takes the temperature in degrees Centigrade as input and displays the temperature both in degrees Centigrade and degrees Fahrenheit. Use a temperature indicator for display.

2.0 PROGRAMMING TECHNIQUES

THEORY

2.1 Define and Construct Modular Programs with Graphical User Interfaces for Measurement and Automation tasks.
2.2 Define loops and charts in VI and explain them.
2.3 Explain the various clusters, graphs, cases, and sequence structures in VI.
2.4 Explain various formulae nodes, local and global variables in LabVIEW.
2.5 Explain various string and file I/O, Publishing measurement data in the web, and Internet Connectivity.

LABORATORY

2.6 Create a VI to evaluate the equation $y = 4a + 3b + 5c$ using an arithmetic block or formula node.
2.7 Create a VI to compute and display the roots of a quadratic equation: $ax^2 + bx + c$ by taking the values of a, b, and c as inputs.
2.8 Design a VI to display whether the given integer is odd or even.
2.9 Create a VI to find the factorial of the given number using a for loop and shift the registers.
2.10 Create a VI of an array, initialize and access the elements in an array.
2.11 Design a VI to display whether the given integer is odd or even.

3.0 ANALYSIS TOOLS AND APPLICATIONS OF VIRTUAL INSTRUMENTATION

THEORY

3.1 Explain the applications of CRO using LabVIEW.
3.2 Explain the ON-OFF controller and PID controller using LabVIEW.
3.3 Explain the use of a virtual function generator in electronic applications.
3.4 Explain the concept of a multimeter and the design of a voltmeter with a transducer input.
3.5 Define Signal processing.
3.6 Define and explain the Fourier transform and power spectrum of a signal.
3.7 Explain windowing and filtering in signal processing.
3.8 Explain correlation methods.

LABORATORY

3.9 Device virtual function generator and CRO with front panels and block diagrams, for generation of signals using function generator and measurement of frequency and amplitude using CRO.

3.10 Design virtual CRO capable of addition of two waveforms with front panel and block diagram.
3.11 Create a VI to generate and analyze a sine wave signal.
3.12 Explain how to implement a Fourier Transform (FT) using LabVIEW to convert a time-domain signal into the frequency domain.

4.0 SMART SENSORS

THEORY

4.1 Define a sensor and classify them.
4.2 Explain the general architecture for smart sensors.
4.3 Explain the block-level design for consideration for smart sensors.
4.4 Explain the importance and adoption of smart sensors.
4.5 Explain in detail the types of smart sensor compensation.

LABORATORY

4.6 Design a front panel and block diagram to simulate a temperature control system.
4.7 Design a front panel and block diagram to simulate a tank control system.

CO-PO/PSO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	3			3	3	3	3
CO2	3	3	3	3			3	3	3	3
CO3	3	3	3	3			3	3	3	3
CO4	3	3	3	3			3	3	3	3
Average	3	3	3	3			3	3	3	3

3= Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENTS

1.0 INTRODUCTION TO VIRTUAL INSTRUMENTATION:

Review of Digital Instrumentation, Concept of Virtual Instrumentation- Historical perspective -need of VI -advantages- definition of VI- Block diagram and architecture of a Virtual Instrument – Traditional Instruments versus Virtual Instruments - dataflow techniques, graphical programming in data flow, VI Debugging Techniques.

2.0 PROGRAMMING TECHNIQUES:

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formulae nodes, local and global variables, State machine, string and file I/O, Publishing measurement data in the web, Internet Connectivity.

3.0 ANALYSIS TOOLS AND APPLICATIONS OF VI:

Analysis tools- Signal Processing Tool set- Fourier transforms, Control and Simulation Toolkit, On-Off controller, PID Control. Application of VI in process control designing of equipment like oscilloscope, Multimeter, Design of digital Voltmeters with transducer input- Applications of VI for Process Control and Instrumentation.

4.0 SMART SENSORS:

Definition – Sensor classification- General architecture of smart sensors, Description of smart sensor architecture- Block level design consideration for smart sensor-Importance and adoption of smart sensor.

REFERENCES

1. Jovitha Jerome - Virtual Instrumentation using LabVIEW, Eastern Economy edition, PHI learning private Ltd., 2010.
2. Gary Johnson - LabVIEW Graphical Programming, McGraw Hill, 2006.
3. Skolkoff - Basic concepts of LABVIEW 4, PHI, 1998.
4. Paul Bates - Practical Digital and Communications, Prentice-Hall, 1987.
5. J.B.Dixit, Amit Yadav - Intelligent Instrumentation for Engineers, University Science Press2012.
6. Lisa .K, Wells and Jeffrey Travis - LABVIEW for Everyone, Prentice Hall, 2009.
7. Kevin James - PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.
8. Gupta. S, Gupta. J.P - PC Interfacing for Data Acquisition and Process Control, ISA, 1994.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 2.5
Unit Test – 2	From 3.1 to 4.5

AI BASED INSTRUMENTATION

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN506A	AI BASED INSTRUMENTATION	02	30	-	-	0

TIME SCHEDULE

S. NO	Chapter/ Unit Title	No. of Periods	Cos Mapped
1	Introduction to Artificial Intelligence-based Instrumentation	10	C01
2	Advanced Control System	09	CO2
3	Machine Learning for Instrumentation	05	CO3
4	Deep Learning for Instrumentation	04	CO4
5	Case studies	02	CO5
	TOTAL	30	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Familiarize with the knowledge of AI based Instrumentation, advanced control system.
(ii)	Familiarize with the knowledge of machine learning and deep learning for instrumentation and analysis of case studies

COURSE OUTCOMES

CO1	IN506.1	Understand the fundamental concepts of AI and its application in instrumentation systems.
CO2	IN506.2	Analyze and compare advanced AI-based control systems, including adaptive, robust, optimal, fuzzy logic, and neural network controllers
CO3	IN506.3	Apply machine learning techniques to solve real-world instrumentation problems such as predictive maintenance, process optimization, and quality control.
CO4	IN506.4	Explain and utilize deep learning concepts like computer vision and natural language processing in industrial instrumentation and HMI
CO5	IN506.5	Evaluate and analyze the successful implementation of AI in instrumentation through real-world case studies.

LEARNING OUTCOMES

1.0. INTRODUCTION TO AI-BASED INSTRUMENTATION

1.1. Overview of AI
1.2. Explain the history of AI
1.3. Explain about Intelligent Agents in AI
1.4. What are the search algorithms in AI?
1.5. Know about Knowledge Representation (KR) in Artificial Intelligence (AI).
1.6. Define the term Artificial Intelligence (AI) powered instrumentation.
1.7. State the use of AI-based instrumentation.
1.8. Draw and explain the block diagram of AI-based Instrumentation.
1.9. List the advantages and disadvantages of AI used for instrumentation.

2.0. ADVANCED CONTROL SYSTEMS

2.1. Define and explain the optimal control system.
2.2. List the applications of the optimal control system.
2.3. Define and explain the fuzzy logic control system.
2.4. List the applications of a fuzzy logic control system.
2.5. Define and explain the neural network-based control system.
2.6. List the applications of a neural network-based control system.

3.0. MACHINE LEARNING FOR INSTRUMENTATION

3.1. What is the meaning of machine learning for instrumentation?
3.2. Define and explain predictive maintenance.
3.3. Define and explain process optimization.
3.4. How does AI improve quality control?
3.5. Define sensor fusion.

4.0. DEEP LEARNING FOR INSTRUMENTATION

4.1. How deep learning helps for instrumentation.
4.2. Define neural networks.
4.3. List the types of neural networks.
4.4. Explain Computer Vision for Industrial Applications.
4.5. Explain Natural Language Processing (NLP) in HMI.

5.0. CASE STUDIES

5.1. Analyse case studies of successful applications of AI in instrumentation.

CO-PO/PSO Mapping

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

CO3	2	2	3	3	3	1	1	3	3	3
CO4	2	2	3	2	3			2	3	3
CO5	1	2	2	3	2	2	1	2	2	3
Average	2.2	2.2	2.2	2.5	2.25	1.3	1	2.4	2.2	2.8

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

Note:

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

COURSE CONTENT

1.0 INTRODUCTION TO ARTIFICIAL INTELLIGENCE-BASED INSTRUMENTATION

Overview of AI, history, intelligent agents, search algorithms, knowledge representation, AI-based instrumentation.

2.0 ADVANCED CONTROL SYSTEMS

Optimal control, fuzzy logic control, and neural network-based control.

3.0 MACHINE LEARNING FOR INSTRUMENTATION

Predictive Maintenance, Process Optimization, Quality Control, Sensor Fusion.

4.0 DEEP LEARNING FOR INSTRUMENTATION

Neural Networks, Computer Vision for Industrial Applications, Natural Language Processing (NLP) in HMI.

5.0 CASE STUDIES

Analysing case studies of successful applications of AI in instrumentation to learn from real-world examples.

REFERENCES

1. Stuart Russell and Peter Norvig- Artificial Intelligence: A Modern Approach.
2. Katsuhiko Ogata - Modern Control Engineering.
3. Karl J. Åström and Björn Wittenmark - Adaptive Control: Stability, Convergence and Robustness.
4. Timothy J. Ross - Fuzzy Logic with Engineering Applications.
5. Simon HaykIN Neural Networks and Learning Machines.
6. Christopher M. Bishop - Pattern Recognition and Machine Learning.
7. Ian Goodfellow, Yoshua Bengio, and Aaron Courville - Deep Learning.
8. Keras & TensorFlow" by Aurélien Géron -Hands-On Machine Learning with Scikit-Learn.
9. Richard Szeliski - Computer Vision: Algorithms and Applications.

ARM MICROCONTROLLERS LAB

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN507L	ARM MICROCONTROLLERS LAB	06	90	40	60	02

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	COs Mapped
1	Familiarization with the CORTEX-M3 microcontroller board/Arduino board (Arduino Due)	10	CO1
2	Familiarization with Keil µVision software	10	CO2
3	ARM Programming using Keil µVision software	20	CO3
4	Embedded C programming & Interfacing with ARM Microcontroller	20	CO4
5	Familiarize with the real-time Arduino Applications	30	CO5
	TOTAL	90	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Developing practical skills in microcontroller programming and application development.
(ii)	Students will learn to use Cortex-M3 ARM microcontrollers and Arduino boards (Arduino Due), along with relevant software tools, to create and implement embedded systems.

COURSE OUTCOMES

CO1	IN507.1	Understand the architecture of the Cortex-M3 ARM microcontroller and become proficient with KeilµVision and Arduino IDE development environments.
CO2	IN507.2	Develop and implement Assembly language programs for fundamental arithmetic and data manipulation tasks on the ARM platform.
CO3	IN507.3	Apply knowledge of ARM Assembly language to solve more complex algorithmic problems like finding the largest number in an array or the factorial of a number.

CO4	IN507.4	Write and execute Embedded C programs to interface with and control peripherals such as LEDs, LCDs, and sensors.
CO5	IN507.5	Design and build real-time embedded applications by integrating software and hardware components for automation projects.

LEARNING OUTCOMES

I. FAMILIARIZATION WITH THE CORTEX-M3 MICROCONTROLLER BOARD/ARDUINO BOARD (ARDUINO DUE)

1. Familiarization with the Cortex-M3 ARM microcontroller board/Arduino board (Arduino Due), which contains Cortex-M3 ARM microcontroller.

II. FAMILIARIZATION WITH THE KEIL µVISION SOFTWARE:

2. Know how to download and install KeilµVision 4 or 5 software, Arduino IDE, or any equivalent software.

III. ARM PROGRAMMING USING KEIL µVISION SOFTWARE:

3. Write an Assembly language program to add two 32-bit numbers.
4. Write an Assembly language program to add two 32-bit numbers and store the result with carry in memory.
5. Write an Assembly language program to subtract and reverse subtract two 64-bit numbers
6. Write an Assembly language program to perform the Multiplication of two 32-bit numbers and store the result in memory.
7. Write an Assembly language program to find a number is even or odd.
8. Write an Assembly language program to perform one's complement of a given number.
9. Write an assembly language program to find the sum of the first 10 integer numbers.
10. Write an assembly language program to find the factorial of a number.
11. Write an ALP to find the largest/smallest number in an array of 10 numbers.
12. Write an ALP to block transfer the data from one location to another location.
13. Using logical instructions, perform logical AND & ORing of two 32-bit numbers.

IV. EMBEDDED C PROGRAMMING & INTERFACING WITH ARM MICROCONTROLLER /ARDUINO BOARD (ARDUINO DUE):

14. Write a C program to blink an LED for 2 seconds and to perform testing, interface the LED to a Cortex-M3 ARM microcontroller board/Arduino board.
15. Write a C program to Interface PIR motion sensor with Cortex-M3 ARM microcontroller board/Arduino board, and detect the presence of a person.
16. Write a C program to Interface Ultrasonic Distance Sensor with Cortex-M3 ARM microcontroller board/Arduino board, and measure the distance from an object.
17. Write a C program to Interface DHT11 sensor (Digital Humidity & Temperature Sensor) to Cortex-M3 ARM microcontroller board/Arduino board, and measure the temperature and humidity in the room.

V. FAMILIARIZE WITH THE FOLLOWING REAL-TIME ARDUINO APPLICATIONS

18. Automation of Street Lights,
19. Automation of watering of plants
20. Automation of a Smart house.

CO-PO/PSO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1				3			1	1	
CO2	3	2	2	1	2				3	1
CO3	3	2	2	1	2				3	1
CO4	3	3	3	2	3			2	3	3
CO5	2	3	3	3	3	2	1	2	3	3
AVERAGE	2.4	2.5	2.5	1.75	2.6	2	1	1.6	2.6	2

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

Note:

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test – I	From 1 to 13
Unit Test– II	From 14 to 20

INTERNET OF THINGS & INDUSTRY 4.0 LAB (PRACTIUM-PRACTICAL)

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN508L	INTERNET OF THINGS & INDUSTRY 4.0 LAB	06	90	40	60	02

TIME SCHEDULE

S.NO	Chapter/ Unit Title	No. of Periods	COs Mapped
1	Introduction to Industry 4.0	09	CO1
2	Introduction to Internet of Things	11	CO2
3	IoT and M2M	12	CO3
4	Elements of IoT	12	CO4
5	IoT Application Development	12	CO5
6	Ethics in IoT	17	CO5
7	IoT Case Studies	17	CO5
	TOTAL	90	

COURSE OBJECTIVES

Upon Completion of the course, the student shall be able to	
(i)	Explain the Internet of Things, Industry 4.0, and its hardware and software components.
(ii)	Explain interface I/O devices, sensors & communication modules.
(iii)	Understand IoT-based case studies and projects.
(iv)	Familiarize with software installation.
(v)	Interfacing one component with another.
(vi)	Write a program on Arduino/Raspberry Pi to perform various operations.

COURSE OUTCOMES

CO1	IN508.1	Understand internet of Things, industry 4.0 and its hardware and software components.
CO2	IN508.2	Know about Software Installation.

CO3	IN508.3	Interface I/O devices, sensors & communication modules.
CO4	IN508.4	Remotely monitor data and control devices and develop real-life IoT based projects.
CO5	IN508.5	Know about ethics in IoT and working on IoT case studies

LEARNING OUTCOMES

1.0 INTRODUCTION TO INDUSTRY 4.0

THEORY

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.

LABORATORY

1.8 Familiarization with Arduino/Raspberry Pi and perform necessary software installation.

2.0 INTRODUCTION TO INTERNET OF THINGS

THEORY

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

LABORATORY

2.8 To Interface LED/Buzzer with Arduino/Raspberry Pi and write a program to Turn ON LED for 1 second after every 2 seconds.

3.0 IOT AND M2M

THEORY

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).

LABORATORY

3.10 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.

4.0 ELEMENTS OF IOT

THEORY

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.

LABORATORY

4.8 To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.

5.0 IOT APPLICATION DEVELOPMENT

THEORY

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.

LABORATORY

5.9 To interface Motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.

6.0 ETHICS IN IOT

THEORY

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.

LABORATORY

6.5 To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.

7.0 IOT CASE STUDIES

THEORY

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.

LABORATORY

7.2 To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.

7.3 To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1' or '0' received from smart phone using Bluetooth.

7.4 Write a program on arduino/Raspberry Pi to upload temperature and humidity data to things peak could.

7.5 Write a program on arduino/Raspberry Pi to retrieve temperature and humidity data from things peak could.

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1	1	2	1			3	2	1
CO2	1	1	1	3	1			3	2	1
CO3	1	1	1	2	1			3	2	1
CO4	1	1	1	2	1			3	2	1
CO5	1	1	1	2	1			3	2	1
Average	1	1	1	2.2	1			3	2	1

3 = Strongly Mapped 2= Moderately Mapped 1= Slightly Mapped

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (vii) Industrial Visits (viii) Tech Fests (ix) Mini Projects (x) Library Visits etc.,

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, IoT communication API's, IoT enabling Technologies Wireless sensornetworks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT Levels and 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:

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.

6.0 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

REFERENCES

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3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry - IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things. Cisco Press, 2017
4. Arshdeep Bahga, Vijay Madisetti - Internet of Things – A hands-on approach, Universities Press, 2015
5. Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley - The Internet of Things – Key applications and Protocols, 2012 (for Unit 2).
6. Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle - From Machine-to-Machine to the Internet of Things –

Introduction to a New Age of Intelligence, 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
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TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning Outcomes to be Covered
Unit Test– I	1.8,2.8,3.10 and 4.8
Unit Test– II	5.9,6.5, 7.2 to 7.5

PROJECT WORK

Course Code	Course Title	No. Of Periods/ Week	Total No of Periods/ Semester	FA Marks	SA Marks	Credits
26IN509L	PROJECT WORK	4	60	40	60	1.5

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
i	Enhance the knowledge by innovative learning and get the skills through the teamwork
ii	Provide with the opportunity to synthesize knowledge from various areas of learning
iii	Critically and creatively apply it to real life situations

COURSE OUTCOMES

CO1	IN509.1	Organising teamwork.
CO2	IN509.2	Innovative learning.
CO3	IN509.3	Apply theoretical knowledge to practical work situations.
CO4	IN509.4	Practice technical project reports preparation and presentation.

LEARNING OUTCOMES

1. Problem-solving and Critical Thinking

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 Draw Appropriate Conclusions

1.13 Preparation of project report.

2. Communication

2.1 Communicate effectively.

2.2 Present Ideas Clearly.

2.3 Present Ideas Coherently.

2.4 Report writing.

3. Collaboration

3.1. Discuss the ideas.

3.2. Coordinate with team members

3.3. Team work in accomplishing the task.

4. Independent Learning

4.1 Involves in the group task.

4.2 Analyse the appropriate actions.

4.3 Compares merits and demerits

4.4 Analyse the activities for sustainability

4.5 Analyse the activities to ensure ethics

5. Ethics

5.1 Give respect and value to all classmates, educators, colleagues, and others

5.2 Understand the health, safety, and environmental impacts of their work

5.3 Recognize the constraints of limited resources

5.4 Develop sustainable products and processes that protect the health, safety, and prosperity of future generations

5.5 Maintain integrity in all conduct and publications and give due credit to the contributions of others.

CO-PO/PSO MAPPING

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1				3			1	1	
CO2	3	2	2	1	2				3	1
CO3	3	2	2	1	2				3	1
CO4	3	3	3	2	3			2	3	3
CO5	2	3	3	3	3	2	1	2	3	3
AVERAGE	2.4	2.5	2.5	1.75	2.6	2	1	1.6	2.6	2

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

Note:

The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

COURSE CONTENT

1.0 Design/Assembling/Analysis/Case Study Projects in the areas of Electronics & Instrumentation Engineering.

Weightage of marks for Assessment of Learning Outcomes of Project work

S.No	Item	Marks
1	**Internal Marks** Completion of Assigned task in the group/individual to complete the project	**40**
2	**End Exam Marks:** i) Demonstration of skill relevant to the project (30) ii) Project Report (20) iii) Viva Voce (10)	**60**
Total marks		**100**

- Each group should have a faculty supervisor assigned by the HOS/Principal.
- End Examination assessment shall be done by HECES, external examiner and faculty supervisor who guided the students during project work.

- The external examiner shall be from an industry/organisation/Head of ECE of other polytechnic/Senior faculty of other polytechnic.

Internal Assessment Guidelines:

- First Review: To be conducted after the completion of 4 weeks.
- Second Review: To be conducted after the completion of 10 weeks.
- Third Review: To be conducted after the completion of 14 weeks.

SCHEME OF EVALUATION

Internal marks

Review 1 (10 Marks)	**Review 2 (15 Marks)**	**Review 3 (15 Marks)**
COMMITTEE: 5 Marks SUPERVISOR: 5 Marks	COMMITTEE: 7.5 Marks SUPERVISOR: 7.5 Marks	COMMITTEE: 7.5 Marks SUPERVISOR: 7.5 Marks

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SIXTH SEMESTER

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI SEMESTER

DIPLOMA IN ELECTRONICS AND INSTRUMENTATION ENGINEERING								
SIXTH SEMESTER (INDUSTRIAL TRAINING)								
SL NO	Course Title	Duration	**SCHEME OF EVALUATION**					
			Assessment No	Upon completion of	Conducted by	Based on	Max Marks	Credits
1	**26IN601I Industrial Training**	**one semester**	Pre-Assessment	15 Days to 30 Days from the commencement of training	Mentor faculty member visits the industry one month after commencement of training and will submit a detailed report to the principal outlining each candidate's details and observed work culture			
			1 (Formative Assessment)	Mid-Semester Assessment (after three months - at the industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120	6
			2 (Formative Assessment)	Last month of training (at industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120	6
			3 (Summative Assessment)	After completion of the training (at Institution)	1. The faculty member concerned, 2. HoS concerned 3. An external examiner from Industry	1. Demonstration of any one of the skills listed in the learning outcomes	30	3
						2. Training Report	20	3
						3. Viva Voce	10	2
						TOTAL	300	20

The industrial training shall carry a maximum of 300 marks. The pass mark is 50% in the first and second assessments put together, and also 50% in the final summative assessment at the institution level.

Each staff member shall be assigned a batch of students 10 to 15 as a mentor faculty for making assessment during industrial training.

INDUSTRIAL TRAINING

Course Code	Course Title	Duration	FA Marks	SA Marks	Credits
26IN601I	Industrial Training	Semester	240	60	20

TIME SCHEDULE

S. No.	TOPICS	Duration
1	Practical training in Industry	Semester
2	Training Report Preparation Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents (introduction of Industry, Plant Layout, Organization Chart, List of Major Equipment's, List of Processes: Skills Acquired, Conclusions, References	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
i	Expose to real time working environment
ii	Enhance knowledge and skill already learnt in the institution.
iii	Acquire the required skills of troubleshooting of various electronic devices, assembling, servicing, and supervising in the engineering fields.
iv	Install the good qualities of integrity, responsibility and self confidence.

COURSE OUTCOMES

CO1	IN601.1	Apply theory to practical work situations
CO2	IN601.2	Cultivate sense of responsibility and good work habits
CO3	IN601.3	Exhibit the strength, teamwork spirit and self-confidence
CO4	IN601.4	Write report in technical projects

CO-PO/PSO MAPPING

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

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

LEARNING OUTCOMES

The student shall be able to display the following skill sets

1) Use appropriate tools/instruments for a given purpose and measure the values using instruments
2) Assembling and Disassembling of circuits
3) Coding and debugging
4) Troubleshoot/ Rectification of the problem
5) Design and Fabrication of the circuit
6) Soft skills and Reporting

SCHEME OF EVALUATION

26IN601I, INDUSTRIAL TRAINING

Assessment No	Upon completion of	Conducted by	Based on	Max Marks
Pre-Assessment	15 Days to 30 Days from the commencement of training	Mentor faculty member visits the industry one month after commencement of training and will submit a detailed report to the principal outlining the each candidate's details and observed work culture		
1 (Formative Assessment)	Mid Semester Assessment (after three months - at industry	1.The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
2 (Formative Assessment)	Last month of training (at industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120

3 (Summative Assessment)	After completion of the training (at Institution)	1.The faculty member concerned, 2.HoS concerned 3.An external examiner from Industry	1.Demonstration of any one of the skills listed in learning outcomes	30
			2.Training Report	20
			3. Viva Voce	10
			TOTAL	300

Weightage of marks for Assessment of Skill sets during first and second assessment.

Skill Set Sl.No	**SKILL SET**	**Max Marks Allotted For each parameter**
1	Use appropriate tools/instruments for a given purpose and measure the values using instruments	15
2	Assembling and Disassembling of circuits	20
3	Programming/Coding/debugging	15
4	Troubleshoot/ Rectification of the problem	20
5	Design and Fabrication of the circuit	25
6	Softskills and Reporting Skills	25
	Total	120

During assessment, the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the weightage assigned as above. In case the student has undergone training in a few skill sets then the total marks obtained shall be raised to 120 marks for the given assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets.

Illustration

If the student has undergone training in only 4 skill sets (namely serial number 1, 3, 4, 5 of above skill sets) and marks awarded during assessment is 50 out of 80 marks, then the marks of 50 shall be enhanced to 120 proportionately as (50/80)*120=75.