COMPETENCY BASED CURRICULUM

DIPLOMA
IN
ELECTRONICS & COMMUNICATION ENGINEERING

(Duration 03 Years)
NSQF Level – 5

Under
Haryana State Board of Technical Education

Developed By

Curriculum Development Center

National Institute of Technical Teachers Training & Research

(Ministry of Education, Government of India)

Sector - 26, Chandigarh, UT, India.

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PREFACE

Learning and learning experience are the foundation of any education system. Appropriateness of education and its useful implications stand on the platform of knowledge and skill. But the knowledge and skill cannot be quantified qualitatively without ensuring learning experience. Curriculum is the pathway to select and organise learning experience. It helps the teachers to provide tangible resources, goals and objectives to learners. Curriculum acts as a catalyst to stimulate creativity, innovation, ethics, values, responsibility and many human factors. Curriculum embodies rigour and high standards and creates coherence to empower learner to meet the industrial and societal needs. Curriculum is a central guide for a teacher to plan a standard based sequence for the instructional delivery.

The industrial revolution 4.0 has forced the technical education system to reinvent the curriculum to meet the human resource requirement of the industry. The data driven systems relying on the subjects like machine-learning, Artificial Intelligence, Data Science etc are literally forcing the technical education system to offer different subjects differently to address the emerging challenges. The non-linear way of learning now facilitates students to choose path of knowledge to skill or vice-versa. The bi-directional process requires innovative curriculum design and revision. Diploma programme is now more challenging than ever. The level of skill and knowledge demanded by industry from diploma holders are highly interdisciplinary at the same time address special need. Hence, there is a need to align the curriculum to National Skill Qualification Framework (NSQF).

National Education Policy, NEP-2020 has now opened up diversities for the education system to explore and exploit to make the education relevant. The policy emphasises to inculcate value, ethics, respect to culture and society etc along with industry ready knowledge and skill among the students. The interdisciplinary nature of curriculum, academic bank of credits and integration of technology in teaching-learning envisaged in NEP-2020 make it more challenging for curriculum development. NITTTR, Chandigarh has developed the art of curriculum development over 54 years of its existence. The expertise and experience available in the institute follow time-tested and acclaimed scientific methods to design/revise curriculum. The experienced faculty members entrusted with the curriculum development or revision activities are well-versed with NSQF, NEP and Outcome based education. I am happy to note that **Haryana State Board of Technical Education, Panchkula, Haryana** reposed their confidence on this expertise to develop **AICTE/NSQF/NEP 2020** aligned curriculum for the state. This documented curriculum is an outcome of meticulous planning and discussions among renowned experts of the subject through series of workshops. The effective implementation of this curriculum supported with quality instructional resources will go a long way in infusing the learning experience among learners to make them industry ready.

Director

National Institute of Technical Teachers Training & Research, Chandigarh

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Professor & Head
Curriculum Development Center
National Institute of Technical Teachers Training & Research, Chandigarh

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1. SALIENT FEATURES

1.	Name	:	**Diploma in Electronics & Communication Engineering**
2.	Duration	:	**03 Years**
3.	Hours per week	:	**35**
4.	Entry Qualification	:	**10th Pass**
5.	Student Intake	:	**As per sanctioned strength**
6.	Pattern	:	**Semester**
7.	Scheme	:	**Multi Point Entry and Exit**
8.	NSQF Level	:	**5**
9.	Theory Practical Ratio	:	**35 : 65**
10.	Project Work	:	**Minor and Major Project**
11.	In-house/Industrial Training	:	**Mandatory after First and Second Year**

2. NSQF GUIDELINES

National Skill Qualification Framework has defined total Ten Levels. Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

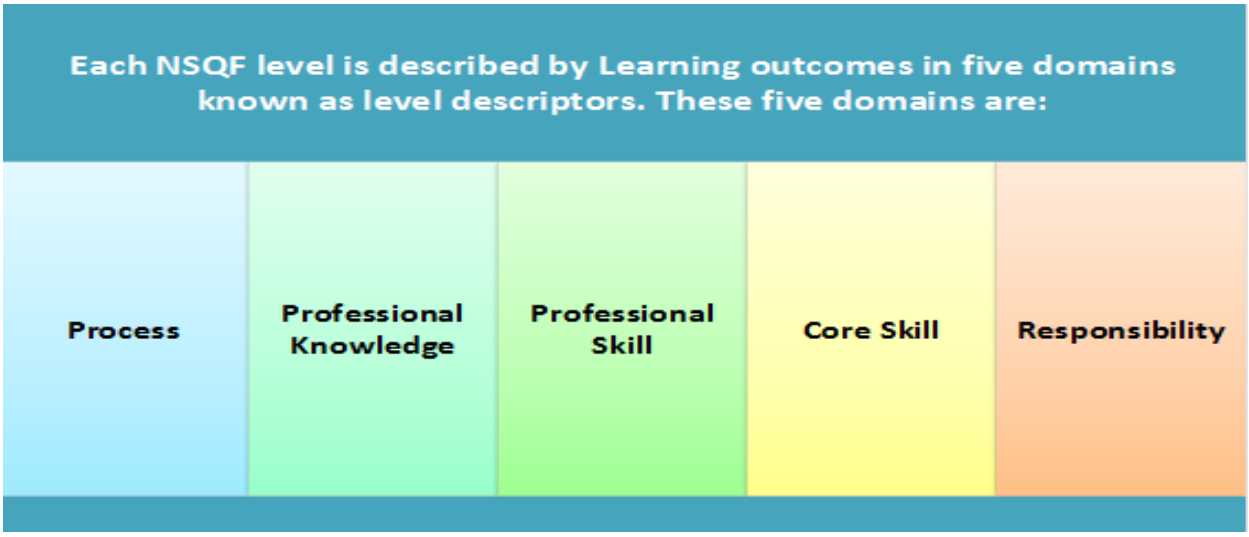

Fig1: NSQF Domains

NSQF LEVEL - 3 COMPLIANCE

The NSQF level - 3 descriptor is as follows:

Process	• Person may carry out a job which may require limited range of activities routine and predictable.
Professional Knowledge	• Basic facts, process and principle applied in trade of employment.
Professional Skill	• Recall and demonstrate practical skill, routine and repetitive in narrow range of application.
Core Skill	• Communication written and oral, with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment.
Responsibility	• Under close supervision. Some responsibility for own work within defined limit.

Fig 2: NSQF Level – 3 Descriptor

Work requiring knowledge, skills and aptitudes at level 3 will be routine and predictable. Job holders will be responsible for carrying out a limited range of jobs under close supervision. Their work may require the completion of a number of related tasks. People carrying out these job roles may be described as “Semi skilled workers”. Individuals in jobs which require level 3 qualifications will normally be expected to be able to communicate clearly in speech and writing and may be required to use arithmetic and algebraic processes. They will be expected to have previous knowledge and skills in the occupation and should know the basic facts, processes and principles applied in the trade for which they are qualified and be able to apply the basic skills of the trade to a limited range of straightforward jobs in the occupation.

They will be expected to understand what constitutes quality in their job role and more widely in the sector or sub-sector and to distinguish between good and bad quality in the context of the jobs they are given. Job holders at this level will be expected to carry out the jobs they are given safely and securely. They will work hygienically and in ways which show an understanding of environmental issues. This means that they will be expected to take responsibility for their own health and safety and that of fellow workers and, where appropriate, customers and/or clients. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social environment. They should be able to make a good contribution to team work.

NSQF LEVEL - 4 COMPLIANCE

The NSQF level-4 descriptor is given below:

Process	• Work in familiar, predictable, routine, situation of clear choice
Professional Knowledge	• Factual knowledge of field of knowledge or study.
Professional Skill	• Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts.
Core Skill	• Communication written and oral, with required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment.
Responsibility	• Responsibility for own work and learning.

Fig 3: NSQF Level – 4 Descriptor

Work requiring knowledge, skills and aptitudes at level 4 will be carried out in familiar, predictable and routine situations. Job holders will be responsible for carrying out a range of jobs, some of which will require them to make choices about the approaches they adopt. They will be expected to learn and improve their practice on the job. People carrying out these jobs may be described as "skilled workers". Individuals in jobs which require level 4 qualifications should be able to communicate clearly in speech and writing and may be required to use arithmetic and algebraic processes. They will be expected to have previous knowledge and skills in the occupation in which they are employed, to appreciate the nature of the occupation and to understand and apply the rules which govern good practice. They will be able to make choices about the best way to carry out routine jobs where the choices are clear.

They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their job roles. Job holders at this level will be expected to carry out their work safely and securely and take full account of the health and safety on colleagues and customers. They will work hygienically and in ways which show an understanding of environmental issues. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social and political environment. They should be able to guide or lead teams on work within their capability.

NSQF LEVEL - 5 COMPLIANCE

The NSQF level-5 description is given below:

Process	• Job that requires well developed skill, with clear choice of procedures in familiar context.
Professional Knowledge	• Knowledge of facts, principles, processes and general concepts, in a field of work or study.
Professional Skill	• A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information.
Core Skill	• Desired mathematical skill; understanding of social, political; and some skill of collecting and organising information, communication.
Responsibility	• Responsibility for own work and learning and some responsibility for others' works and learning

Fig 4: NSQF Level – 5 Descriptor

Work requiring knowledge, skills and aptitudes at level 5 will also be carried out in familiar situations, but also ones where problems may arise. Job holders will be able to make choices about the best procedures to adopt to address problems where the choices are clear. Individuals in jobs which require level 5 qualifications will normally be responsible for the completion of their own work and expected to learn and improve their performance on the job. They will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others' work and learning. People carrying out these jobs may be described as "fully skilled workers" or "supervisors".

Individuals employed to carry out these jobs will be expected to be able to communicate clearly in speech and writing and may be required to apply mathematical processes. They should also be able to collect and organise information to communicate about the work. They will solve problems by selecting and applying methods, tools, materials and information. They will be expected to have previous knowledge and skills in the occupation, and to know and apply facts, principles, processes and general concepts in the occupation. They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their work. They will be expected to operate hygienically and in ways which show an understanding of environmental issues. They will take account of health and safety issues as they affect the work they carry out or supervise.

In working with others, they will be expected to conduct themselves in ways which show an understanding of the social and political environment.

3. NATIONAL EDUCATION POLICY (NEP) - 2020

NEP 2020 aims at a comprehensive holistic education to develop all capacities of human beings - intellectual, aesthetic, social, physical, emotional, and moral - in an integrated manner. A holistic arts education will help develop well-rounded individuals that possess: critical 21st century capacities in fields across the arts, humanities, languages, sciences, social sciences, and professional, technical, and vocational fields; an ethic of social engagement; soft skills, such as communication, discussion and debate; and rigorous specialization in a chosen field or fields. Such a holistic education shall be, in the long term, the approach of all undergraduate programmes, including those in professional, technical, and vocational disciplines.

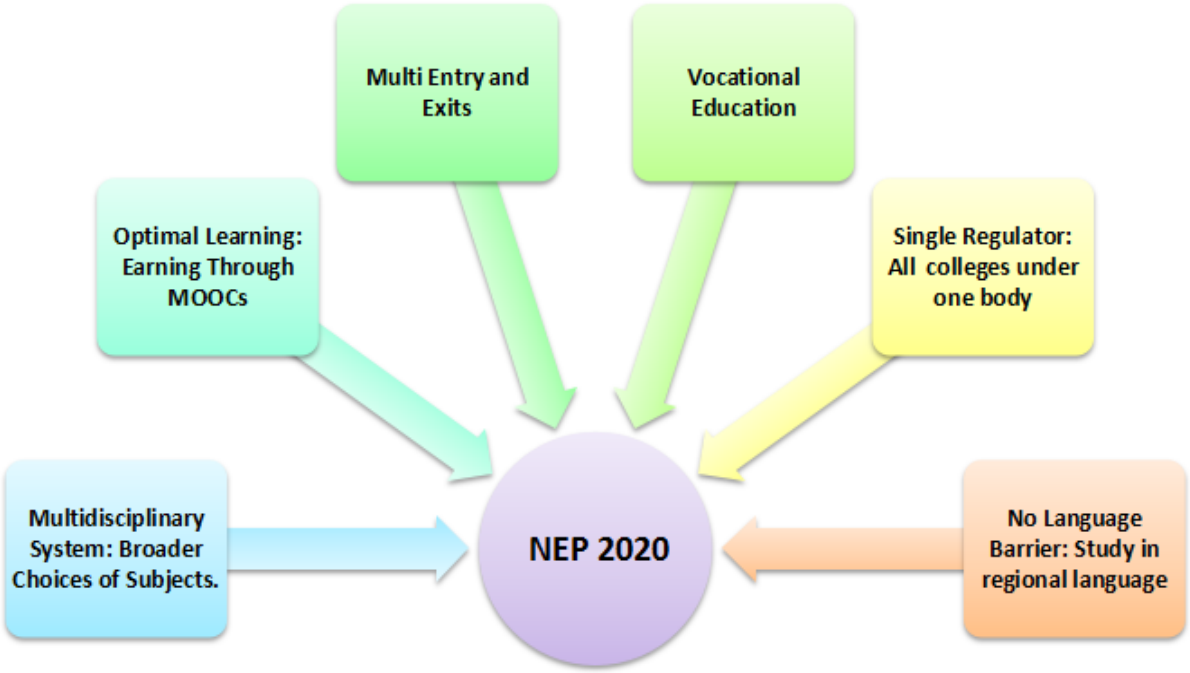

Fig 5: NEP 2020

Flexibility in curriculum and novel and engaging course options will be on offer to students, in addition to rigorous specialisation in a subject or subjects. Pedagogy for courses will strive for significantly less rote learning and an increased emphasis on communication, discussion, debate, research, and opportunities for cross-disciplinary and interdisciplinary thinking. The flexible and innovative curriculum shall emphasize on offering credit-based courses and projects in the areas of community engagement and service, environmental education and value-based education. as part of a holistic education, students will be provided with opportunities for internships with local industry, businesses, artists, crafts persons, villages and local communities, etc., as well as

research internships with faculty and researchers at their own or other HEIs or research institutions, so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

Effective learning requires relevant curriculum, engaging pedagogy, continuous formative assessment and adequate student support. The curriculum must be updated regularly aligning with the latest knowledge requirements and shall meet specified learning outcomes. High-quality pedagogy is then necessary to successfully impart the curricular material to students; pedagogical practices determine the learning experiences that are provided to students - thus directly influencing learning outcomes. The assessment methods have to be scientific and test the application of knowledge. Higher Education Institutes should move to a criterion-based grading system that assesses student achievement based on the learning goals for each programme, making the system fairer and outcomes more comparable. HEIs should also move away from high-stakes examinations towards more continuous and comprehensive evaluation.

4. DIPLOMA PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this programme, the student will be able to:

PO1: Perform tasks in limited range of activities, familiar situation with clear choice of procedures.

PO2: Acquire knowledge of principles and processes in the field of Electronics and Communication Engineering.

PO3: Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information**.**

PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.

PO5: Take the responsibility of own works and supervises others work.

PO6: Select multidisciplinary and open subjects of own interest and perform self learning through Massive Open Online Courses.

5. DERIVING CURRICULUM AREAS FROM DIPLOMA PROGRAMME OUTCOMES

The following curriculum areas have been derived from Diploma Programme Outcomes:

Sr. No.	Programme Outcomes	Curriculum Subjects / Areas
1.	Perform tasks in limited range of activities, familiar situation with clear choice of procedures.	• Applied Physics - I • Fundamentals of Electrical Engineering. • Electrical & Electronics Workshop-I • Electronic Devices & Circuits -1 • Applied Physics - II • Electronic Instruments and Measurement. • Engineering Graphics • Analog and Digital Communication • Digital Electronics • Electronic Devices and Circuits-II • Programming in C • Electronic Design and Simulation • Electronic Design and Simulation • Microprocessor & Micro-controllers • Communication Systems\Power Electronics • Instrumentation • PLC & SCADA • Optical Fibre Communication • Wireless & Mobile Communication • Computer Networks • Programme Elective – I • Programme Elective - II
2.	Acquire knowledge of principles and processes in Electronics and Communication Engineering related field.	• Applied Physics - I • Fundamentals of Electrical Engineering.

		• Electronic Devices & Circuits - I • Applied Physics - II • Electronic Instruments and Measurement. • Analog and Digital Communication • Digital Electronics • Electronic Devices and Circuits-II • Programming in C • Electronic Design and Simulation • Microprocessor & Micro-controllers • Communication Systems\Power Electronics • Instrumentation • PLC & SCADA • Optical Fibre Communication • Wireless & Mobile Communication • Computer Networks • Programme Elective – I • Programme Elective - II
3.	Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information**.**	• Fundamentals of Electrical Engineering. • Electrical & Electronics Workshop-I • Electronic Devices & Circuits - I • Electrical & Electronics Workshop -II • Industrial / In - House Training – I • Analog and Digital Communication • Digital Electronics • Electronic Devices and Circuits-II • Programming in C • Electronic Design and Simulation • Microprocessor & Micro-controllers • Communication Systems\Power Electronics • Instrumentation • PLC & SCADA

		• Optical Fibre Communication • Wireless & Mobile Communication • Computer Networks • Programme Elective – I • Programme Elective - II
4.	Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• English and Communication Skills - I • Applied Mathematics - I • Fundamentals of IT • Applied Mathematics - II • Environmental Studies & Disaster Management • Industrial / In - House Training - I • English and Communication Skills – II • Minor Project • Industrial Training – II • Entrepreneurship Development & Man agement • Industrial Internship / Major Project
5.	Take the responsibility of own works and supervises others work.	• Electrical & Electronics Workshop-I • Electrical & Electronics Workshop -II • Industrial / In - House Training – I • Minor Project • Industrial Training – II • Industrial Internship / Major Project
6.	Select multidisciplinary and open subjects of own interest and perform self learning through Massive Open Online Courses.	• Multidisciplinary Elective • Open Elective

FIRST YEAR

NSQF LEVEL - 3

FIRST YEAR
6. STUDY CUM EVALUATION SCHEME

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L + P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
1.1	*English and Communication Skills - I	2	2	2 + 1 = 3	40	40	80	60	60	120	200
1.2	*Applied Mathematics - I	4	-	4 + 0 = 4	40	-	40	60	-	60	100
1.3	*Applied Physics - I	2	2	2 + 1 = 3	40	40	80	60	60	120	200
1.4	*Fundamentals of IT	2	4	2 + 2 = 4	40	40	80	60	60	120	200
1.5	**Fundamental of Electrical Engineering.	3	4	3 + 2 = 5	40	40	80	60	60	120	200
1.6	***Electrical & Electronics Workshop-I	-	4	0 + 2 = 2	-	40	40	-	60	60	100
# Student Centered Activities(SCA)		-	6	-	-	-	-	-	-	-	-
Total		13	**22**	**21**	**200**	**200**	**400**	**300**	**300**	**600**	**1000**

* Common with other Diploma Courses.

** Common with Instrumentation and Control Engineering, Automation and Robotics

*** Common with Automation and Robotics

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India etc, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

FIRST YEAR

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L + P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
2.1	**Electronic Devices & Circuits - I	3	4	3 + 2 = 5	40	40	80	60	60	120	200
2.2	*Applied Mathematics-II	4	-	4 + 0 = 4	40	-	40	60	-	60	100
2.3	*Applied Physics - II	2	2	2 + 1 = 3	40	40	80	60	60	120	200
2.4	Electronic Instruments and Measurement.	3	4	3 + 2 = 5	40	40	80	60	60	120	200
2.5	*Engineering Graphics	-	6	0 + 3 = 3	-	40	40	-	60	60	100
2.6	**Electrical & Electronics Workshop -II	-	4	0 + 2 = 2	-	40	40	-	60	60	100
2.7	*Environmental Studies & Disaster Management	2	-	2 + 0 = 2	40	-	40	60	-	60	100
# Student Centered Activities (SCA)		-	1	-	-	-	-	-	-	-	-
Total		**14**	**21**	**24**	**200**	**200**	**400**	**300**	**300**	**600**	**1000**

* Common with other Diploma Courses

** Common with Automation and Robotics

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India etc, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

Industrial/In-house Training: After 2nd semester, students shall undergo Summer Training of minimum 4 Weeks.

7. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects/Areas	Hours Per Week	
		First Semester	Second Semester
1.	English and Communication Skills - I	4	-
2.	Applied Mathematics - I	4	-
3.	Applied Physics - I	4	-
4.	Fundamentals of IT	6	-
5.	Fundamentals of Electrical Engineering	7	-
6.	Electrical & Electronics Workshop-I	4	-
7.	Electronic Devices & Circuits - I	-	7
8.	Applied Mathematics-II	-	4
9.	Applied Physics - II	-	4
10.	Electronic Instruments and Measurement	-	7
11.	Engineering Graphics	-	6
12.	Electrical & Electronics Workshop -II	-	4
13.	Environmental Studies & Disaster Management	-	2
14.	Student Centered Activities	6	1
	Total	**35**	**35**

8. COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

In government and private sectors related to **Electronics and Communication Engineering**, **"Semi Skilled workers"** are required to carry out a limited range of predictable tasks under close supervision. They are normally expected to communicate clearly in speech and along with knowledge of arithmetic and algebraic processes. They should know the basic facts, processes and principles applied in limited area of Electronics and Communication Engineering.

Electronics & Communication Engineering NSQF Level – 3 pass out students are expected to recall and demonstrate practical routine and repetitive skills, in narrow range of related applications. They should have the basic knowledge of principles of DC and AC fundamental, ac circuits, batteries, electromagnetic induction, voltage and current sources etc. They should demonstrate general manual and machining skills along with awareness of dignity of labour, safety at work place, team working and right attitude. They should have good knowledge of physical principles and analysis in various technical fields. They are expected to handle wide variety of instruments while testing, trouble shooting, calibration etc. along with the knowledge of working principles and operation of different instruments. They should be able to design basic Electronic circuits on Printed Circuit Board using software. They are expected to show their capability to design their own projects on PCB as per industrial requirement.

They will have scope wage employment in organizations like Radar and Wireless, Railways, Defence Services, Para-military Forces**,** Civil Aviation**,** Defence Organizations**,** Electricity Boards and Corporations etc., manufacturing industries like wireless mobile equipment, PCB Design and Fabrication**,** Consumer Electronics**,** Electronic Components and Devices Manufacturing and Installation**,** Computer Assembling and Computer Peripheral, Computer Software Areas for Electronic Design and Semi Conductor Manufacturing**,** Instrumentation and Control**,** Internet Server Providers**,** D.T.H component and Fabrication**,** Mobile Phone assembly**,** Medical Electronics**,** EPBX/ Telephone Exchange Manufacturing**.**

They will also have scope in establishing small start ups in the area of Marketing and Sales, Repair and Maintenance**,** Cable laying and jointing DBs, Preparing Simulated Models**,** Manufacturing Unit like Bulb manufacturing, chalk manufacturing, circuit manufacturing units etc.

9. PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level – 3 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this level, the student will be able to:

PO1: Carry out a task which may require limited range of predictable activities.

PO2: Acquire knowledge of Basic facts, process and principles related to Electronics and Communication Engineering for employment.

PO3: Demonstrate practical skill in narrow range of Electronics and Communication Engineering applications.

PO4: Communicate in written and oral, with minimum required clarity along with skill of basic arithmetic and algebraic principles, personal banking and basic understanding of social and natural environment.

PO5: Perform task under close supervision with some responsibility for own work within defined limit.

10. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Carry out a task which may require limited range of predictable activities.	• Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy. • Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications. • Apply the knowledge of basic circuital law and simplify the network • Understand the fundamental behaviour of AC circuits and solve AC circuit problems. • Comprehend the concept of Electrostatics and magentostatics and apply the knowledge. • Identify tools, equipments and their respective functions. • Prepare independently simple jobs and inspect the same. Select proper tools for a particular operation. • Handle safety equipment, follow safety procedures and measures. • Take measurements with basic measuring tools/equipment. • Describe the VI characteristics of PN junction diode and Zener diode. Fabricate half wave, full wave and bridge rectifier and observe waveforms of each • Measure voltage gain, input and output impedance in a single state CE amplifier circuit. • Differentiate between types of waves and their motion. • Illustrate laws of reflection and refraction of light. • Demonstrate competency in phenomena of

	electrostatics and electricity. • Demonstrate the working principles of measuring instruments like multi-meter, CRO, DSO. • Measure frequency, voltage, time period and phase using CRO and DSO. • Utilize RF signal generator, pulse generator and Q-meter • Measure of capacitance, inductance and using different bridges and use of logic pulser, logic probe. • Draw Orthographic views of different objects viewed from different angles.. • Draw and interpret sectional views of an object which are otherwise not visible in normal view. • Draw Isometric views of different solids and develop their surfaces. • Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances /fittings. • Draw orthographic views of different objects by using basic commands of AutoCAD.
PO2: Acquire knowledge of Basic facts, process and principles related to Electronics and Communication Engineering for employment.	• Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy. • Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications. • Acquire knowledge and understand the elements of electricity and DC circuits. • Explain the various batteries as storage devices and be aware of safe disposal of batteries. • Demonstrate competency in phenomena of electrostatics and electricity. • Characterize properties of material to prepare

	new materials for various technical applications. • Identify and able to understand physics behind various types of materials. • Describe the VI characteristics of PN junction diode and Zener diode. Fabricate half wave, full wave and bridge rectifier and observe waveforms of each • Draw input and output characteristics of transistor in CB and CE mode • Analyse the characteristics of FET and MOSFET. • Describe the loading effect of a multi-meter the limitation of multi-meter for high frequency measurement
PO3: Demonstrate practical skill in narrow range of Electronics and Communication Engineering applications.	• Elaborate scientific work, energy and power, forms of friction and solve problems related to them. • Comprehend properties of matter and effect of temperature on various matter and phenomenon. • Demonstrate the use of physical principles and analysis in various technical fields. • Prepare independently simple jobs and inspect the same. Select proper tools for a particular operation. • Handle safety equipment, follow safety procedures and measures. • Take measurements with basic measuring tools/equipment. • Characterize properties of material to prepare new materials for various technical applications. • Demonstrate a strong foundation on Modern Physics to use at various technical applications. • Describe the VI characteristics of PN junction diode and Zener diode. Fabricate half wave, full wave and bridge rectifier and observe waveforms of each • Measure voltage gain, input and output

	impedance in a single state CE amplifier circuit. • Measure frequency, voltage, time period and phase using CRO and DSO. • Utilize RF signal generator, pulse generator and Q-meter • Measure of capacitance, inductance and using different bridges and use of logic pulser, logic probe. • Identify tools, equipments and their respective functions. • Prepare independently simple jobs and inspect the same. • Select and handle tools for a particular operation. • Handle safety equipment, follow safety procedures and measures. • Take measurements with basic measuring tools/equipment. • Perform safety procedures to maintain good housekeeping practices. • Handle materials, sequence of operations, tools to make a given job based on interpretation of drawing as per given specification • Develop a job using resources of shops and compare the job with given specifications. Analyze a given job and identify various operations required to make it. • Design and simulate the PCB using EDA Tools. • Acquire hands-on experience of PCB fabrication.
PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• Identify the nuances of Communication, both Oral and Written. • Acquire knowledge of the meaning of communication, communication process and speaking skills. • Acquire enhanced vocabulary and in-depth understanding of Grammatical Structures and their usage in the communication.

	• Communicate effectively with an increased confidence to read, write and speak in English language fluently. • Understand the geometric shapes used in engineering problems by Co-ordinate Geometry and Trigonometry. • Formulate engineering problems into mathematical formats with the use matrices, coordinate geometry and trigonometry • Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem. • Explore the idea of location, graph, and linear relationships between two variables. • Explain the basic components of Computers, Internet and issues of abuses/ attacks on information and computers. • Handle the Computer / Laptop / Mobiles / Internet Utilities and Install/Configure OS. • Assemble a PC and connect it to external devices. • Manage and Use Office practiced Automation Tools. • Develop worksheets and Prepare presentations. • Formulate the engineering problems into mathematical format with the use of differential equations and differential • Use the differentiation and Integration in solving various Mathematical and Engineering problems. • Calculate the approximate area under a curve by applying integration and numerical methods. • Understand the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data. • Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

	• Comprehend the importance of sustainable ecosystem • Demonstrate interdisciplinary nature of environmental issues • Implement corrective measures for the abatement of pollution. • Identify the role of non-conventional energy resources in environmental protection. • Manage various types of disasters
PO5: Perform task under close supervision with some responsibility for own work within defined limit.	• Identify tools, equipments and their respective functions. • Prepare independently simple jobs and inspect the same. • Select and Handle tools for a particular operation. • Handle safety equipment, follow safety procedures and measures. • Take measurements with basic measuring tools/equipment. • Perform safety procedures to maintain good housekeeping practices. • Handle materials, sequence of operations, tools to make a given job based on interpretation of drawing as per given specification • Develop a job using resources of shops and compare the job with given specifications. Analyze a given job and identify various operations required to make it. • Design and simulate the PCB using EDA Tools. • Acquire hands-on experience of PCB fabrication.

11. SUBJECTS & CONTENTS

(FIRST YEAR)

FIRST SEMESTER

1.1 ENGLISH & COMMUNICATION SKILLS – I

L	P
2	2

RATIONALE

Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life –personal, social and professional. This course is intended to break fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework. This course is designed to help students to acquire the concept of communication and develop ability or skills to use them effectively to communicate with the individuals and community.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Identify the nuances of Communication, both Oral and Written.

CO2: Acquire knowledge of the meaning of communication, communication process and speaking skills.

CO3: Acquire enhanced vocabulary and in-depth understanding of Grammatical Structures and their usage in the communication.

CO4: Communicate effectively with an increased confidence to read, write and speak in English language fluently.

DETAILED CONTENTS

UNIT I

Reading

1.1 Techniques of reading: Skimming and Scanning

1.2 Extensive and Intensive Reading: Textual Study

1.3 Homecoming – R.N. Tagore

1.4 Life Sketch of Sir Mokshagundam Visvesvarayya

1.5 Life Sketch of Dr. Abdul Kalam

1.6 Narayan Murthy's speech at LBSNA, Dehradun

UNIT II

Fundamentals of Communication

2.1 Concept and Process of Communication,

2.2 Types of Communication (Verbal Communication)
2.3 Barriers to Communication
2.4 Speaking Skill: Significance and essentials of Spoken Communication
2.5 Listening Skill: Significance and essentials of Listening

UNIT III

Grammar and Usage

3.1 Nouns
3.2 Pronouns
3.3 Articles
3.4 Verbs(Main and Auxiliary)
3.5 Tenses

UNIT IV

Writing Skills

4.1 Significance, essentials and effectiveness of Written Communication
4.2 Notice Writing
4.3 Official Letters and E-mails.
4.4 Frequently-used Abbreviations used in Letter-Writing
4.5 Paragraph Writing
4.6 Netiquettes

PRACTICAL EXERCISES

1 READING

Reading Practice of lessons in the Lab Activity classes.

i. Comprehension exercises of unseen passages along with the lessons prescribed.
ii. Vocabulary enrichment and grammar exercises based on the selected readings.
iii. Reading aloud Newspaper headlines and important articles.

2 FUNDAMENTALS OF COMMUNICATION

i. Introducing oneself, others and leave- taking(talking about yourself)
ii. Just a minute (JAM) sessions: Speaking extempore for one minute on given topics
iii. Situational Conversation: Offering-Responding to offers; Congratulating; Apologising and Forgiving; Complaining; Talking about likes and dislikes, Self-introduction Mock Interviews

3 GRAMMAR AND USAGE

i. Written and Oral Drills will be undertaken in the class to facilitate holistic linguistic competency among learners.
ii. Exercises on the prescribed grammar topics.

4 WRITING SKILLS

i. Students should be given Written Practice in groups so as to inculcate team-spirit and collaborative learning .

ii. Group exercises on writing paragraphs on given topics.

iii. Opening an e-mail account, receiving and sending emails

RECOMMENDED BOOKS

1) Alvinder Dhillon and Parmod Kumar Singla, "Text Book of English and Communication Skills Vol – 2", M/S Abhishek Publications, Chandigarh.
2) V Sasikumar & PV Dhamija, "Spoken English", Tata MC Graw Hills, New Delhi, Second Edition.
3) JK Gangal, "A Practical Course in Spoken English", PHI Learning Pvt. Ltd., New Delhi.
4) NK Aggarwal and FT Wood, "English Grammar, Composition and Usage", Macmillan Publishers India Ltd., New Delhi.
5) RC Sharma and Krishna Mohan, "Business Correspondence & Report writing", Tata MC Graw Hills, New Delhi, Fourth Edition.
6) Kavita Tyagi & Padma Misra, "Professional Communication", PHI Learning Pvt. Ltd., New Delhi.
7) Nira Konar, "Communication Skills for professionals", PHI Learning Pvt. Ltd., New Delhi.
8) Krishna Mohan & Meera Banerji, "Developing Communication Skills", Macmillan Publishers India Ltd., New Delhi, Second Edition
9) M. Ashraf Rizwi, "Effective Technical Communication", Tata MC Graw Hills, New Delhi.
10) Andrea J Rutherfoord, "Basic Communication Skills for Technology", Pearson Education, New Delhi.

INSTRUCTIONAL STRATEGY

This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains four units of equal weight age.

1.2 APPLIED MATHEMATICS - I

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RATIONALE

Contents of this course provide fundamental base for understanding engineering problems and their solution algorithms. Contents of this course will enable students to use basic tools like logarithm, binomial theorem, matrices, t-ratios and co-ordinates for solving complex engineering problems with exact solutions in a way which involve less computational task. By understanding the logarithm, they will be able to make long calculations in short time and it is also a pre-requisite for understanding Calculus.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Understand the geometric shapes used in engineering problems by Co-ordinate Geometry and Trigonometry.

CO2: Formulate engineering problems into mathematical formats with the use matrices, co-ordinate geometry and trigonometry

CO3: Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem.

CO4: Explore the idea of location, graph, and linear relationships between two variables.

CO5: Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

DETAILED CONTENTS

UNIT I

Algebra

1.1 Complex Numbers: definition of complex number, real and imaginary parts of a complex number, Polar and Cartesian Form and their inter conversion, Conjugate

of a complex number, modulus and amplitude, addition subtraction, multiplication and division of complex numb

1.2 Logarithms and its basic properties

UNIT II

Binomial Theorem, Determinants and Matrices

2.1 Meaning of ${}^{n}p_{r}$ & ${}^{n}c_{r}$ (mathematical expression). Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion up to 3 terms - without proof), first binomial approximation with application to engineering problems.

2.2 Determinants and Matrices – Evaluation of determinants (upto 2^{nd}order), solution of equations (upto 2 unknowns) by Crammer's rule, definition of Matrices and its types, addition, subtraction and multiplication of matrices (upto 2^{nd} order).

UNIT III

Trigonometry

3.1 Concept of angle, measurement of angle in degrees, grades, radians and their conversions.

3.2 T-Ratios of Allied angles (without proof), Sum, Difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa

3.3 Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

UNIT-IV

Co-ordinate Geometry

4.1 Cartesian and Polar co-ordinates (two dimensional), Distance between two points, mid-point, centroid of vertices of a triangle.

4.2 Slope of a line, equation of straight line in various standards forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, symmetric form, normal form, general form), intersection of two straight lines, concurrency of lines, angle

between straight lines, parallel and perpendicular lines, perpendicular distance formula, conversion of general form of equation to the various forms.

UNIT V

Geometry of Circle and Software

Circle

5.1 General equation of a circle and its characteristics. To find the equation of a circle, given:

I. Centre and radius

II. Three points lying on it

III. Coordinates of end points of a diameter

Software

5.2 **MATLAB Or SciLab software –** Theoretical Introduction, MATLAB or Scilab as Simple Calculator (Addition and subtraction of values –Trigonometric and Inverse Trigonometric functions) – General Practice

RECOMMENDED BOOKS

1) R. D. Sharma, "Applied Mathematics – I & II for Diploma Courses", Dhanpat Rai Publications.

2) "Mathematics for Class XI", NCERT Publication, New Delhi.

3) "Mathematics for Class XII", NCERT Publication, New Delhi.

4) H. K Dass, "Applied Mathematics for Polytechnics", CBS Publishers & Distributers.

5) A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics – I", CBS Publisher, New Delhi.

6) A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –II", CBS Publisher, New Delhi.

7) G. B. Thomas, R. L. Finney, "Calculus and Analytic Geometry", Addison Wesley, Ninth Edition.

8) B S Grewal, "Elementary Engineering Mathematics", Khanna Publishers, Delhi, Thirty-fifth edition.

9) R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, New Delhi, Second Edition, 2003.
10) SS Sabharwal & Dr Sunita Jain, "Applied Mathematics Vol. I & II", Eagle Parkashan, Jalandhar.
11) S Kohli, "Engineering Mathematics Vol. I & II", IPH, Jalandhar.
12) Reena Garg & Chandrika Prasad, "Advanced Engineering Mathematics", Khanna Publishing House, New Delhi
13) R. Pratap, "Getting Started with MATLAB 7", Oxford University Press, Seventh Edition.
14) E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1) http://swayam.gov.in
2) https://www.scilab.org

INSTRUCTIONAL STATREGY

This is theoretical subject and contains five units of equal weight age. Basic elements of algebra, trigonometry and co-ordinate geometry can be taught in the light of their applications in the field of engineering and technology. By laying more emphasis on applied part, teacher can also help in providing a good continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics related to Algebra, Trigonometry and Coordinate Geometry that the industry requires. Examples to be used should be related to engineering. Useful software MATLAB or open source software SciLab can be taught theoretically by books/online literatures and basic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Students should be able to relate to the actual use of these examples and the way mathematical calculations will help them in doing their job.

1.3 APPLIED PHYSICS-I

L	P
2	2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various technical fields are given prominence in the course content.

COURSE OUTCOMES

After completing this course, student should be able to:

CO1: Identify physical quantities, select their units and make measurements with accuracy.

CO2: Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications.

CO3: Elaborate scientific work, energy and power, forms of friction and solve problems related to them.

CO4: Comprehend properties of matter and effect of temperature on various matter and phenomenon.

CO5: Demonstrate the use of physical principles and analysis in various technical fields.

DETAILED CONTENTS

UNIT I

Unit and Dimensions

1.1 Definition of Physics, physical quantities- fundamental and derived

1.2 Units: fundamental and derived

1.3 System of units: CGS, FPS, MKS, SI

1.4 Dimension, dimensional formulae and SI units of physical quantities-distance, displacement, area, volume, density, velocity, acceleration, linear momentum, force, impulse, work, power, energy, pressure, surface tension, stress, strain)

1.5 Dimensional equations, principle of homogeneity of dimensional equation

1.6 Application of dimensional analysis: checking the correctness of physical equation, conversion of system of unit (force, work, acceleration)

UNIT II

Force and Motion

2.1 Scalar and vector quantities– definition and examples, representation of vector, types of vector (unit vector, position vector, co-initial vector, collinear vector, co-planar vector)

2.2 Vector algebra- aaddition of vectors, Triangle & Parallelogram law (statement and formula only),

2.3 Scalar and vector pproduct (statement and formula only)

2.4 Force and its units, rresolution of force (statement and formula only)

2.5 Newton's laws of motion (statement and examples)

2.6 Linear momentum, Law of conservation of linear momentum (statement and examples), Impulse

2.7 Circular motion: definition of angular displacement, angular velocity, angular acceleration, frequency, time period; Relation between linear and angular velocity, centripetal and centrifugal forces (definition and formula only), application of centripetal force in banking of road

2.8 Rotational motion: definition with examples

2.9 Definition of torque, angular momentum, moment of inertia and its physical significance

UNIT III

Work, Power and Energy

3.1 Work- ddefinition, ssymbol, fformula and SI unit, types of work (zero work, positive work and negative work) with example

3.2 Friction– ddefinition and its simple daily life aapplications

3.3 Power- definition, formula and units

3.4 Energy- ddefinition and its SI unit, eexamples of transformation of energy.

3.5 Kinetic energy- definition, examples, formula and its derivation

3.6 Potential energy- definition, examples, formula and its derivation

3.7 Law of conservation of mechanical energy for freely falling bodies (with derivation)

3.8 Simple numerical problems based on formula of Power and Energy

UNIT IV

Properties of Matter

4.1 Elasticity and plasticity- definition, deforming force, restoring force, example of elastic and plastic body

4.2 Definition of stress and strain, Hooke's law, modulus of elasticity

4.3 Pressure- definition, atmospheric pressure, gauge pressure, absolute pressure, Pascal's law

4.4 Surface tension- definition, SI unit, applications of surface tension, effect of temperature on surface tension

4.5 Viscosity: definition, unit, examples, effect of temperature on viscosity

UNIT V

Heat and Temperature

5.1 Definition of heat and temperature (on the basis of kinetic theory)

5.2 Difference between heat and temperature

5.3 Principle and working of mercury thermometer

5.4 Modes of transfer of heat- conduction, convection and radiation with examples.

5.5 Properties of heat radiation

5.6 Different scales of temperature and their relationship

LIST OF PRACTICALS

1. Familiarization of measurement instruments and their parts (for example - vernier calliper, screw gauge, spherometer, travelling microscope etc.), and taking a reading. (compulsory to all students)
2. To find diameter of solid cylinder using a vernier calliper
3. To find internal diameter and depth of a beaker using a vernier calliper and hence find its volume.
4. To find the diameter of wire using screw gauge
5. To find thickness of paper using screw gauge.
6. To determine the thickness of glass strip using a spherometer
7. To determine radius of curvature of a given spherical surface by a spherometer.
8. To verify parallelogram law of force
9. To determine the atmospheric pressure at a place using Fortin's Barometer
10. To determine force constant of spring using Hooke's law
11. Measuring room temperature with the help of thermometer and its conversion in different scale.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr. HH Lal, "Applied Physics, Vol. I and Vol. II", TTTI Publications, Tata McGraw

Hill, Delhi.
3. AS Vasudeva, "Applied Physics – I", Modern Publishers, Jalandhar.
4. R A Banwait, "Applied Physics – I", Eagle Prakashan, Jalandhar.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.
6. C. L. Arora, "Practical Physics", S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in
2. The Physics Classroom
3. https://www.khanacademy.org/science/physics

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age. Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students. Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

1.4 FUNDAMENTALS OF IT

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2	4

RATIONALE

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concepts of information technology and its scope, operating a computer: use of various office management tools, using internet and mobile applications etc. This course is intended to make new students comfortable with computing environment - Learning basic computer skills, learning basic application software tools, Understanding Computer Hardware, Cyber security awareness.

COURSE OUTCOMES

At the end of the course student will be able to

CO1: Explain the basic components of Computers, Internet and issues of abuses/ attacks on information and computers.
CO2: Handle the Computer / Laptop / Mobiles / Internet Utilities and Install/Configure OS.
CO3: Assemble a PC and connect it to external devices.
CO4: Manage and Use Office practiced Automation Tools.
CO5: Develop worksheets and Prepare presentations.

DETAILED CONTENTS

UNIT I

Basics of Computer

Brief history of development of computers, Definition of Computer, Block diagram of a Computer, Hardware, Software, Booting: Cold and Hot Booting, Interaction between the CPU and Memory with Input/Output devices, Function of CPU and major functional parts of CPU.
Memory, Bit, Nibble, Byte, KB, MB, GB, TB, PB, Functions of memory, Use of storage devices in a Computer, List types of memory used in a Computer, Importance of cache memory, CPU speed and CPU word length

UNIT II

Basic Internet Skills

Understanding browser, Introduction to WWW, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals. Advantages of Email, Various email service providers, Creation of email id, sending and receiving emails, attaching documents with email and drive.

Effective use of Gmail, G-Drive, Google Calendar, Google Sites, Google Sheets, Online mode of communication using Google Meet & WebEx.

Unit III

Basic Logic building

Introduction to Programming, Steps involved in problem solving, Definition of Algorithm, Definition of Flowchart, Steps involved in algorithm development, differentiate algorithm and flowchart, symbols used in flowcharts, algorithms for simple problems, flowcharts for simple problems, Practice logic building using flowchart/algorithms

Unit IV

Office Tools

Office Tools like LibreOffice/OpenOffice/MSOffice.

OpenOffice Writer – Typesetting Text and Basic Formatting, Inserting Images, Hyperlinks, Bookmarks, Tables and Table Properties in Writer

Introducing LibreOffice/OpenOffice *Calc*, Working with Cells, Sheets, data, tables, using formulae and functions, using charts and graphics.

OpenOffice Impress – Creating and Viewing Presentations, Inserting Pictures and Tables, Slide Master and Slide Design, Custom Animation.

Unit V

Use of Social Media

Introduction to Digital Marketing – Why Digital Marketing, Characteristics of Digital Marketing, Tools for Digital Marketing, , Effective use of Social Media like LinkedIn, Google+, Facebook, Twitter, etc.: Features of Social media, Advantages and Disadvantages of Social Media.

PRACTICAL EXERCISES

1. Browser features, browsing, using various search engines, writing search queries
2. Visit various e-governance/Digital India portals, understand their features, services offered

3. Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognize various ports/interfaces and related cables, etc.
4. Using Administrative Tools/Control Panel Settings of Operating Systems
5. Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.
6. Explore features of Open Office tools and MS-Office, create documents, create presentation, create spread sheet, using these features, do it multiple times
7. Working with Conversion Software like pdfToWord, WordToPPT, etc.
8. Working with Mobile Applications – Searching for Authentic Mobile app, Installation and Settings, Govt. of India Mobile Applications
9. Creating email id, sending and receiving mails with attachments.
10. Using Google drive, Google calendar
11. Create Flow chart and Algorithm for the following
    a. Addition of n numbers and display result
    b. To convert temperature from Celsius to Fahrenheit
    c. To find Area and Perimeter of Square
    d. Swap Two Numbers
    e. find the smallest of two numbers
    f. Find whether given number is Even or Odd
    g. To print first n even Numbers
    h. find sum of series 1+2+3+…..+N
    i. print multiplication Table of a number
    j. generate first n Fibonacci terms 0,1,1,2,3,5…n (n>2)
    k. sum and average of given series of numbers
    l. Factorial of number n (n!=1x2x3x…n)
    m. Armstrong Number
    n. Find whether given number is Prime or not

RECOMMENDED BOOKS

1. R.S. Salaria, “Computer Fundamentals” Khanna Publishing House
2. Ramesh Bangia, “PC Software Made Easy – The PC Course Kit” Khanna Publishing House
3. Online Resources, Linux man pages, Wikipedia
4. Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming, by Mokhtar Ebrahim, Andrew Mallett
5. Vikas Gupta, “Comdex Hardware and Networking Course Kit” Dream Tech press, New Delhi, 2008

6. Sumitabha Das,"UNIX concepts and applications" Tata McGraw Hill, New Delhi, 4th Edition, 2008

SUGGESTED WEBSITES

1. https://nptel.ac.in/courses/106/106/106106222/ - NPTEL Course on Modern Application Development
2. https://onlinecourses.swayam2.ac.in/aic19_de01/preview -
3. https://spoken-tutorial.org/ - Tutorials on Introduction to Computers, HTML, LibreOffice Tools, etc.
4. NOTEPAD++
5. https://tms-outsource.com/blog/posts/web-development-ide/

INSTRUCTIONAL STRATEGY

This is a skill based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

1.5 FUNDAMENTAL OF ELECTRICAL ENGINEERING

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RATIONALE

A diploma holder may be involved in various jobs ranging from preventive maintenance of electrical installation to fault location. In addition, he/she may be working in testing laboratories where he/she uses measuring instruments. To carry out these jobs effectively, knowledge of basic concepts, principles and their applications is very essential. This course will enable the students to understand the basic concepts and principles of DC and AC fundamental, ac circuits, batteries, electromagnetic induction, voltage and current sources etc.

COURSE OUTCOMES

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

CO1: Acquire knowledge and understand the elements of electricity and DC circuits.
CO2: Apply the knowledge of basic circuital law and simplify the network
CO3: Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
CO4: Comprehend the concept of Electrostatics and magentostatics and apply the knowledge.
CO5: Explain the various batteries as storage devices and be aware of safe disposal of batteries.

DETAILED CONTENTS

UNIT I

Electrical Fundamentals

1.1 Nature of Electricity, Charge, free electrons, Electric current, Electric potential and potential difference, Electric current, Electrical Energy, Electrical power and their unit.

1.2 Resistance: Definition, Unit, Laws of resistance, conductivity and resistivity, Effect of temperature on resistance, Temperature coefficient of resistance, Types of resistance & their applications, Color coding of resistance.

1.3 Inductors and capacitors with their wattage consideration.

1.4 Factors affecting capacitance of a capacitor. Capacitors in series and parallel.

UNIT II

DC Circuits & Theorems

2.1 Ohm's law and its verification.

2.2 Kirchhoff's current law and Kirchhoff's voltage law.

2.3 Star – Delta connections.

2.4 Voltage and current source, symbol and graphical representation, characteristics of ideal and practical sources.

2.5 Mesh and Loop analysis

2.6 Thevenin's theorem, Norton's theorem, Superposition Theorem, Maximum Power Transfer Theorem.

UNIT III

AC Circuits

3.1 AC Fundamentals: Cycle, frequency, time period, amplitude, difference between AC and DC, instantaneous value, average value, r.m.s. value, maximum value, form factor and peak factor.

3.2 Concept of conductance, susceptance, admittance, impedance and concept of inductive and capacitive reactance

3.3 RL-RC Circuits

3.4 Introduction to series and parallel resonance and its conditions

3.5 Power in pure resistance, inductance and capacitance, power in combined RLC circuits.

3.6 Power factor, active and reactive power: Definition and their significance.

UNIT IV

Electro Magnetic Circuit

4.1 Concept of electro-magnetic field produced by flow of electric current, magnetic circuit, concept of magneto-motive force (MMF), flux, reluctance, permeability, analogy between electric and magnetic circuit.

4.2 Faraday's laws of electro-magnetic induction, principles of self and mutual induction, self and mutually induced emf.

4.3 Energy stored in an inductor, series and parallel combination of inductors.

UNIT V

Batteries

5.1 Basic idea of primary and secondary cells.

5.2 Construction, working principle and applications of Lead-Acid, Nickel-Cadmium, Li- Ion batteries.

5.3 Series and parallel connections of batteries.

5.4 Introduction to maintenance of free batteries.

5.5 Disposal of batteries

5.6 General idea of solar cells, solar panels and their applications.

PRACTICE EXERCISES

1. Familiarization of measuring instruments viz voltmeter, ammeter, CRO, Wattmeter and multi-meter and other accessories.
2. To measure (very low) resistance of an ammeter and (very high) resistance of a voltmeter
3. To verify Ohm's law by drawing a graph between voltage and current.
4. To observe change in resistance of a bulb in hot and cold conditions, using voltmeter and ammeter.
5. To determine the value of resistance using colour coding method.
6. Verification of Kirchhoff's Current and Voltage Laws in a DC circuit on bread board.
7. Verification of Thevenin's theorem.
8. Verification of Norton's theorem.
9. Verification of Superposition theorem.
10. Verification of Maximum Power theorem.
11. Alternating voltage applied to resistance and inductance, resistance and capacitance in series.
12. To find the voltage current relationship in a single phase R-L circuits and draw their impedance triangles.
13. To find the voltage current relationship in a single R-C Series circuits, and draw their impedance triangles.
14. Measurement of power and power factor in a single phase R,L,C. circuit
15. Calculation of active and reactive powers in the circuit.
16. To test a lead - acid storage battery and measure its specific gravity.

17. Care and maintenance of lead-acid battery.
18. Visit to a nearby Power Station.

RECOMMENDED BOOKS

1. SK Bhattacharya, KM Rastogi, "Experiments in Basic Electrical Engineering", New Age International (P) Ltd., Publishers, New Delhi, January 2007.
2. BR Gupta, "Principles of Electrical Engineering", S Chand and Co, New Delhi, 2001.
3. JB Gupta, "Basic Electrical Engineering", SK Kataria and Sons, New Delhi, Eighth Edition, January 2020.
4. T.S. Anand, "Basic Electrical Engineering", North Publications, Jalandhar, March 2019.
5. Edward Hughes, "Electrical Technology", Fifth Edition, Longman Publishers, 2008.
6. GP Chhalhotra, "Experiments in Basic Electrical Engineering", Khanna Publishers, New Delhi, 2016-17.
7. SK Sahdev, "Basic Electrical and Electronics Engineering", Dhanpat Rai and Sons, New Delhi, November 2017.

INSTRUCTIONAL STRATEGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage. The teacher should make the students aware about the basic knowledge of electrical circuits including A.C and D.C circuit. The teacher should explain the importance of the electrical engineering, and reinforce theory with practical exercises. Teacher may encourage student to perform practical simultaneously for better understanding of the subject and verification of theoretical subject.

1.6 ELECTRICAL AND ELECTRONICS WORKSHOP – I

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RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. This workshop is included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

COURSE OUTCOMES[i]

After undergoing the subject, the students will be able to:

CO1: Identify tools, equipments and their respective functions.
CO2: Prepare independently simple jobs and inspect the same.
CO3: Select and handle tools for a particular operation.
CO4: Handle safety equipment, follow safety procedures and measures.
CO5: Take measurements with basic measuring tools/equipment.

DETAILED CONTENTS-CUM-PRACTICAL EXERCISES

Workshop Safety Induction Session

First turn of each shop shall be dedicated to safety practices and the contribution of safety to quality. The safety aspects can be categorized 3 categories

1. PSS (Process Safety System)
2. SSS (Safety Shutdown System)
3. ESD (Emergency Shutdown) or Emergency Depressurization System.

The following practices should be included:

i. Use of PPE (Personal Protection Equipment)
ii. Use of Safety Equipment like fire extinguishers etc.)
iii. Paramedic teaching suite, First –Aid
iv. Reports to be prepared for the damages
v. At the end of this session the student must sign “Student Safety Declaration form”.

The following shops are included in the syllabus:

1. Welding Shop
2. Fitting Shop
3. Sheet Metal Shop
4. Electric Shop – I
5. Electronic Shop – I

UNIT I

Welding Shop

1.1 Introduction and importance of welding process as compared to other material joining processes. Specifications and type of ARC welding machines, parts identification, classification, selection and coding of electrodes, welding parameters, welding joints and welding positions. Common weldable Materials, safety precautions, use of PPEs, welding screens, Hazards and remedies during welding, Elementary symbolic representations, demo of types of welding defects.

1.2 Jobs to be prepared Job I Practice of striking arc (Minimum 4 continuous beads on 100 mm long M.S. flat).

Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level and differentiating their characteristics).
Types of joints and their edge preparations:

Job III Preparation of lap joint using arc welding process.

Job IV Preparation of butt joint using arc welding process. (100 mm long).

Job V Preparation of T Joint using arc or gas welding (100mm x 6 mm M.S. Flat).

UNIT II

Fitting Shop

2.1 Introduction and Practical Importance of fitting jobs

2.2 Basic deburring processes.

2.3 Introduction to fitting shop tools, marking and measuring devices/equipment.

2.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminum etc.)

2.5 Identification of various steel sections (flat, angle, channel, bar etc.).

2.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing). Demonstration of wrong fitting practices causing damage to filed surfaces (outsized, out angled etc.) and tool/blade breakages.

2.7 Jobs to be prepared:

Job I Marking of job, use of marking tools and various types of files, use of tri square, surface plate, filing and use of measuring instruments. (Zero error and least count of Vernier calliper, Micrometer and Vernier height gauge).

Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of ±0.5 mm.

Job III Making a cut-out from a square piece of MS flat using hand hacksaw and chipping.

UNIT III

Sheet Metal Shop

3.1. Introduction and practical importance of sheet metal jobs, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.

3.2 Introduction and demonstration of hand tools used in sheet metal shop.

3.3 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine, Turning Machine, Wiring Machine, Setting down Machine, Forming Machine, Brake etc.

3.4 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.

3.5 Study of various types of nuts, bolts, rivets, screws etc.

Any Two Jobs to be prepared

Job I Shearing practice on a sheet using hand shears.

Job II Prepare a seam joint of G.I. Sheet

Job III Practice on making Single riveted lap joint/Double riveted lap Joint.

Job IV Development of sheet for preparation of cubical container (300x150x25 mm)

UNIT IV

Electric Shop – I

4.1 Study, demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, MCB & ELCB, fuses, cleats, clamps and allied items, tools and accessories.

4.2 Study of electrical safety measures and protective devices.

Job I Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs. Difference between series and parallel wiring.

Job II Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping. Demo of conduit wiring through junctions

Job III To prepare a three level Godown wiring circuit with PVC conduit wiring system.

4.3 Introduction to the construction of lead acid battery, its working and its specification parameters (mAH, sp gravity), precautions while handling battery, Introduction to battery charger and its functioning. Types of charging

Job IV Installation of battery and connecting two or three batteries in series and parallel and its effect. Charging a battery and testing with hydrometer and cell tester

4.4 Introduction to solar energized lighting or water heater system and their defects.

Job V Installation of Solar cells, costing according to capacity

UNIT V

Electronic Shop – I

Safety precautions to be observed in the Electronics Shop:

Identification and familiarization with the following tools used in electronic shop such as Tweezers, Screw drivers (different sizes), Insulated Pliers, Cutter, Sniper, Screw Driver (Star Screw Driver), L- Keys, Identification, familiarization and uses of commonly used components ; active and passive components; colour code and types of resistor and potentiometers ,Diode, Transistor, LED, LDR, SCR, TRIAC,DIAC, Thermistor etc.

Identification, familiarization, demonstration and use of the following electronic instruments:

a) Analog multimeter
b) Digital multimeter

Identification, familiarization, demonstration and use of the following electronic instruments:

a) Simple CRO, function of every knob on the front panel
b) Power supply, fixed voltage and variable voltage, single output as well as dual output.
c) Function generator

Job I Practice in the use of above mentioned tools and instruments. For this a small experimental set up may be done

RECOMMENDED BOOKS

1. SK Hajra, Choudhary and AK Choudhary, “Workshop Technology” I, II, III by Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Manchanda, “Workshop Technology” Vol. I, II, III by India Publishing House, Jalandhar.
3. S.S. Ubhi, “Workshop Training Manual” Vol. I, II by Katson Publishers, Ludhiana.
4. K Venkata Reddy, “Manual on Workshop Practice” by MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by; Vikas Publishing House (P) Ltd., New Delhi
6. T Jeyapoovan, “Workshop Technology” by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi

7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based workshop and topics taught in the class should be practiced in the lab regularly for development of required skills in the students. This workshop contains five units equal weightage. The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of many tools/jobs in their practical Notebook.

SECOND SEMESTER

SECOND SEMESTER

2.1 ELECTRONIC DEVICES AND CIRCUITS - I

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RATIONALE

This subject gives the knowledge of fundamental concepts and principles of basic electronics. It's aims to provide the students with basic understanding of various types of materials such as conductors, semiconductors, insulators, extrinsic and intrinsic semi-conductors. Students will study p-n junction, need of rectifiers, significance, use of filters in rectifiers, basic structure and working principle of transistors in various configurations. This also covers fundamental knowledge of FETs & MOSFETs and their applications.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Identify and able to understand physics behind various types of materials.

CO2: Describe the VI characteristics of PN junction diode and Zener diode. Fabricate half wave, full wave and bridge rectifier and observe waveforms of each

CO3: Draw input and output characteristics of transistor in CB and CE mode

CO4: Measure voltage gain, input and output impedance in a single state CE amplifier circuit.

CO5: Analyse the characteristics of FET and MOSFET.

DETAILED CONTENTS

UNIT I

Semiconductor Physics

1.1 Review of basic atomic structure and energy levels, concept of insulators, conductors and semiconductors, atomic structure of Germanium (Ge) and Silicon (Si), covalent bonds.

1.2 Concept of intrinsic and extrinsic semiconductor, process of doping.

1.3 Energy level diagram of conductors, insulators and semiconductors; minority and majority charge carriers.

1.4 P and N type semiconductors and their conductivity, effect of temperature on conductivity of intrinsic semiconductors.

UNIT II

Semiconductor Diode

2.1 PN junction diode, mechanism of current flow in PN junction, forward and reverse biased PN junction, potential barrier, drift and diffusion currents, depletion layer, concept of junction capacitance in forward and reverse biased condition.

2.2 V-I characteristics, static and dynamic resistance and their value calculation from the characteristics.

2.3 Application of diode as half-wave, full wave and bridge rectifiers. Peak Inverse Voltage, rectification efficiencies and ripple factor calculations, shunt capacitor filter, series inductor filter, LC and π filters.

2.4 Types of diodes, characteristics and applications of Zener diodes. Zener and avalanche breakdown

2.5 Introduction to Clipping and Clamping Circuits

UNIT III

Introduction to Bipolar-Transistors

3.1 Concept of a bipolar transistor, its structure, PNP and NPN transistors, their symbols and mechanism of current flow; Current relations in a transistor; concept of leakage current;

3.2 CB, CE, CC configurations of a transistor; Input and output characteristics in CB and CE configurations; input and output dynamic resistance in CB and CE configurations; Current amplification factors, relation between α, β and γ. Comparison of CB, CE and CC Configurations;

3.3 Transistor as an amplifier in CE Configuration; concept of DC load line and calculation of current gain and voltage gain using DC load line.

UNIT IV

Transistor Biasing Circuits

Concept of transistor biasing and selection of operating point. Need for stabilization of operating point. Different types of biasing circuits. Single stage transistor amplifier circuit, concept of dc and ac load line and its use. Explanation of phase reversal of output voltage with respect to input voltage.

UNIT V

Field Effect Transistors

Construction, operation and characteristics of FETs and their applications.

6.1 Construction, operation and characteristics of a MOSFET in depletion and enhancement modes and its applications.

6.2 Comparison of JFET, MOSFET and BJT.

PRACTICALS EXERCISES

1. Plotting of V-I characteristics of a PN junction diode
2. Plotting of V-I characteristics of a Zener diode
3. To observe input and output of series clipping circuits.
5. To observe input and output of shunt clipping circuits.
6. To observe input and output of positive clamping circuit.
7. To observe input and output of negative clamping circuit.
8. Fabrication of Half-wave rectifier circuit on breadboard and observe the output
9. Fabrication of Full-wave rectifier circuit on breadboard and observe the output
10. Plotting of the wave shape of full wave rectifier with
    a. Shunt capacitor filter
    b. Series inductor filter
11. Plotting of input and output characteristics and calculation of parameters of transistors in CE configuration.
12. Plotting of input and output characteristics and calculation of parameters of transistors in CB configuration.
13. Measurement of voltage gain, input and output impedance in a single stage CE amplifier circuit.
14. Plotting of V-I characteristics of FET.

RECOMMENDED BOOKS

1. Kulshreshta and SC Gupta, “Basic Electronics and Linear Circuit” byTata McGraw Hill Education Pvt Ltd., New Delhi.
2. VK Mehta, “Principles of Electrical and Electronics Engineering” by S Chand and Co., New Delhi
3. SM Dhir, “Electronic Components and Materials” by Tata McGraw Hill Education Pvt Ltd., New Delhi.
4. SK Bhattacharya and Renu Vig, “Principles of Electronics” by, SK Kataria and Sons, Delhi
5. Millman and Halkias, “Electronics Devices and Circuits” by McGraw Hill.
6. Albert Paul Malvino, “Principles of Electronics” by Tata McGraw Hill Education Pvt Ltd., New Delhi.

7. Albert Malvino and David J. Bates, "Basic Electronics – Problems and Solutions" by Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi.
8. J.S. Katre, Sandeep Bajaj, "Basic Electronics" by Tech. Max. Publications, Pune.
9. SK Sahdev, "Electronic Principles" by Dhanpat Rai& Co., New Delhi
10. JC Karhara, "Analog Electronics" by King India Publication, New Delhi
11. Rama Reddy, "Electrical Devices and Circuits" by Narosa Pulishing House Pvt. Ltd., New Delhi
12. Dharma Raj Cheruku and Battula Tirumala Krishna, "Electronic Devices and Circuits" by Pearson Education (Singapore) Pvt Ltd., Indian Branch, 482 F.I.E Patparganj, Delhi- 92
13. JB Gupta, "Basic Electronics" BY SK Kataria and Sons, New Delhi
14. Schultz, "Grob's Basic Electronics- A text Lab Manual" (Special Indian Edition) by Tata McGraw Hill Education Pvt Ltd, New Delhi.
15. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

Note: This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

2.2 APPLIED MATHEMATICS – II

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RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus, Integral calculus and Differential Equations have been included in this course. This will develop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Formulate the engineering problems into mathematical format with the use of differential equations and differential

C02: Use the differentiation and Integration in solving various Mathematical and Engineering problems.

CO3: Calculate the approximate area under a curve by applying integration and numerical methods.

CO4: Understand the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data.

CO5: Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

DETAILED CONTENTS

UNIT I

Differential Calculus

1.1 Definition of function; Concept of limits (Introduction only) and problems related to four standard limits only.

1.2 Differentiation of x^n, sin x, cos x, e^x by first principle.

1.3 Differentiation of sum, product and quotient of functions.

UNIT II

Differential Calculus and Its Applications

2.1 Differentiation of trigonometric functions, inverse trigonometric functions. Logarithmic differentiation, successive differentiation (upto 2nd order)

2.2 Application of differential calculus in:

(a) Rate measures (b) Maxima and minima

UNIT III

Integral Calculus

3.1 Integration as inverse operation of differentiation with simple examples.

3.2 Simple standard integrals and related problems, Integration by Substitution method and Integration by parts.

3.3 Evaluation of definite integrals with given limits.

Evaluation of $\int_0^{\pi/2} \sin^n x.\, dx$, $\int_0^{\pi/2} \cos^n x\, dx$, $\int_0^{\pi/2} \sin^m x\, \cos^n x\, dx$

using formulae without proof (m and n being positive integers only) using pre-existing mathematical models.

UNIT IV

Application of Integration, Numerical Integration and Differential Equations

4.1 Applications of integration: for evaluation of area under a curve and axes (Simple problems).

4.2 Numerical integration by Trapezoidal Rule and Simpson's $1/3^{rd}$ Rule using pre-existing mathematical models.

Differential Equations

4.3 Definition, order, degree, Type of differential Equations, linearity, Formulation of ordinary differential equation (up to 1^{st} order), solution of ODE (1^{st} order) by variable separation method.

UNIT V

Statistics and Software

Statistics

5.1 Measures of Central Tendency: Mean, Median, Mode

5.2 Measures of Dispersion: Mean deviation, Standard deviation

Software

5.3 SciLab software – Theoretical Introduction.

5.4 Basic difference between MATLAB and SciLab software,

5.5 Calculations with MATLAB or ScilLab - (a) Representation of matrix (2×2 order), (b) Addition, Subtraction of matrices (2×2 order) in MATLAB or SciLab

RECOMMENDED BOOKS

1) R. D. Sharma, "Applied Mathematics – I & II for Diploma Courses", Dhanpat Rai Publications.
2) "Mathematics for Class XI", NCERT Publication, New Delhi.
3) "Mathematics for Class XII", NCERT Publication, New Delhi.
4) H. K Dass, "Applied Mathematics for Polytechnics", CBS Publishers & Distributers.
5) A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –I", CBS Publisher, New Delhi.
6) A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –II", CBS Publisher, New Delhi.
7) G. B. Thomas, R. L. Finney, "Calculus and Analytic Geometry", Addison Wesley, Ninth Edition.
8) B S Grewal, "Elementary Engineering Mathematics", Khanna Publishers, Delhi, Thirty-fifth Edition.
9) R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics" Narosa Publishing House, New Delhi, Second Edition, 2003.
10) SS Sabharwal & Dr Sunita Jain, "Applied Mathematics Vol. I & II", Eagle Parkashan, Jalandhar.
11) S Kohli, "Engineering Mathematics Vol. I & II", IPH, Jalandhar.
12) Reena Garg & Chandrika Prasad, "Advanced Engineering Mathematics", Khanna Publishing House, New Delhi.
13) R. Pratap, "Getting Started with MATLAB 7", Oxford University Press, Seventh Edition.
14) E-books/e-tools/relevant software to be used as recommended by AICTE /HSBTE/ NITTTR.

SUGGESTED WEBSITES

1) https://www.scilab.org
2) http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is theoretical subject and contains five units of equal weight age. Basic elements of Differential Calculus, Integral Calculus, and Differential Equations can be taught in the light of their applications in the field of engineering and technology. By laying more stress on applied part, teachers can also help in providing continuing education base to the students. Students need

to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics that the industry requires. For example they need to know how to use mathematical models that use integration as opposed to learning how integration can be used. Useful authenticated software MATLAB or open source software SciLab can be taught theoretically by books/online literatures and basic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Diploma students need to know which tools to use and how to do the job.

2.3 APPLIED PHYSICS-II

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RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various technical fields are given prominence in the course content to prepare students for various engineering applications.

COURSE OUTCOMES

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

CO1: Differentiate between types of waves and their motion.

CO2: Illustrate laws of reflection and refraction of light.

CO3: Demonstrate competency in phenomena of electrostatics and electricity.

CO4: Characterize properties of material to prepare new materials for various technical applications.

CO5: Demonstrate a strong foundation on Modern Physics to use at various technical applications.

DETAILED CONTENTS

UNIT I

Wave Motion and its Applications

1.1 Waves: definition, types (mechanical and electromagnetic wave)

1.2 Wave motion- transverse and longitudinal with examples, terms used in wave motion like displacement, amplitude, time period, frequency, wavelength, wave velocity; relationship among wave velocity, frequency and wave length

1.3 Simple harmonic motion (SHM): definition, examples

1.4 Cantilever: definition, formula of time period (without derivation)

1.5 Free, forced and resonant vibrations with examples

1.6 Sound waves: types (infrasonic, audible, ultrasonic) on the basis of frequency, noise, coefficient of absorption of sound, echo

UNIT II

Optics

2.1 Reflection and refraction of light with laws, refractive index

2.2 Lens: introduction, lens formulae (no derivation), power of lens and simple numerical problems

2.3 Total internal reflection and its applications, critical angle and conditions for total internal reflection

2.4 Superposition of waves (concept only), definition of Interference, Diffraction and Polarization of waves

2.5 Introduction to Microscope, Telescope and their applications

UNIT III

Electrostatics and Electricity

3.1 Electric charge, unit of charge, conservation of charge

3.2 Coulomb's law of electrostatics

3.3 Electric field, electric lines of force (definition and properties), electric field intensity due to a point charge

3.4 Definition of electric flux, Gauss law (statement and formula)

3.5 Capacitor and capacitance (with formula and unit)

3.6 Electric current and its SI Unit, direct and alternating current

3.7 Resistance, conductance (definition and unit)

3.8 Series and parallel combination of resistances

3.9 Ohm's law (statement and formula)

UNIT IV

Classification of Materials and their Properties

4.1 Definition of eenergy level, eenergy bands

4.2 Types of materials (conductor, semiconductor, insulator and dielectric) with examples, intrinsic and extrinsic semiconductors (introduction only)

4.3 Introduction to magnetism, type of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials with examples

4.4 Magnetic field, magnetic lines of force, magnetic flux

4.5 Electromagnetic induction (definition)

UNIT V

Modern Physics

5.1 Laser: introduction, pprinciple, aabsorption, sspontaneous emission, stimulated emission, population inversion

5.2 Engineering and medical applications of laser

5.3 Fibre optics**:** introduction to optical fibers (definition, principle and parts), light propagation, fiber types (mono-mode, multi-mode), applications in medical, telecommunication and sensors

5.4 Nanotechnology: introduction, definition of nanomaterials with examples, properties at nanoscale, aapplications of nanotechnology (brief)

PRACTICAL EXERCISES

1. Familiarization with apparatus (resistor, rheostat, key, ammeter, voltmeter, telescope, microscope etc.)
2. To find the time period of a simple pendulum.
3. To study variation of time period of a simple pendulum with change in length of pendulum.
4. To determine and verify the time period of Cantilever.
5. To verify Ohm's laws by plotting a graph between voltage and current.
6. To study colour coding scheme of resistance.
7. To verify laws of resistances in series combination.
8. To verify laws of resistance in parallel combination.
9. To find resistance of galvanometer by half deflection method.
10. To verify laws of reflection of light using mirror.
11. To verify laws of refraction using glass slab.
12. To find the focal length of a concave lens, using a convex lens.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XII (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr. HH Lal, "Applied Physics, Vol. I & II", TTTI Publications, Tata McGraw Hill, Delhi.
3. AS Vasudeva, "Applied Physics –II", Modern Publishers, Jalandhar.
4. R A Banwait, "Applied Physics – II", Eagle Prakashan, Jalandhar.
5. N Subrahmanyam, Brij Lal and Avadhanulu, "A text book of OPTICS", S Chand Publishing, New Delhi.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.
7. M H Fulekar, "Nanotechnology: Importance and Applications", IK International Publishing House (P) Ltd., New Delhi.
8. C. L. Arora, "Practical Physics", S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age. Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students. Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

2.4 ELECTRONIC INSTRUMENTS AND MEASUREMENT

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RATIONALE

In the real world of work, the technician is required to handle wide variety of instruments while testing, trouble shooting, calibration etc. The study of this subject will help students to gain the knowledge of working principles and operation of different instruments. During practical sessions, they will acquire the requisite skills.

COURSE OUTCOMES

After undergoing the subject, student will be able to:

CO1: Demonstrate the working principles of measuring instruments like multi-meter, CRO, DSO.

CO2: Describe the loading effect of a multi-meter the limitation of multi-meter for high frequency measurement

CO3: Measure frequency, voltage, time period and phase using CRO and DSO.

CO4: Utilize RF signal generator, pulse generator and Q-meter

CO5: Measure of capacitance, inductance and using different bridges and use of logic pulser, logic probe

DETAILED CONTENTS

UNIT I

Basics of Instruments and Measurements

Measurement, method of measurement, types of instruments, Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors, loading effect, importance and applications of standards and calibration

UNIT II

Voltage, Current and Resistance Measurement Moving Coil and Moving Iron Instruments

a. Principles of measurement of DC voltage, DC current, AC voltage, AC current,
b. Principles of operation and construction of permanent magnet moving coil (PMMC) instruments and Moving iron type instruments, VOM Meter.

UNIT III

Cathode Ray Oscilloscope

Construction and working of Cathode RayTube (CRT)

Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls

Specifications of CRO and their Applications

Measurement of current, voltage, frequency, time period and phase using CRO, lissajous pattern for phase measurement.

Digital storage oscilloscope (DSO): block diagram and working principle

UNIT IV

Impedance Bridges, Q Meter and Function Generator

a. Wheat stone bridge
b. AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge
c. Block diagram and working principle of Qmeter.

Explanation of block diagram, specifications of low frequency and RF generators, pulse generator, function generator

UNIT V

Digital Instruments

a. Comparison of analog and digital instruments
b. Block diagram and working of a digital multi-meter
c. Applications and Limitations of digital multi-meters.
d. Working principle of logic probe, logic pulser

PRACTICAL EXERCISES

1. Measurement of voltage, resistance and current using analog multimeter
2. Measurement of voltage, resistance, frequency using digital multimeter
3. To study the front panel controls of CRO
4. Measurement of voltage, frequency, time period and phase using CRO
5. Measurement of voltage, frequency, time and phase using DSO
6. Measurement of phase using lissajous pattern on CRO.
7. Measurement of unknown resistance using Wheat Stone bridge.
8. Measurement of Q of a coil
9. Measurement of inductance using Hay's Bridge.
10. Measurement of inductance using Maxwell Induction Bridge.
11. Measurement of capacitance using De Sauty's Bridge.

12. Use of logic pulser and logic probe.

RECOMMENDED BOOKS

1. AK Sawhney, "Electronics Measurement and Instrumentation" by Dhanpat Rai and Sons, New Delhi
2. Oliver, "Electronics Measurement and Instrumentation" by Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Cooper, "Electronics Instrumentation" by Prentice Hall of India, New Delhi
4. Sanjeev Kumar and Yash Pal, "Electronics Instrumentation and measurement" by North Publications
5. JB Gupta, "Electronics Instrumentation" by Satya Prakashan, NewDelhi
6. E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

Note: This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

2.5 ENGINEERING GRAPHICS

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RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawings is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Draw Orthographic views of different objects viewed from different angles..

CO2: Draw and interpret sectional views of an object which are otherwise not visible in normal view.

CO3: Draw Isometric views of different solids and develop their surfaces.

CO4: Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances /fittings.

CO5: Draw orthographic views of different objects by using basic commands of AutoCAD.

DETAILED CONTENTS

UNIT I

1. Introduction to Engineering Drawing and Graphics

1.1 Introduction to use and care of drawing instruments, drawing materials, layout and sizes of drawing sheets and drawing boards.

1.2 Symbols and conventions-

a) Conventions of Engineering Materials, Sectional Breaks and Conventional lines.
b) Civil Engineering Sanitary fitting symbols
c) Electrical fitting symbols for domestic interior installations.

1.3 Geometrical construction-geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagons, pentagons bisecting a line and arc , division of line and circle with the help of drawing instruments.

2. Technical Lettering of Alphabet and Numerals

Definition and classification of lettering, Free hand (of height of 5,8,12 mm) and instrumental

lettering (of height 20 to 35 mm) : upper case and lower case, single and double stroke, vertical and inclined (Gothic lettering) at 75 degree to horizontal and with suitable height to width ratio 7:4.

3. Dimensioning

3.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions).

3.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., countersunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches.

4. Scales

4.1 Scales –Needs and importance (theoretical instructions), Type of scales, Definition of Representative Fraction (R.F.) and Length of Scale.

4.2 To draw/construct plain and diagonal scales.

UNIT II

1 Orthographic Projections

1.1 Theory of orthographic projections (Elaborate theoretical instructions).

1.2 Three views of orthographic projections of different objects of given pictorial view of a block in 1st and 3rd angle.

1.3 Projection of Points in different quadrant

1.4 Projection of Straight Line (1^{st} angle)

i. Line parallel to both the planes.
ii. Line perpendicular to any one of the reference plane and parallel to others
iii. Line inclined to any one of the references and parallel to another plane.

1.5 Projection of Plane – Different lamina like square rectangular, triangular, circle and Hexagonal pentagon. Trace of planes (HT and VT).

1.6 Identification of surfaces.

2. Sectioning

2.1 Importance and salient features

2.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections (theoretical only).

2.3 Orthographic sectional views of different objects.

UNIT III

1. Introduction of projection of right solids such as prism & pyramid (square, Pentagon, Hexagonal) cube, cone & cylinder (Axes perpendicular to H.P and parallel to V.P.)

2. Introduction of sections of right solids - Section planes, Sections of Hexagonal prism, pentagon pyramid, cylinder and cone (Section plane parallel to anyone reference planes and perpendicular to V.P. and inclined to H.P.)
3. Development of Surfaces – Development of lateral surfaces of right solids like cone, cylinder, pentagonal prism, pyramid and hexagonal pyramid (Simple problems)

UNIT IV

Isometric Views

1. Fundamentals of isometric projections and isometric scale.
2. Isometric views of different laminas like circle, pentagon and hexagon.
3. Isometric views of different regular solids like cylinder, cone, cube, cuboid, pyramid and prism.
4. Isometric views from given different orthographic projections(front, side and top view)

UNIT V

Introduction to AutoCAD

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets of different objects on AutoCAD (given pictorial/isometric view of a block). AutoCAD skill of student is evaluated in internal assessment only not in external exam.

RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co.,Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, NewDelhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt;Charotar Publishing House Pvt. Ltd.,Anands
4. Engineering Drawing and Graphics using AutoCAD by T. Jeyapoovan,Vikas Publishing House Pvt, Ltd Noida.
5. A Text Book of Engineering Drawing by S.R.Singhal and O.P.Saxena, Asian Publisher, Delhi
6. Engineering Drawing by RB Gupta, Satya Prakashan, New Delhi

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. First angle projection is to be followed. Minimum of 20 sheets to be prepared and at least 2 sheets on AutoCAD**.** Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students. This subject contains five units of equal weight age.

2.6 ELECTRICAL AND ELECTRONICS WORKSHOP -II

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RATIONALE

Psychomotor skills are mastered through practice, an opportunity therefore, has been extended to students through this course to refine their skills in different trades. The basic skills developed during first semester will be refined during this course by doing higher order skill jobs. In addition to developing general machining skills in the students, the objective of development of sense of dignity of labour, precision, safety at work places, team working and right attitude among the students will also be met. In addition a basic course for designing of Printed Circuit Board using software. PCB designing is an integral part of each electronics products. This program is designed to make students capable to design their own projects on PCB as per industrial requirement.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Perform safety procedures to maintain good housekeeping practices.

CO2: Handle materials, sequence of operations, tools to make a given job based on interpretation of drawing as per given specification

CO3: Develop a job using resources of shops and compare the job with given specifications. Analyze a given job and identify various operations required to make it.

CO4: Design and simulate the PCB using EDA Tools.

CO5: Acquire hands-on experience of PCB fabrication.

DETAILED CONTENTS

UNIT I

Electric Shop- II

1.1 Introduction to single phase and three phase supply and wiring system. Importance of three phase supply (RYB) & its sequence and wiring system.

Job I Connecting Generator and 3 phase wiring through Change over Switch.

1.2 Estimating and costing of power consumption

Job II Connecting single phase energy meter with supply and load. Reading and working out power consumption and cost of energy.

1.3 Study of internal wiring diagram of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc.

Job III Dismantling, servicing and reassembling of any of the above electrical appliances, finding faults with series testing lamp and multimeter.

1.4 Identification and familiarization with the following tools: Soldering Iron and its use.

Job IV Practice on joining using soldering flux and removing components/wires by desoldering

UNIT II

Electronic Shop - II

Various types of protective devices such as: wire fuse, cartridge fuse etc.

Demonstrate the joining (or connecting) methods/mounting and dismantling method, as well as uses of the items mentioned below:

a) Various types of plugs, sockets, connectors suitable for general purpose audio video use. Connectors, Banana plugs, sockets and similar male and female connectors and terminal strips.

b) Various types of switches such as: normal/miniature toggle, slide, push button piano key, rotary, SPST, SPDT, DPST, DPDT, band selector, multi-way Master Mains Switch.

Job-I Cut, bend, tin component, leads, inserts. Solder components e.g. resistor, capacitor, diodes, transistors on a PCB

Job-II Wiring of a small circuit on a PCB/tag strip involving laying, sleeving and use of identifier tags

Job-III De-soldering practice with de-soldering pump and with de-soldering wick.

Job-IV Cut, strip, join and insulate two lengths of wires/cables (repeat with different types of cables/ wires)

UNIT III

Printed Circuit Board (PCB) shop

Introduction: What is PCB, Difference between PWB and PCB, Types of PCBs: Single/Double Sided and Multi-Layer PCBs, PCB Layer Masks: Top Layer Mask, Bottom Layer Mask, Solder Mask, Legend Print or Silk screen Mask, Hand-Taping Vs CAD

PCB Materials: FR-2 and FR-4 material advantages and disadvantages, PCB Design Rules.

UNIT IV

Computer Aided Design

Brief History of EDA, Latest Trends in Market, How it helps and Why it requires, Different EDA Tools (Licensed like Orcad or Free Open Source Software like Circuit Maker or Dip Trace or Eagle etc.), Schematic Entry, Net listing, Electrical Rule Check (ERC), PCB Layout Designing, Auto and Manual Routing, Design Rule Check (DRC), Gerber Generation, Creating Library, Creating component, Symbols and Footprints for components.

UNIT V

Fabrication

Photo Processing for Pattern Transfer, Etching, Drilling, Component Mounting, Soldering and De-soldering, PCB Testing, PCB design and fabrication of Basic Analog Electronic Circuits, Power Supplies, 555 Based circuits etc.

RECOMMENDED BOOKS

1. SK Hajra, Choudhary and AK Choudhary, "Workshop Technology" I, II, III, by Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Manchanda, "Workshop Technology" Vol. I, II, III by India Publishing House, Jalandhar.
3. S.S. Ubhi, "Workshop Training Manual" Vol. I, II by Katson Publishers, Ludhiana.
4. K Venkata Reddy, "Manual on Workshop Practice" by MacMillan India Ltd., New Delhi
5. T Jeyapoovan,"Basic Workshop Practice Manual" by Vikas Publishing House (P) Ltd., New Delhi
6. B.S. Raghuwanshi, "Workshop Technology" by Dhanpat Rai and Co., New Delhi
7. HS Bawa, "Workshop Technology" by Tata McGraw Hill Publishers, New Delhi
8. Bosshart, "Printed Circuit Boards: Design and Technology" by TMH, 2008 or latest edition
9. Al Williams, "Build Your Own Printed Circuit Board" by Mc GrawHill, 2003 or latest edition
10. Jan Axelsen, "Making Printed Circuit Boards" by Mc GrawHill, 1993 or latest edition
11. "Complete PCB Design Using" Or "CAD Capture and PCB" Editor Paperback – Illustrated, 28 May 2009
12. "User Manual Circuit Maker" for Computer Aided PCB Design.
13. R. S. Khandpur, "Printed Circuit Boards" by McGraw-Hill, 2005
14. Chris Schroeder, "PCB Design Using AutoCAD
15. Module on "CAD for PCBs using EAGLE" by Prof.(Dr.) Rajesh Mehra, NITTTR, Chandigarh.
16. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based workshop and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

2.7 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

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RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industrial and construction activities so that he/she may help in balancing the ecosystem and controlling pollution by various control measures. The course is intended to provide a general concept in the dimensions of environmental pollution and disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.

COURSE OUTCOMES

After undergoing the subject, the student will be able to:

CO1: Comprehend the importance of sustainable ecosystem
CO2: Demonstrate interdisciplinary nature of environmental issues
CO3: Implement corrective measures for the abatement of pollution.
CO4: Identify the role of non-conventional energy resources in environmental protection.
CO5: Manage various types of disasters

DETAILED CONTENTS

UNIT I

Introduction

1.1 Basics of ecology, eco system- concept, and sustainable development, Sources, advantages, disadvantages of renewable and nonrenewable energy.
1.2 Rain water harvesting
1.3 Deforestation – its effects & control measures

UNIT II

Air and Noise Pollution

2.1 Air Pollution: Source of air pollution. Effect of air pollution on human health, economy, Air pollution control methods.

2.2 Noise Pollution: Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimizing noise pollution.

UNIT III

Water and Soil Pollution

3.1 Water Pollution: Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of DO, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

3.2 Soil Pollution :Sources of soil pollution, Effects and Control of soil pollution, Types of Solid waste- House hold, Industrial, Agricultural, Biomedical, Disposal of solid waste, Solid waste management E-waste, E – waste management

UNIT IV

Impact of Energy Usage on Environment

Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings, Concept of Carbon Credit & Carbon footprint.

UNIT V

Disaster Management

A. Different Types of Disaster:

Natural Disaster: such as Flood, Cyclone, Earthquakes and Landslides etc.

Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc.

B.Disaster Preparedness:

Disaster Preparedness Plan

Prediction, Early Warnings and Safety Measures of Disaster

Psychological response and Management (Trauma, Stress, Rumour and Panic)

RECOMMENDED BOOKS

1. Environmental Studies by S.C. Sharma & M.P. Poonia, Khanna Publishing House, New Delhi
2. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.

5. Environmental Engineering and Management by Suresh K Dhamija; S K KatariaandSons, New Delhi.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/BTE/NITTTR, Chandigarh.
7. Disaster Management by Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.
8. Disaster Science and Management by Tushar Bhattacharya, McGraw Hill Education (India) Pvt. Ltd.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies and Disaster Management like expert lectures, seminars, visits etc. may also be organized This subject contains five units of equal weight age.

SECOND YEAR

NSQF LEVEL - 4

12. STUDY AND EVALUATION SCHEME

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits L+P= C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
3.1	Industrial/In-House Training - I	-	2	0+1=1	-	40	40	-	60	60	100
3.2	Analog and Digital Communication	3	4	3+2=5	40	40	80	60	60	120	200
3.3	**Digital Electronics	3	4	3+2=5	40	40	80	60	60	120	200
3.4	Electronic Devices and Circuits-II	3	2	3+1 =4	40	40	80	60	60	120	200
3.5	**Programming in C	3	4	3+2=5	40	40	80	60	60	120	200
3.6	Electronic Design and Simulation	-	4	0+2=2	-	40	40	-	60	60	100
	# SCA	-	3	-	-	-	-	-	-	-	-
	Total	**12**	**23**	**22**	**160**	**240**	**400**	**240**	**360**	**600**	**1000**

** Common with Computer Engineering.

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L + P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
4.1	*English and Communication Skills - II	2	2	2+1=3	40	40	80	60	60	120	200
4.2	**Microprocessor & Micro-controllers	3	4	3+2=5	40	40	80	60	60	120	200
4.3	Communication Systems	3	2	3+1=4	40	40	80	60	60	120	200
4.4	Power Electronics	3	4	3+2=5	40	40	80	60	60	120	200
4.5	Open Elective (MOOCs^{+}/Offline)	2	-	2+0=2	40	-	40	60	-	60	100
4.6	Minor Project	-	8	0+4=4	-	40	40	-	60	60	100
# Student Centered Activities (SCA)		-	2	-	-	-	-	-	-	-	-
Total		**13**	**22**	**23**	**200**	**200**	**400**	**300**	**300**	**600**	**1000**

* Common with other Diploma Courses.

** Common with Automation and Robotics

\+ Assessment of Open Elective through MOOCs shall be based on assignments out of 100 marks.

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

Industrial Training: After 4th Semester, students shall undergo Industrial Training of 4 Weeks.

13. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects/Areas	Hours Per Week	
		Third Semester	Fourth Semester
1.	Industrial/In-House Training - I	2	-
2.	Analog and Digital Communication	7	-
3.	Digital Electronics	7	-
4.	Electronic Devices and Circuits-II	5	-
5.	Programming in C	7	-
6.	Electronic Design and Simulation	4	
7.	English and Communication Skills - II	-	4
8.	Microprocessor & Micro-controllers	-	7
9.	Communication Systems	-	5
10.	Power Electronics	-	7
11.	Open Elective (MOOCs/Offline)	-	2
12.	Minor Project	-	8
13.	Student Centered Activities	3	2
	Total	**35**	**35**

14.COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

Government and private sectors related to **Electronics and Communication Engineering** require **skilled manpower** to work in familiar, predictable, routine situations of clear choice. They are expected to have factual knowledge of Electronics and Communication field. They are expected to communicate with required clarity. Students after completing level 4 shall have knowledge of basic arithmetic, algebraic principles and basic understanding of social and natural environment. They are expected to recall and demonstrate skills in narrow range of applications using appropriate rules and tools to maintain quality.

Skilled employees will be responsible for carrying out a range of jobs, some of which will require them to make choices about the approaches they adopt. They will be expected to learn and improve their practice on the job. They should know what constitutes quality in the occupation and should distinguish between good and bad quality in the context of their job roles. Skilled worker at this level will be expected to carry out their work safely and securely and take full account of the health and safety on colleagues and customers. They should work hygienically and in ways which show an understanding of environmental issues. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social and political environment.

Electronics and Communication Engineering students after completing NSQF Level – 4 are expected to have good theoretical knowledge and hands-on practice of analog and digital communication systems. They should be able to design digital combinational and sequential circuits. They are also expected to have good theoretical and practical exposure of electronic devices and circuits. They should be able to design and simulate electronic circuit using EDA tool and fabricate them on Printed Circuit Boards. At this level, students should also have theoretical and practical knowledge of Microprocessors, Microcontrollers, Communication Systems and Power Electronics. They should be able to write programs for small application using suitable programming language. They are also expected to handle small projects related to Electronics and Communication Engineering industries at this level.

Electronics and Communication Engineering students have scope in organizations like Radar and Wireless, Railways, Defense Services, Para-military Forces**,** Civil Aviation**,** Defense Organizations**,** Electricity Boards and Corporations, manufacturing industries like wireless mobile equipment's, PCB Design and Fabrication**,** Consumer Electronics etc. They will also have scope in establishing small startups in the area of Marketing and Sales, Repair and Maintenance**,** Cable laying and jointing DBs etc.

15. PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level – 4 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this level, the student will be able to:

PO1: Work in familiar, predictable, routine situation of clear choice.

PO2: Acquire factual knowledge in the field of Electronics and Communication Engineering for employment.

PO3: Demonstrate routine and repetitive skills in narrow range of applications using appropriate rules and tools for quality.

PO4: Communicate with required clarity along with social and natural environment understanding.

PO5: Perform tasks with responsibility for own work and learning.

PO6: Select open elective of own interest to develop self-learning habit through online courses.

16. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Work in familiar, predictable, routine situation of clear choice.	• Measure the modulation index of the Amplitude Modulated wave. • Measure the frequency deviation of FM wave for different modulating signals. • Use different types of modulators and demodulators. • Interpret wave forms at input and output of PSK and FSK modulators. • Describe the logic gates and able to perform logics simplification. • Design various combinational circuits • Develop various sequential circuits. • Analyze A/D & D/A converters and various memories. • Demonstrate the concept of multistage amplifiers and plot the frequency response. • Design various wave-shaping circuits. • Identify various control structures, variables and implement them. • Practice pointer in an array and structure. • Use structures and union for handling data. • Explain and execute member functions in C language. • Describe and implement array in C language. • Perform the execution of pointers in C language. • Design and simulate electronic circuits using EDA Tools. • Develop layout of electronic circuits using EDA Tools. • Perform drilling and etching of PCBs. • Demonstrate skills in assembly and soldering of

	components. • Fabricate PCB along with is testing for working. • Interpret the program for 8051 in C language. • Interpret the program for serial communication in C. • Interface the I/O devices to 8051. • Identify and able to understand AM and FM Transmitters. • Describe and analyze different AM and FM receivers. • Differentiate various types of antennas used for different communication purposes. • Detect propagation of sky waves used for long range communication. • Plot and explain V-I characteristics of TRIAC, UJT, DIAC • Demonstrate the wave shapes of controlled rectifiers. • Install UPS system and carry out routine maintenance of batteries. • Demonstrate the concept and working of choppers, inverters and converters.
PO2: Acquire factual knowledge in the field of Electronics and Communication Engineering for employment.	• Explain the concept and need of modulation and demodulation. • Understand various types of number systems and digital codes. • Describe the logic gates and able to perform logics simplification. • Describe the operation of large signal amplifiers. • Explain the concept of feedback amplifiers. • Describe the concept of multi-vibrators, operational amplifiers and their applications. • Describe the concept of regulated DC supplies. • Identify various control structures, variables and implement them. • Explain and execute member functions in C

	language. • Analyse Architecture of 8051 microcontroller IC. • Understand the Timer and I/O ports of 8051 and its programming in C. • Identify and able to understand AM and FM Transmitters. • Describe and analyze different AM and FM receivers. • Acquire basic knowledge of satellite communication. • Describe the construction, working principles of SCR.
PO3: Demonstrate routine and repetitive skills in narrow range of applications using appropriate rules and tools for quality.	• Measure the modulation index of the Amplitude Modulated wave. • Measure the frequency deviation of FM wave for different modulating signals. • Use different types of modulators and demodulators. • Interpret wave forms at input and output of PSK and FSK modulators. • Describe the logic gates and able to perform logics simplification. • Design various combinational circuits • Develop various sequential circuits. • Analyze A/D & D/A converters and various memories. • Demonstrate the concept of multistage amplifiers and plot the frequency response. • Design various wave-shaping circuits. • Identify various control structures, variables and implement them. • Practice pointer in an array and structure. • Use structures and union for handling data. • Explain and execute member functions in C language. • Describe and implement array in C language.

	• Perform the execution of pointers in C language. • Design and simulate electronic circuits using EDA Tools. • Develop layout of electronic circuits using EDA Tools. • Perform drilling and etching of PCBs. • Demonstrate skills in assembly and soldering of components. • Fabricate PCB along with is testing for working. • Interpret the program for 8051 in C language. • Interpret the program for serial communication in C. • Interface the I/O devices to 8051. • Identify and able to understand AM and FM Transmitters. • Describe and analyze different AM and FM receivers. • Differentiate various types of antennas used for different communication purposes. • Detect propagation of sky waves used for long range communication. • Plot and explain V-I characteristics of TRIAC, UJT, DIAC • Demonstrate the wave shapes of controlled rectifiers. • Install UPS system and carry out routine maintenance of batteries. • Demonstrate the concept and working of choppers, inverters and converters.
PO4: Communicate with required clarity along with social and natural environment understanding.	• Develop required competencies for effective communication and presentation. • Communicate effectively with an increased confidence; read, write and speak in English language fluently. • Comprehend special features of format and style of formal communication through various

	modes. • Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews • Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships. • Write the minor project report effectively. • Present the minor project report using PPT.
PO5: Perform tasks with responsibility for own work and learning.	• Understand the working environment of industries. • Take necessary safety precautions and measures. • Learn about present and future requirement of industries. • Work in team for solving industrial problems. • Develop required competencies and skills for relevant industries. • Select the minor project according to the need of relevant industries. • Work as a team member for successful completion of minor project. • Acquire Life Long Learning skills.
PO6: Select open elective of own interest to develop self-learning habit through online courses.	• State the basic concepts and principles about the subject of interest. • Perform in a better way in the professional world. • Select and learn the subject related to own interest. • Explore latest developments in the field of interest. • Develop the habit of self-learning through online courses.

17. SUBJECTS & CONTENTS

(SECOND YEAR)

THIRD SEMESTER

3.1 INDUSTRIAL / IN – HOUSE TRAINING - I

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RATIONALE

Industrial training / In – house training will help the students to understand the working environment of relevant industries. The student will learn to work in team to solve the industrial problems. It will also give exposure about the present and future requirements of the relevant industries. This training is very important for development of required competencies and skills for employment and start– ups.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1: Understand the working environment of industries
CO2: Take necessary safety precautions and measures.
CO3: Learn about present and future requirement of industries.
CO4: Work in team for solving industrial problems
CO5: Develop competencies and skills required by relevant industries.
CO6: Develop writing, speaking and presentations skills.

PRACTICAL EXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training / In – house training report and their presentation using Power Point about the knowledge and skills gained during the training. The Head of the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation. The following performance parameters are to be considered for assessment of the students out of 100 marks:

	Parameter	**Weightage**
i	Industrial / In-house assessment of the candidate by the trainer	40%
ii	Report Writing	20%
iii	Power Point Presentation	20%
iv	Viva-voce	20%

3.4 ANALOG AND DIGITAL COMMUNICATION

L	P
3	4

RATIONALE

This course deals with the analog and digital communication techniques. The students should understand the advantage and limitations of various analog and digital modulation systems on a comparative scale and relate to them while studying practical communication systems. It encompasses the modern communication network and integrated services

COURSE OUTCOMES

After undergoing this subject, the students will be able to:

CO1: Explain the concept and need of modulation and demodulation.
CO2: Measure the modulation index of the Amplitude Modulated wave.
CO3: Measure the frequency deviation of FM wave for different modulating signals.
CO4: Use different types of modulators and demodulators.
CO5: Interpret wave forms at input and output of PSK and FSK modulators.

DETAILED CONTENTS

UNIT I

Analog Communication

- Need for modulation, frequency translation and demodulation in communication systems
- Basic scheme of a modern communication system.

UNIT II

Amplitude Modulation

- Derivation of expression for an amplitude modulated wave. Carrier and side band components. Modulation index. Spectrum and BW of AM Wave. Relative power distribution in carrier and side bands.

- Elementary idea of DSB-SC, SSB-SC, ISB and VSB modulations, their comparison, and areas of applications.

UNIT III

Frequency Modulation

- Expression for frequency modulated wave and its frequency spectrum (without Proof and analysis of Bassel function) Modulation index, maximum frequency deviation and deviation ratio, BW of FM signals, Carson's rule.

- Effect of noise on FM carrier. Noise triangle, Role of limiter, Need for pre-emphasis and de-emphasis, capture effect.

- Comparison of FM and AM in communication systems

UNIT IV

Digital Communication

Basic block diagram of digital and data communication systems. Their comparison with analog communication systems. Sampling theorem and its basic concept. Use of Sampling Theorem:

- Introduction to PAM, PPM, PWM
- Quantization and error of Quantization
- PCM, DPCM, their advantage and disadvantages
- DELTA and ADAPTIVE DELTA Modulation concept of COMPANDING
- Frequency hopping spread spectrum technique.

UNIT V

Digital Modulation Techniques

Basic block diagram and principle of working of the following:

- Amplitude shift keying (ASK): Interrupted continuous wave (ICW), two tone modulation

- Frequency Shift keying (FSK)

- Phase shift keying (PSK), Quadrature Phase Shift Keying (QPSK)

PRACTICAL EXERCISES

1. Observe wave forms at input and output of pulse code modulator with CRO.

2. To observe an AM wave on CRO produced by a standard signal generator using internal and external modulation
3. To measure the modulation index of the wave obtained in above practical
4. To obtain an FM wave and measure the frequency deviation for different modulating signals.
5. Observe wave forms at input and output of QPSK modulators
6. Observe wave forms at input and output of PSK modulators
7. Observe wave forms at input and output of ASK modulators
8. Observe wave forms at input and output of FSK modulators

RECOMMENDED BOOKS

1. Electronic Communication Systems by George Kennedy Tata McGraw Hill Education Pvt. Ltd.
2. Communication system by A.K. Gautam S.K. Kataria Sons, Delhi
3. Electronics communication by K.S. Jamwal, DhanpatRai and Sons, Delhi
4. Principles of Communication Engineering by Taub, Tata McGraw Hill Education Pvt Ltd,
5. Radio Engineering by GK Mittal, Khanna Publishers, New Delhi
6. Principles of Communication Engineering by Sanjeev Kumar, Ishan Publications, Ambala
7 Communication Engineering by A Kumar
8 Principles of Communication Engineering by Manoj Kumar, Satya Prakashan, New Delhi
9 Principles of Communication Engineering by Anokh Singh, S. Chand and Co., New Delhi
10 Principles of Communication Engineering by Roody , Coolen, Pearson Publisher
11. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. For the better awareness, visit must be arranged to the relevant industries. This subject contains five units of equal weight age.

3.3 DIGITAL ELECTRONICS

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RATIONALE

This course has been designed to make the students know about the fundamental principles of digital electronics and gain familiarity with the available IC chips. This subject aims to give a detailed exposure of number systems and various codes. The students will understand various logic gates and their logic simplification. It will help the students to design various combinational, sequential circuits, converters and memories.

COURSE OUTCOMES

After undergoing this subject, the students will be able to:
CO1: Understand various types of number systems and digital codes.
CO2: Describe the logic gates and able to perform logics simplification.
CO3: Design various combinational circuits
CO4: Develop various sequential circuits.
CO5: Analyze A/D & D/A converters and various memories.

DETAILED CONTENTS

UNIT I

Number Systems and Codes

1.1 Introduction to analog and digital signal
1.2 Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa.
1.3 Binary addition and subtraction including binary points. 1's and 2's complement method of addition/subtraction.
1.4 Concept of code, weighted and non-weighted codes, examples of 8421, BCD, excess-3 and Gray code.
1.5 Concept of parity, single and double parity and error detectio

UNIT II

Logic Gates and Logic Simplifications

2.1 Concept of negative and positive logic

2.2 Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates, NAND and NOR as universal gates.

2.3 Introduction to TTL and CMOS logic families

2.4 Postulates of Boolean algebra, De Morgan's Theorems. Implementation of Boolean

2.5 Karnaugh map (upto 4 variables) and simple application in developing combinational logic circuits

UNIT III

Combinational Circuits

3.1 Half adder, Full adder circuit, design and implementation.

3.2 4 bit adder circuit

3.3 Four bit decoder circuits for 7 segment display and decoder/driver ICs.

3.4 Basic functions and block diagram of MUX and DEMUX with different ICs

3.5 Basic functions and block diagram of Encoder

UNIT IV

Sequential Circuits

4.1 Concept and types of latch with their working and applications

4.2 Operation using waveforms and truth tables of RS, T, D, Master/Slave JK flip flops. Difference between a latch and a flip flop

4.3 Introduction to Asynchronous and Synchronous counters. Binary counters, Divide by N ripple counters, Decade counter, Ring counter

4.4 Introduction and basic concepts including shift left and shift right.

4.5 Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.

4.6 Universal shift register

UNIT V

Converters and Memories

5.1 Working principle of A/D and D/A converters

5.2 Brief idea about different techniques of A/D conversion and study of :

a) Stair step Ramp A/D converter

b) Dual Slope A/D converter
c) Successive Approximation A/D Converter

5.3 Detail study of :
a) Binary Weighted D/A converter
b) R/2R ladder D/A converter

5.4 Applications of A/D and D/A converter.

5.5 Memory organization, classification of semiconductor memories (RAM, ROM, PROM, EPROM, EEPROM), static and dynamic RAM, introduction to 74181 ALU IC

PRACTICAL EXERCISES

1. Verification and interpretation of truth tables for AND, OR, NOT NAND, NOR and Exclusive OR (EXOR) and Exclusive NOR(EXNOR) gates
2. Realisation of logic functions with the help of NAND or NOR gates
3. To design a half adder using XOR and NAND gates and verification of its operation
4. To design of a full adder circuit using XOR and NAND gates and verify its operation
5. To design circuit for 7 segment display ICs.
6. Verification of truth table for positive edge triggered, negative edge triggered, level triggered IC flip-flops (At least one IC each of D latch, D flip-flop, JK flip-flops).
7. Verification of truth table for encoder and decoder ICs.
8. Verification of truth table for Multiplexers and x and De-Multiplexers
9. To design a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation.
10. To design a 4 bit ring counter and verify its operation.
11. Use of Asynchronous Counter ICs (7490 or 7493)
12. To design and verification of A/D converter
13. To design and verification of D/A converter
14. To design and verification of 74181 ALU IC

RECOMMENDED BOOKS

1. Malvino Leach, “Digital Electronics and Applications”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 8th Edition, 2015.
2. Morris Mano, “Digital Logic Designs”, Prentice Hall of India, New Delhi, 6th Edition, 2018.
3. Soumitra Kumar Mandal, “Digital Electronics”, Tata McGraw Hill Education Pvt. Ltd., 2010.

4. V K Sangar, "Digital Electronics", Raj Publishers, Jalandhar, 2017.
5. Tokheim, "Digital Electronics", Tata McGraw Hill Education Pvt. Ltd, 4th Edition, 2007.
6. Thomas Floyds, "Digital Fundamentals", Universal Book Stall, 11th Edition, 2017.
7. RP Jain, "Digital Electronics", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 4th Edition, 2010.
8. KS Jamwal, "Digital Electronics", Dhanpat Rai and Co., New Delhi, 2010.
9. Yashpal and Sanjeev Kumar, "Digital Electronics", North Publication, Ambala City, 1st Edition, 2020.
10. BR Gupta, "Digital Electronics", Dhanpat Rai & Co., New Delhi, 2020.
11. RJ Tocci, "Digital Systems: Principles and Applications", Prentice Hall of India, New Delhi, 2000 Edition.
12. V. Rajaraman, "Digital Electronics by Prentice Hall of India", New Delhi, 5th Edition, 2007.
13. Naresh Gupta, "Fundamentals of Digital Electronics", Jain Brothers, New Delhi, 2005.
14. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age. All experiments may preferably be done on Bread Boards.

3.4 ELECTRONIC DEVICES AND CIRCUITS - II

L	P
3	2

RATIONALE

After attaining basic knowledge of electronic devices like diodes, transistors, and elementary circuits, this course will enable the students to learn about the use of transistors in analog circuits like power amplifier, multistage amplifier, oscillators, wave shaping circuits and multivibrators etc. It also gives information about timer, operational amplifier, voltage regulator, ICs and their applications for effective functioning in the field of electronic service industry.

COURSE OUTCOMES

CO1: Demonstrate the concept of multistage amplifiers and plot the frequency response.

CO2: Describe the operation of large signal amplifiers.

CO3: Explain the concept of feedback amplifiers.

CO4: Design various wave-shaping circuits.

CO5: Describe the concept of multi-vibrators, operational amplifiers and their applications.

CO6: Describe the concept of regulated DC supplies.

DETAILED CONTENTS

UNIT I

Multistage Amplifier

- Need for multistage amplifier
- Gain of multistage amplifier
- Different types of multistage amplifier like RC coupled, transformer coupled, direct coupled, and their frequency response and bandwidth

UNIT II

Large Signal Amplifier

- Difference between voltage and power amplifiers
- Importance of impedance matching in amplifiers

- Class A, Class B, Class AB, and Class C amplifiers, collector efficiency and Distortion in class A,B,C.
- Single ended power amplifiers, Graphical method of calculation (without derivation) of output power; heat dissipation curve and importance of heat sinks. Push-pull amplifier, and complementary symmetry push-pull amplifier
- Single and double tuned voltage amplifiers and their frequency response characteristics

UNIT III

Feedback in Amplifiers

- Basic principles and types of feedback
- Derivation of expression for gain of an amplifier employing feedback
- Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier
- RC coupled amplifier with emitter bypass capacitor
- Emitter follower amplifier and its application

UNIT IV

Sinusoidal Oscillators

- Use of positive feedback
- Barkhausen criterion for oscillations
- Different oscillator circuits-tuned collector, Hartley, Colpitts, phase shift, Wien's bridge, and crystal oscillator. Their working principles (no mathematical derivation but only simple numerical problems)

UNIT V

Multivibrator Circuits and Operational Amplifiers

- Working principle of transistor as switch
- Concept of multi-vibrator: astable, monostable, and bistable and their applications
- Block diagram of IC555 and its working and applications
- IC555 as monostable and astable multi-vibrator and bistable multivibrator
- Characteristics of an ideal operational amplifier and its block diagram
- IC-741 and its pin configuration
- Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current
- Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator

PRACTICAL EXERCISES

1. Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth.
2. To measure the gain of push-pull amplifier.
3. To measure the voltage gain of emitter follower circuit and plot its frequency response.
4. To observe the output wave form of Hartley Oscillator.
5. To observe the output wave form of Colpitt's Oscillator.
6. To observe the output wave form of RC phase shift oscillator.
7. To observe the output wave form of Wein bridge Oscillator.
8. Use of IC 555 as mono astable multivibrator and observe the output for different values of RC.
9. Use of IC 555 as astable multivibrator and observe the output at different duty cycles.
10. To use IC 741 (op-amplifier) as i) Inverter, ii) Adder, iii) Subtractor iv) Integrator.

RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuits by NN Bhargava; Tata McGraw Hill, New Delhi
2. Electronic Principles by Sahdev; DhanpatRai and Sons, New Delhi.
3. Electronics Devices and Circuits by D.R. Arora, North Publication
4. Electronics Devices and Circuits by Bhupinderjit Kaur; Modern Publishers, Jalandhar
5. Electronic Devices and Circuits by BL Theraja; S Chand and Co Ltd. New Delhi
6. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
7. Electronics Devices and Circuits-II by Rajesh Kumar, Eagle Prakashan, Jalandhar
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES:

1. https://onlinecourses.nptel.ac.in/ ,

2. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

3.5 PROGRAMING IN C

L	P
3	4

RATIONALE

Computers play a vital role in present day professional life of technician's. People working in the field of computer industry, use computers in solving problems more easily and effectively. In order to enable the students use the computers effectively in problem solving, this course offers the modern programming language C along with exposition to various applications of computers.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Identify various control structures, variables and implement them.
CO2: Practice pointer in an array and structure.
CO3: Use structures and union for handling data.
CO4: Explain and execute member functions in C language.
CO5: Describe and implement array in C language.
CO6: Perform the execution of pointers in C language.

DETAILED CONTENTS

UNIT I

Basics of C Programming

1.1 Steps in development of a program, Flow charts, Algorithm development
1.2 Programme Debugging, I/O statements, Constants, variables and data types
1.3 Operators & Expressions, Unformatted and Formatted IOS, Data Type Casting
1.4 Decision making with IF – statement, IF – Else and Nested IF
1.5 While and do-while, for loop, Break. Continue, goto and switch statements

UNIT II

Pointers and Functions

2.1 Introduction to pointers, Address operator and pointers
2.2 Declaring and initializing pointers, Single pointer,
2.3 Introduction to functions, Function Declaration, calling, definition

2.4 Parameter Passing, Call - by value/reference, Global and Local Variables

UNIT III

Arrays and Strings

3.1 Introduction to Arrays
3.2 Array Declaration, Length of array
3.3 Single and muti dimensional array
3.4 Arrays of characters
3.5 Introduction of Strings
3.6 String declaration and definition
3.7 String related function i.e. strlen, strcpy, strcmp
3.8 Passing an array to function
3.9 Pointers to an array and strings.

UNIT IV

Structures and Unions

4.1 Declaration of structures
4.2 Accessing structure members
4.3 Structure Initialization
4.4 Pointer to a structures,
4.5 Unions

UNIT V

File Handling

5.1 Opening and Closing of File
5.2 Modes of Accessing Files
5.3 Reading and Writing in the File

PRACTICAL EXERCISES

1. Programming exercises on executing and editing a C program.
2. Programming exercises on defining variables and assigning values to variables.
3. Programming exercises on arithmetic and relational operators.
4. Programming exercises on arithmetic expressions and their evaluation.
5. Programming exercises on formatting input/output using print f and scan f and their return type values.
6. Programming exercises using if statement.
7. Programming exercises using if – Else.

8. Programming exercises on switch statement.
9. Programming exercises on do – while, statement.
10. Programming exercises on for – statement.
11. Simple programs using pointers.
12. Programs on one-dimensional array.
13. Programs on two-dimensional array.
14. Programs for putting two strings together. (ii) Programs for comparing two strings.
15. Simple programs using functions
16. Simple programs using structures.
17. Simple programs using union.
18. Program on Reading and Writing data to a file.

RECOMMENDED BOOKS

1. Yashwant Kanetkar, "Let us C".
2. E Balaguruswami, "Programming in ANSI C", Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. RS Salaria, "Problem Solving and Programming in C", Khanna Book Publishing Co (P) Ltd. New Delhi.
4. Reema Thareja, "Programming in C", Oxford University Press, New Delhi.
5. Gottfried, "Programming in C", Schaum Series, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
6. Yashwant Kanetkar, "Exploring C", BPB Publications, New Delhi.
7. R Subburaj, "Programming in C", Vikas Publishing House Pvt. Ltd., Jangpura, New Delhi.
8. M.H. Lewin, "Elements of C", Khanna Publishers, New Delhi.
9. Stephen G Kochan, "Programming in C".
10. BP Mahapatra, "Programming in C", Khanna Publishers, New Delhi.
11. Ajay Mittal, "Programmming in C: A Practical Approach", Pearson Publication.
12. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is a programming skill based subject and topics taught in the class should be practiced in the lab regularly for development of required skills in the students. This subject contains five units of equal weight age with hands on practice for programming skill development.

3.6 ELECTRONIC DESIGN AND SIMULATION

L	P
-	4

RATIONALE

Electronic design and simulation using Electronic Design Automation (EDA) tools play key role in electronic industries related to Printed Circuit Boards (PCB). To fulfill the requirements of PCB industries, the main purpose of this subject is to give practice to the students in design, simulation and fabrication of the PCBs using Computer Aided Design (CAD). The topics of assembly, soldering, testing, and documentation have been included to give overall picture of the process of manufacturing of electronic circuits.

COURSE OUTCOMES

After undergoing this subject, the students will be able to:

CO1: Design and simulate electronic circuits using EDA Tools.

CO2: Develop layout of electronic circuits using EDA Tools.

CO3: Perform drilling and etching of PCBs.

CO4: Demonstrate skills in assembly and soldering of components.

CO5: Fabricate PCB along with is testing for working.

DETAILED CONTENTS

UNIT I

Electronic Design

Selection and use of commonly used active and passive components using bread board.

- Testing of active and passive components
- Develop skills in assembly of components

UNIT II

Printed Circuit Boards

- PCB board materials, their characteristics and plating, corrosion and its prevention.
- Photo processing, screen printing, etching, drilling, surface treatment and protection from harsh environments, plated through holes, double sided and multilayer PCBs.

- Assembly of circuits on PCB, soldering and de-soldering techniques, Role of tinning, flow and wave soldering, solderability, composition of solder, Edge connector.

UNIT III

Electronic Circuit Design and Simulation

Electronic circuit design and simulation using EDA Tools like EAGLE/Circuit Maker/ORCAD etc. of the following types:

i. Analog Circuits
ii. Digital Circuits
iii. Power Supplies

UNIT IV

PCB Fabrication & Testing

Electronic layout design and simulation using EDA Tools like EAGLE/Circuit Maker/ORCAD etc. Development of Top/Bottom layer mask, Legend Print/Silk Screen mask, Solder mask. Pattern transfer using photo-processing, Etching.

Assembly of circuits on PCB, component soldering, PCB fabrication and testing.

PRACTICAL EXERCISES

Following are the some suggested electronic circuits for PCB fabrication and testing:

1. Regulated power supply
2. Timers using 555 and other oscillators
3. Touch plate switches – transistorized or 555 based
4. Door bell / cordless bell
5. Clapping switch and IR switch
6. Blinkers
7. Sirens and hooters
8. Electronic dice
9. Battery charger, mobile charger
10. Fire/smoke/intruder alarm
11. Liquid level controller
12. Counters
13. Combination locks
14. Electronics musical instruments

15. Electronic Ballasts
16. Emergency light
17. Fan regulator

RECOMMENDED BOOKS

1. Printed Circuit Board by Bosshart; McGraw Hill Education Pvt Ltd., New Delhi
2. Printed Circuit Board by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi
3. Module on CAD for PCBs using EAGLE Software by Dr. Rajesh Mehra, Professor, NITTTR, Chandigarh
4. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES:

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/
3. EAGLE by CadSoft Computer GmbH 5.1 Download (Free trial) - eagle.exe (informer.com)
4. Free PCB Design Software | CircuitMaker

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught by the teacher should be practiced in the Lab regularly for development of required skills in the students. Every student should fabricate and test at least one electronic circuit on PCB. This subject contains four units of equal weight age.

FOURTH SEMESTER

4.1 ENGLISH AND COMMUNICATION SKILL - II

L	P
2	2

RATIONALE

Communication II moves a step further from Communication Skills I and is aimed at enhancing the linguistic competency of the students. Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life – personal, social and professional. This course is intended to make fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Communicate effectively with an increased confidence; read, write and speak in English language fluently.

CO2: Comprehend special features of format and style of formal communication through various modes.

CO3: Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews

CO4: Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships.

DETAILED CONTENTS

UNIT I

Reading

1.1 Portrait of a Lady - Khushwant Singh

1.2 The Doctor's Word by R K Narayan

1.3 Speech by Dr Kiran Bedi at IIM Indore2007 Leadership Concepts

1.4 The Bet - by Anton Chekov

UNIT II

Effective Communication Skills

2.1 Modern means of Communication (Video Conferencing, e- mail, Teleconferencing)

2.2 Effective Communication Skills: 7 C's of Communication
2.3 Non-verbal Communication – Significance, Types and Techniques for Effective Communication
2.4 Barriers and Effectiveness in Listening Skills
2.5 Barriers and Effectiveness in Speaking Skills

Unit III

Professional Writing

3.1 Correspondence: Enquiry letters, placing orders, complaint letters
3.2 Report Writing
3.3 Memos
3.4 Circulars
3.5 Press Release
3.6 Inspection Notes and tips for Note-taking
3.7 Corrigendum writing
3.8 Cover Letter

UNIT IV

Grammar and Vocabulary

4.1 Prepositions
4.2 Conjunctions
4.3 Punctuation
4.4 Idioms and Phrases: A bird of ill omen, A bird's eye view, A burning question, A child's play, A cat and dog life, A feather in one's cap, A fish out of water, A shark, A snail's pace, A snake in the grass, A wild goose chase, As busy as a bee, As faithful as dog, Apple of One's eye, Behind one's back, Breath one's last, Below the belt, Beat about the bush, Birds of a feather flock together, Black Sheep, Blue blood, By hook or crook, Chicken hearted, Cut a sorry figure ,Hand in glove, In black and white, In the twinkling, In full swing ,Is blind as a bat, No rose without a thorn, Once in a blue moon, Out of the frying pan in to the fire, know no bounds ,To back out, To bell the cat, To blow one's trumpet, To call a spade a spade, To cut one's coat according to one's cloth, To eat humble pie, To give ear to, To have a thing on one's finger tips, To have one's foot in the grave, To hold one's tongue, To kill two birds with one stone, To make an ass of oneself, To put two and two together, To the back bone, Turn coat, ups and downs.
4.5 Pairs of words commonly misused and confused: Accept-except, Access-excess, Affect-effect, Artificial- artful, Aspire-expire, Bail-bale, Bare-bear, Berth-birth, Beside-besides,

Break-brake, Canvas-canvass, Course- coarse, Casual-causal, Council-counsel, Continual-continuous, Coma-comma, Cue- queue, Corpse- corps-core, Dairy-diary, Desert-dessert, Dual-duel, Dew- due, Die-dye, Draft- draught-drought, Device-devise, Doze-dose, Eligible-illegible, Emigrant- immigrant, Envelop-envelope, Farther-further, Gate-gait, Goal-goal, Human-humane, Honorable-honorary, Hail-hale, Hair-heir-hare, Industrial-industrious, Impossible- impassable, Idle-idol-ideal, Lose-loose, Later-latter, Lesson-lessen, Main-Mane, Mental-mantle, Metal-mettle, Meter-metre, Oar-ore, Pray-prey, Plain-plan, Principal - principle, Personal- personnel, Roll- role, Route-rout- roote, Stationary-stationery, Union- unity, Urban- urbane, Vocation- vacation, Vain- vein-vane, Vary- very.

4.6 Translation of Administrative and Technical Terms in Hindi or Mother tongue: Academy, Abandon, Acting in official capacity, Administrator, Admission, Aforesaid, Affidavit, Agenda, Alma Master, Ambiguous, Appointing Authority, Apprentice, Additional, Advertisement, Assistant, Assumption of charge, Assurance, Attested copy, Bonafide, Bond, Cashier, Chief Minister, Chief Justice Clerical error, Commanding ,Officer, Consent, Contractor, corruption, Craftsman, Compensation, Code, Compensatory allowance, Compile, Confidential letter, Daily Wager, Data, Dearness allowance, Death - Cum Retirement, Dispatch, Dispatch Register, Disciplinary, Disciplinary Action, Disparity Department, Dictionary, Director, Director of Technical Education, Earned Leave, Efficiency Bar, Estate, Exemption, Executive Engineer, Extraordinary, Employment Exchange, Flying Squad, General Body, Head Clerk, Head Office, High Commission, Inconvenience, Income Tax, Indian Assembly Service, Justify, Legislative Assembly, Negligence, Officiating ,Office Record, Office Discipline, On Probation, Part Time, Performance, Polytechnic, Proof Reader Precautionary, Provisional, Qualified, Regret, Responsibility, Self-Sufficient, Senior, Simultaneous ,Staff, Stenography ,Superior, Slate, Takeover, Target Data Technical Approval, Tenure, Temporary, Timely Compliance, Under Investigation, Under Consideration, Verification, Viva-voce, Write off, Working Committee, Warning, Yours Faithfully , Zero Hour.

UNIT V

Employability Skills

5.1 Presentation Skills: How to prepare and deliver a good presentation

5.2 Telephone Etiquettes

5.3 Importance of developing employable and soft skills

5.4 Resume Writing: Definition, Kinds of Resume, Difference between Bio-data and Curriculum Vitae and Preparing a Resume for Job/ Internship

5.5 Group discussions: Concept and fundamentals of GD, and learning Group Dynamics.

5.6 Case Studies and Role Plays

PRACTICAL EXERCISES

1. Reading Practice of the above lessons in the Lab Activity classes.
2. Comprehension exercises of unseen passages along with the given lessons.
3. Vocabulary enrichment and grammar exercises based on the above selective readings.
4. Situational Conversation: Requesting and responding to requests; Expressing sympathy and condolence.
5. Warning; Asking and giving information.
6. Getting and giving permission.
7. Asking for and giving opinions.
8. A small formal and informal speech.
9. Seminar.
10. Debate.
11. Interview Skills: Preparing for the Interview and guidelines for success in the Interview and significance of acceptable body-language during the Interview.
12. Written Drills will be undertaken in the class to facilitate a holistic linguistic competency among learners.
13. Participation in a GD, Functional and Non-functional roles in GD, Case Studies and Role Plays
14. Presentations, using audio-visual aids (including power-point).
15. Telephonic interviews, face to face interviews.
16. Presentations as Mode of Communication: Persuasive Presentations using multi-media aids.
17. Practice of idioms and phrases on: Above board , Apple of One's eye , At sea, At random, At large, A burning question, A child's play, A wolf in sheep's clothing, A deal, Breath one's last, Bid fair to, Beat about the bush, Blue Blood, Big Gun, Bring to Book, Cut a sorry figure, Call names, Carry weight, Dark Horse, Eat Humble pie, Feel small, French leave, Grease the palm, Go against the grains, Get One's nerves, Hard and Fast, Hue and Cry, Head and ears, In full swing, Jack of all trades, know no bounds, kiss the dust, Keep an eye on, Lion's share, learn by rote, Null and void, on the cards, Pull a long face, Run amuck, Right and Left, Rain on Shine, Small talk, Take to one's heels, Tooth and nail, to take by storm, , Wet blanket, Yearn for.

RECOMMENDED BOOKS

1. Alvinder Dhillon and Parmod Kumar Singla, "Text Book of English and Communication Skills Vol – 1, 2", M/s Abhishek Publications, Chandigarh.
2. J Sethi, Kamlesh Sadanand & DV Jindal, "Course in English Pronunciation", PHI Learning Pvt. Ltd., New Delhi.
3. Wren and Martin, "High School English Grammar and Composition" .
4. NK Aggarwal and FT Wood, "English Grammar, Composition and Usage", Macmillan Publishers India Ltd., New Delhi.
5. RC Sharma, and Krishna Mohan, "Business Correspondence & Report Writing", (4^{th} Edition), by Tata MC Graw Hills, New Delhi.
6. Varinder Kumar, Bodh Raj & NP Manocha, "Business Communication Skills", Kalyani Publisher, New Delhi.
7. Kavita Tyagi & Padma Misra, "Professional Communication", PHI Learning Pvt. Ltd., New Delhi.
8. Nira Konar, "Communication Skills for Professionals", PHI Learning Pvt. Ltd., New Delhi.
9. Krishna Mohan & Meera Banerji, "Developing Communication Skills", (2^{nd} Edition), Macmillan Publishers India Ltd., New Delhi.
10. M. Ashraf Rizwi, "Effective Technical Communication", Tata MC Graw Hills, New Delhi.
11. Andrea J Rutherford, "Basic Communication Skills for Technology", Pearson Education, New Delhi.

INSTRUCTIONAL STRATEGY

This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. Emphasis should be given on practicing of communication skills. This subject contains five unit of equal weight age.

4.2 MICROPROCESSOR AND MICRO-CONTROLLERS

L	P
3	4

RATIONALE

Microprocessor and microcontrollers are the most useful electronic chips which are used to design and develop processor and computer based automatic smart electronics systems for home and industry application. This subject is devoted to the study of microprocessor and microcontroller interfacing of memory and I/O devices like A to D converter, D to A converter LED, LCD etc. The students learn Programming of microcontroller using C language. The subject will help the students to study concepts of embedded system. It will also help to understand design of simple microcontroller systems.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Analyse Architecture of 8051 microcontroller IC.
CO2: Interpret the program for 8051 in C language.
CO3: Understand the Timer and I/O ports of 8051 and its programming in C.
CO4: Interpret the program for serial communication in C.
CO5: Interface the I/O devices to 8051.

DETAILED CONTENTS

UNIT I

Introduction to Microprocessors and Microcontrollers

1.1 Basic Introduction and comparison of Microcomputer, Microprocessor, and Microcontroller, Selection of Microcontroller
1.2 Introduction to 8051- History, Architecture, Pin Diagram, Crystal Circuit, Reseat Circuit.

UNIT II

Programming Languages and Instruction Set

2.1 Different Types of Programming languages for 8051, Advantages of Programming in C
2.2 Addressing Modes

2.3 Instruction Set of 8051
2.4 Types of Instructions
2.5 Data types and time delay in 8051, I/O programming in 8051 C,
2.6 Hex file generation using Keil Compiler

UNIT III

8051 Timers

3.1 Timers and Registers of 8051, Timer / Counter logic and modes
3.2 Programming of 8051 timers, Programming Timer 1 using C

UNIT IV

Serial Port Communication

4.1 Serial Port of 8051 –Basics of serial communication, Serial Communication-SCON, SBUF; Modes of serial communication
4.2 8051 connection to RS232
4.3 Interrupts

UNIT V

Real World Interfacing with 8051

5.1 I/O Interfacing – LED, LCD and Keyboard Interfacing
5.2 Interfacing ADC and DAC
5.3 Sensor Interfacing and Signal Conditioning

PRACTICAL EXERCISES

1. Understand 8051 development board
2. Generating Hex File using Keil Compiler
3. Programming and interfacing of RELAY and Buzzer
4. Programming to interface switches and LEDs
5. Programming and interfacing of LCD
6. Programming for A/D converter, result on LCD.
7. Programming for D/A converter, result on LCD
8. Interfacing Stepper Motor with 8051.
9. Interfacing different sensors with 8051.

RECOMMENDED BOOKS

1. "8051 Microcontroller, Architecture programming & application", K. J. Ayala EEE/ Prentice Hall of India.
2. Mohmad-ali-mazidi, Janice-elispe- Mazidi, Roline D. Mckinlay, "The 8051 microcontroller & embedded system", Pearson / Prentice hall.
3. Satish Shaha, "8051 Microcontroller Mcs-51 family and its variant", Oxford.
4. Rajkamal, "Microcontroller Architecture, programming, interfacing, & system design", Pearson.

SUGGESTED WEBSITES

1. http://swayam.gov.in
2. http://www.nitttrchd.ac.in/nctel/electrical.php

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

4.3 COMMUNICATION SYSTEMS

L	P
3	2

RATIONALE

This course provides the basics of electronic communication systems including transmitters, receivers, antennas and various modes of propagation of signals. In addition to the components and systems of fiber optic communication, the students will learn the basics of satellite communication. This course will provide the students with perspectives of different communication systems.

COURSE OUTCOMES

CO1: Identify and able to understand AM and FM Transmitters.
CO2: Describe and analyze different AM and FM receivers.
CO3: Differentiate various types of antennas used for different communication purposes.
CO4: Detect propagation of sky waves used for long range communication.
CO5: Acquire basic knowledge of satellite communication.

DETAILED CONTENTS

UNIT I
AM/FM Transmitters

- Classification of transmitters on the basis of modulation, service, frequency and power.
- Block diagram of AM transmitters and working of each stage.
- Block diagram and working principles of reactance FET and armstrong FM transmitters.

UNIT II
AM/FM Radio Receivers

- Principle and working with block diagram of super heterodyne AM receiver. Function of each block and typical waveforms at input and output of each block.
- Performance characteristics of a radio receiver: sensitivity, selectivity, fidelity, S/N ratio, image rejection ratio and their measurement procedure.
- Concepts of simple and delayed AGC.

- Block diagram of an FM receiver, function of each block.

UNIT III

Antennas

- Electromagnetic spectrum and its various ranges: VLF, LF, MF, HF, VHF, UHF, Microwave.
- Physical concept of radiation of electromagnetic energy from a dipole. Concept of polarization of EM Waves.
- Definition and physical concepts of the terms used with antennas like point source, gain directivity, aperture, effective area, radiation pattern, beam width and radiation resistance, loss resistance.
- Types of antennas-brief description, characteristics and typical applications of half wave dipole, folded dipole, patch, loop, Ferrite rod, Yagi antenna, dish antenna.

UNIT IV

Propagation

- Basic idea about different modes of wave propagation and typical areas of application. Ground wave propagation and its characteristics, Space wave communication – line of sight propagation, standard atmosphere, Structure of standard atmosphere

-Sky wave propagation - ionosphere and its layers. Explanation of terms - virtual height, critical frequency, skip distance, maximum usable frequency, multiple hop propagation.

UNIT V

Satellite Communication

- Basic idea, passive and active satellites, Meaning of the terms; orbit, apogee, perigee
- Geo-stationary satellite and its need. Block diagram and explanation of a satellite communication link.
- Introduction to VSAT and its features.

PRACTICAL EXERCISES

1. To observe the waveforms at different stages of an AM low power transmitter.
2. To observe the waveforms at different stages of a Radio Receive.
3. To align AM broadcast radio receiver.
4. To align the dish antenna.
5. To identify and study the various types of antennas used in different frequency ranges.
6. To plot the radiation pattern of a directional and omni directional antenna

7. To plot the variation of field strength of a radiated wave, with distance from a transmitting antenna.
8. To study and rectify different faults in a broadcast radio receiver.

RECOMMENDED BOOKS

1. Communication Systems by George Kennedy, Tata McGraw Hill Education Pvt Ltd, New Delhi.

2. Communication Systems by A.K. Gautam; SK Kataria and Sons, New Delhi.

3. Electronic Communication Systems by K.S. Jamwal; Dhanpat Rai and Sons, New Delhi.

4. Electronic Communication System by Roddy and Coolen; Prentice Hall of India, New Delhi.

5.Handbook of Experiments in Electronics and Communication Engineering by S Poornachandra Rao, and B Sasikala, Vikas Publishing House Pvt. Ltd, Jangpura, New Delhi.

6. Radio Engineering by G.K Mittal; Khanna Publications, Delhi.

7. Communication System by Deepika Chadha; Ishan Publications, Ambala City.

8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. Visits to appropriate sites of digital/data communication networks, satellite communication, telemetry centers should be made with a view to understand their working. This subject contains five units of equal weight age.

4.4 POWER ELECTRONICS

L	P
3	4

RATIONALE

Electronics and Communication engineering students after this level are expected to handle a wide variety of power electronic equipment used in process control industry. This subject will provide the student basic understanding of the principles of their working. The practical training will further reinforce the knowledge and skill of the students.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Describe the construction, working principles of SCR.
CO2: Plot and explain V-I characteristics of TRIAC, UJT, DIAC
CO3: Demonstrate the wave shapes of controlled rectifiers.
CO4: Install UPS system and carry out routine maintenance of batteries.
CO5: Demonstrate the concept and working of choppers, inverters and converters.

DETAILED CONTENTS

UNIT I

Power Electronics Devices

- Role of Power electronics
- Construction, working principles of SCR, two transistor analogy of SCR, V-I characteristics of SCR.
- SCR specifications & ratings.

  $\frac{di}{dt}$ & $\frac{dv}{dt}$ protection of SCR

- Different methods of SCR triggering.
- Different commutation circuits for SCR.
- Construction & working principle of DIAC, TRIAC and their V-I characteristics.

- Construction, working principle of UJT, V-I characteristics of UJT. UJT as relaxation oscillator.
- Basic idea about the selection of Heat sink for thyristors.
- Application such as light intensity control, speed control of universal motors, fan regulator, battery charger.

UNIT II

Controlled Rectifiers

- Single phase half wave controlled rectifier with load (R, R-L)
- Single phase half controlled full wave bridge rectifier (R, R-L)
- Single phase fully controlled full wave bridge rectifier.
- Single phase full wave centre tap controlled rectifier.

UNIT III

Inverters, Choppers, Dual Converters and Cyclo converters

- Principle of operation of basic inverter circuits, series and parallel inverters & their applications.
- Choppers: Introduction, concepts of duty cycle, types of choppers (Class A, Class B, Class C and Class D). Step up and step down choppers.
- Dual Converters and cyclo converters: Introduction, types & basic working principle of dual converters, cyclo converters and their applications.

UNIT IV

Thyristorised Control of Electric drives

a) DC drive control
   - Half wave drives.
   - Full wave drives
   - Chopper drives (Speed control of DC motor using choppers)

b) AC drive control
   - Phase control
   - Constant V/F operation
   - Cyclo converter/Inverter drives.

UNIT V

Uninterruptible Power Supplies

- UPS, on-line, off line & its specifications

- Concept of high voltage DC transmission
- Classification of batteries
- Introduction to solar power plants and their components

PRACTICAL EXERCISES

1. To plot VI characteristic of an SCR.
2. To plot VI characteristics of TRIAC.
3. To plot VI characteristics of UJT.
4. To plot VI characteristics of DIAC.
5. To study UJT relaxation oscillator and observe different wave forms.
6. To observe wave shapes at relevant points in a circuit of single-phase half wave controlled rectifier and effect of change of firing angle.
7. To observe wave shapes and measurement of voltage at relevant points in TRIAC basedAC phase control circuit.
8. To observe output wave shape in a circuit for single phase full wave controlled rectifier.
9. To study installation of UPS system and routine maintenance of batteries.
10. Visit to any Solar Power Plant.

RECOMMENDED BOOKS

1) Power Electronics by P.C. Sen; Tata McGraw Hill Education Pvt Ltd., New Delhi
2) Power Electronics by P.S. Bhimbhra; Khanna Publishers, New Delhi
3) Power Electronics – Pricilpes and Applications by Vithayathi; Tata Mc Graw Hill Education Pvt Ltd. New Delhi
4) Power Electronics by MH Rashid
5) Industrial Electronics and Control by SK Bhattacharya and S. Chatterji; New Age Publications. New Delhi
6) Power Electronics by Sugandhi and Sugandhi
7) Power Electronics – Principles and Applications by J Michael Jacob; Vikas Publishing House, New Delhi
8) Power Electronics by Puri and Chopra; North Publications, Ambala City
9) e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. Student must be taken to electronic industry and solar power plant for industrial and power plant exposure to make them aware about the industry solar plant practices. This subject contains five units of equal weightage.

4.5 OPEN ELECTIVE

L	P
2	-

RATIONALE

Open electives are very important and play major role in implementation of National Education Policy. These subjects provide greater autonomy to the students in the curriculum, giving them the opportunity to customize it to reflect their passions and interests. The system of open electives also encourages cross learning, as students pick and choose subjects from the different streams.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:

CO1: State the basic concepts and principles about the subject of interest.
CO2: Perform in a better way in the professional world.
CO3: Select and learn the subject related to own interest.
CO4: Explore latest developments in the field of interest.
CO5: Develop the habit of self-learning through online courses.

LIST OF OPEN ELECTIVES (The list is indicative and not exhaustive)

1. Computer Application in Business
2. Introduction to NGO Management
3. Basics of Event Management
4. Event Planning
5. Administrative Law
6. Introduction to Advertising
7. Moodle Learning Management System
8. Linux Operating System
9. E-Commerce Technologies
10. NCC
11. Marketing and Sales
12. Graphics and Animations
13. Digital Marketing

14. Human Resource Management
15. Supply Chain Management
16. TQM

GUIDELINES

Open Elective shall be offered preferably in online mode. Online mode open elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, Khan Academy or any other online portal to promote self-learning. A flexible basket of large number of open electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online open electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline open electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.

Assessment of MOOCs open elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable open elective is available online, only then the course may be conducted in offline mode. The assessment of offline open elective shall be internal and external. The offline open elective internal assessment of 40 marks shall be based on internal sessional tests; assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

NOTE

The students enrolled under NCC will compulsorily undertake NCC as an open elective subject.

SUGGESTED WEBSITES

1. https://swayam.gov.in/
2. https://www.udemy.com/
3. https://www.upgrad.com/
4. https://www.khanacademy.org/

4.6 MINOR PROJECT

L	P
-	8

RATIONALE

Minor project work will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get acquainted with desired attributes for industrial environment. For this purpose, students are required to be involved in Minor Project Work in different establishments.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Define the problem statement of the minor project according to the need of industry.
CO2: Work as a team member for successful completion of minor project.
CO3: Write the minor project report effectively.
CO4: Present the minor project report using PPT.

GUIDELINES

Depending upon the interest of the students, they can develop minor projects as per present and future demand of the industry. The supervisors may guide the students to identify their minor project work and chalk out their plan of action well in advance. As a minor project activity each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes/activities. The supervisor may create a group of 4-5 students as per their interest to work as a team for successful completion of the minor project.

The supervisor shall evaluate the students along with one external expert by considering the following parameters:

	Parameter	**Weightage**
I	Defining problem statement, focus and approach	20%
ii	Innovation / creativity	20%
iii	Report Writing	20%
iv	Power Point Presentation	20%
v	Viva - voce	20%

THIRD YEAR

NSQF LEVEL - 5

18. STUDY AND EVALUATION SCHEME

FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits L+P= C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
5.1	Industrial Training - II	-	2	0+1 =1	-	40	40	-	60	60	100
5.2	Instrumentation	3	4	3+2=5	40	40	80	60	60	120	200
5.3	** PLC & SCADA	2	4	2+2 =4	40	40	80	60	60	120	200
5.4	Optical Fibre Communication	3	4	3+2=5	40	40	80	60	60	120	200
5.5	Wireless & Mobile Communication	2	4	2+2=4	40	40	80	60	60	120	200
5.6	Multidisciplinary Elective (MOOCs+/Offline)	2	-	2+0=2	40	-	40	60	-	60	100
	# SCA	-	5	-	-	-	-	-	-	-	-
	Total	**12**	**23**	**21**	**200**	**200**	**400**	**300**	**300**	**600**	**1000**

** Common with Automation & Robotics Diploma Programme.

+ Assessment of Multidisciplinary Elective through MOOCs shall be based on assignments out of 100 marks.

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L + P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
6.1	** Computer Networks	3	4	3+2=5	40	40	80	60	60	120	200
6.2	*Entrepreneurship Development & Man agement	3	-	3+0=3	40	-	40	60	-	60	100
6.3	Programme Elective - I	2	2	2+1=3	40	40	80	60	60	120	200
6.4	Programme Elective - II	2	2	2+1=3	40	40	80	60	60	120	200
6.5	Major Project / Industrial training	-	16	0+8=8	-	40	40	-	60	60	100
# Student Centered Activities (SCA)		-	1	-	-	-	-	-	-	-	-
Total		**10**	**25**	**22**	**160**	**160**	**320**	**240**	**240**	**480**	**800**

* Common with other Diploma Courses.

** Common with Computer Engineering

Programme Elective I: 6.3.1 Microwave and Radar Engineering 6.3.2 Consumer Electronics

Programme Elective II: 6.4.1 Embedded Systems (Common with Automation & Robotics) 6.4.2 Medical Electronics 6.4.3 Maintenance of Computer Systems

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

19. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects/Areas	Hours Per Week	
		Fifth Semester	Sixth Semester
1.	Industrial Training - II	2	-
2.	Instrumentation	7	-
3.	PLC & SCADA	6	-
4.	Optical Fibre Communication	7	-
5.	Wireless & Mobile Communication	6	-
6.	Multidisciplinary Elective (MOOCs/Offline)	2	-
7.	Computer Networks	-	7
8.	Programme Elective - I	-	4
9.	Programme Elective - II	-	4
10.	Entrepreneurship Development & Management	-	3
11.	Major Project / Industrial Training	-	16
12.	Student Centred Activities	5	1
	Total	**35**	**35**

20. COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

Government and private sectors related to **Electronics & Communication Engineering** require **supervisors** having well developed skills with clear choice of procedures. They are expected to have complete knowledge and practical skills related to Electronics and Communication field. They shall be able to communicate clearly with others. Diploma holders after passing level 5 shall have understanding of desired mathematical skills and understanding of social and natural environment. They are expected to collect, organize and communicate information effectively.

Work requiring knowledge, skills and aptitudes at level 5 will also be carried out in familiar situations, but also ones where problems may arise. Job holders will be able to make choices about the best procedures to adopt to address problems where the choices are clear. Individuals in jobs which require level 5 qualifications will normally be responsible for the completion of their own work and expected to learn and improve their performance on the job. They will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others' work and learning.

Electronics and Communication diploma pass out students will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their work. They will be expected to operate hygienically and in ways which show an understanding of environmental issues. They will take account of health and safety issues as they affect the work they carry out or supervise. They are expected have the good programming knowledge of PLCs and SCADA for automation in electronic or relevant industries. They are also expected to have good theoretical and practical exposure of optical fibre, wireless and mobile communication working efficiently in electronic industries and other relevant areas.

Electronics and Communication diploma students are expected to work in organizations like Radar and Wireless, Railways, Defence Services, Para-military Forces**,** Civil Aviation**,** Defence Organizations**,** Electricity Boards and Corporations etc., manufacturing industries like wireless mobile equipment, PCB Design and Fabrication**,** Consumer Electronics**,** Electronic Components and Devices Manufacturing and Installation**,** Computer Assembling and Computer Peripheral, Computer Software Areas for Electronic Design and Semi-Conductor Manufacturing**,** Instrumentation and Control**,** Internet Server Providers**,** D.T.H component and Fabrication**,** Mobile Phone assembly**,** Medical Electronics**,** EPBX/ Telephone Exchange Manufacturing**.** They will also have scope in establishing small startups in the area of Marketing and Sales, Repair and Maintenance**,** Cable laying and jointing DBs, Preparing Simulated Models**,** Manufacturing Unit like Bulb manufacturing, chalk manufacturing, circuit manufacturing units etc.

21. PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level – 5 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this level, the student will be able to:

PO1: Perform task that require well developed skills with clear choice of procedures.

PO2: Acquire knowledge of facts, principles and processes related to Electronics and Communication.

PO3: Demonstrate cognitive and practical skills to complete tasks and solve problems.

PO4: Develop skills to collect, organize and communicate information.

PO5: Accomplish own work and supervise others work.

PO6: Select online multidisciplinary electives of own interest to promote self-learning.

22. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Perform task that require well developed skills with clear choice of procedures.	• Study and perform measurement of basic systems • Operate various displacement and strain devices • Measure force and torque using various devices • Learn and measure flow and pressure • Handle temperature and humidity measurement. • Write program in ladder logic for various applications. • Define addressing formats for various instructions. • Study and evaluate various optical cables for losses • Perform tasks with different optical sources • Describe various multiple access techniques for wireless communication • Define various communication systems in detail • Perform comparative analysis of 3G, 4G and 5G • Handle different IP address classes. • Connect various networking devices. • Troubleshoot networking related issues. • Differentiate PAL, NTSC and SECAM • Describe the principle and working of LCD and LED • Implement C programming for interfacing PIC microcontroller with various peripherals. • Develop complete system using PIC microcontroller. • Classify various equipment used in medical science • Differentiate various electrodes used for ECG, EEG and EMG • Describe different bio transducers, sensors and

	medical recorders • Setup and install different printers with PC • Connect various network devices with PC • Perform tasks using different type of waveguides • Describe the utilize various microwave components
PO2: Acquire knowledge of facts, principles and processes related to Electronics and Communication.	• Study and perform measurement of basic systems • Learn and measure flow and pressure • Describe PLC architecture and its working. • Understand Ladder diagram and logic functions. • Understand the creation and animation of graphics for various applications. • Learn about the need optical fiber communication • Describe photo detector characteristics and noise • Explain principles and operations of optical amplifiers • Understand the basics of mobile and wireless communication • Study the channel interference and its control • Learn about the basic concepts of networking models. • Describe wireless networks and cloud computing • Study about various audio and recording system • Explain block diagram and function of each block of TV receiver • Explain about digital and video compression techniques • Understand the concept of Embedded System. • Explain the architecture of PIC microcontroller. • Learn about various patient monitoring systems and safety aspects • Study about various imaging systems • Study about motherboards, buses and ports • Learn about different types of memories and input devices • Describe various types of computer displays

	• Learn the operating principles of various microwave devices • Study block diagram and working principle of microwave communication systems • Acquire knowledge about the working of different type of radars
PO3: Demonstrate cognitive and practical skills to complete tasks and solve problems.	• Study and perform measurement of basic systems • Operate various displacement and strain devices • Measure force and torque using various devices • Learn and measure flow and pressure • Handle temperature and humidity measurement • Study and evaluate various optical cables for losses • Perform tasks with different optical sources • Describe various multiple access techniques for wireless communication • Define various communication systems in detail • Perform comparative analysis of 3G, 4G and 5G • Handle different IP address classes. • Connect various networking devices. • Troubleshoot networking related issues. • Differentiate PAL, NTSC and SECAM • Describe the principle and working of LCD and LED • Implement C programming for interfacing PIC microcontroller with various peripherals. • Develop complete system using PIC microcontroller. • Classify various equipment used in medical science • Differentiate various electrodes used for ECG, EEG and EMG • Describe different bio transducers, sensors and medical recorders • Setup and install different printers with PC • Connect various network devices with PC

	• Perform tasks using different type of waveguides • Describe the utilize various microwave components
PO4: Develop skills to collect, organize and communicate information.	• Understand the working environment of industries • Learn about present and future requirement of industries. • Develop writing, speaking and presentations skills. • Observe technological developments as per present and future needs of industries. • Collect, communicate and manage the data from connected devices. • Comprehend the importance of entrepreneurship and its role in nation's development. • Classify the various types of business and business organizations. • Identify the various resources / sources and / or schemes for starting a new venture. • Explain the principles of management including its functions in an organisation. • Conduct market survey and prepare project report. • Define the problem statement of the Major project / Industrial training according to the need of industry. • Write the Major project / Industrial training report effectively. • Present the Major project / Industrial training report using PPT.
PO5: Accomplish own work and supervise others work.	• Take necessary safety precautions and measures. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries. • Define the problem statement of the Major project / Industrial training according to the need of industry. • Work as a team member for successful completion of Major project / Industrial training.

	• Write the Major project / Industrial training report effectively. • Present the Major project / Industrial training report using PPT.
PO6: Select online multidisciplinary electives of own interest to promote self-learning.	• Apply critical thinking in problem solving. • Demonstrate self and time management. • Display analytical and research abilities. • Integrate multiple knowledge domains. • Enhance the scope and depth of learning.

23. SUBJECTS & CONTENTS

(THIRD YEAR)

FIFTH SEMESTER

5.1 INDUSTRIAL TRAINING- II

L	P
-	2

RATIONALE

Industrial training will help the students to understand the working environment of relevant industries. The student will learn to work in team to solve the industrial problems. It will also give exposure about the present and future requirements of the relevant industries. This training is very important for development of required competencies and skills for employment and start– ups.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1: Understand the working environment of industries
CO2: Take necessary safety precautions and measures.
CO3: Learn about present and future requirement of industries.
CO4: Work in team for solving industrial problems
CO5: Develop competencies and skills required by relevant industries.
CO6: Develop writing, speaking and presentations skills.

PRACTICAL EXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training report and their presentation using Power Point about the knowledge and skills gained during the training. The Headof the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation. The following performance parameters are to be considered for assessment of the students out of 100 marks:

	Parameter	**Weightage**
i	Industrial assessment of the candidate by the trainer	40%
ii	Report Writing	20%
iii	Power Point Presentation	20%
iv	Viva-voce	20%

5.2 INSTRUMENTATION

L	P
3	4

RATIONALE

This subject deals with the various instruments, their construction and working which control the various parameters and operations in any industry. There is a need of introducing diploma holders to the basics of Instrumentation. This subject will give exposure of electrical equipment maintenance to diagnose faults, rectify them and test the total system.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Study and perform measurement of basic systems

CO2: Operate various displacement and strain devices

CO3: Measure force and torque using various devices

CO4: Learn and measure flow and pressure

CO5: Handle temperature and humidity measurement.

DETAILEDCONTENTS

UNITI

Measurements

Importance of measurement, basic measuring systems, advantages and limitations of each measuring systems.

Transducers

Working principles, construction and use of various transducers like resistance, inductance, capacitance, electromagnetic, piezo-electric type.

UNITII

Measurement of Displacement and Strain

Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges and their different types such as inductance type, resistive type, wire and foil type etc. Gauge factor,

gauge materials and their selections. Use of electrical strain gauges, strain gauge bridges, Proximity switches.

UNITIII

Force and Torque Measurement

Different types of force measuring devices and their principles, load measurements by using elastic transducers and electrical strain gauges. Load cells, measurements of torque by strain gauges and inductive transducers, different methods of speed measurements.

UNITIV

Pressure Measurement

Working principle, construction and applications of pressure cells, Bourdon pressure gauges, and electrical pressure pickups.

Flow Measurement

Basic principles of magnetic and ultrasonic flow meters

UNITV

Measurement of Temperature

Bimetallic thermometer, thermoelectric thermometers, resistance thermometers, thermocouple, thermistors, pyrometer and temperature recorders

Measurement of other non-electrical quantities

Humidity, pH, level and vibrations

PRACTICAL EXERCISES

1. To draw the characteristics of a potentiometer
2. Use of variable capacitive transducer.
3. Use of different proximity Switches.
4. To measure linear displacement using LVDT.
5. To study the use of electrical strain gauge
6. To study weighing machine using load cell

7. To measure temperature using a thermo-couple.
8. To measure temperature using RTD.
9. To measure the speed of a motor.
10. Use of thermistor as ON/OFF switch
11. To measure pH value of given solution.
12. Use of magnetic and ultrasonic flow meters.
13. To measure level of water in a tank using any sensor.

RECOMMENDED BOOKS

1. Electronic Measurement and Instrumentation by Dr. Rajendra Prasad.
2. Electronic Measurement and Instrumentation by JB Gupta, SK Kataria and Sons, New Delhi.
3. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi.
4. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi.
5. Industrial Instrumentation by Umesh Rathore, SK Kataria and Sons, New Delhi.
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. This subject contains five units of equal weightage.

5.3 PLCs & SCADA

L	P
2	4

RATIONALE

Automated industrial process controls or automated power stations require skilled manpower with knowledge of Programmable Logic Controllers (PLCs)and Supervisory Control and Data Acquisition system (SCADA). PLCs and SCADA are widely used in all industries for efficient automatic control operations. Looking at the industrial applications, this subject finds its usefulness in the present curriculum.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Describe PLC architecture and its working.

CO2: Understand Ladder diagram and logic functions.

CO3: Define addressing formats for various instructions.

CO4: Write program in ladder logic for various applications.

CO5: Understand the creation and animation of graphics for various applications.

DETAILED CONTENTS

UNIT I

PLC Overview

Introduction, limitations of relays and advantages of PLCs over electromagnetic relays.PLC Operation or working, PLC Architecture and building blocks, Functions of various blocks, Different programming languages, PLC applications and manufacturers, PLC selection criteria.

UNIT II

Numeric Systems and Logic Concepts for Ladder Programming

Introduction, Number systems and conversions, Binary arithmetic, Binary codes, Boolean

algebra,logicgates,IntroductiontoLadderlogic,Basiccomponentsandtheirsymbols,Fundamentalofladderdiagrams,Ladder logic functions, Boolean logic and relay logic.

UNIT III

File structure and addressing formats

Introduction, Input and output data files, status file, Bit data file, Timer data file, Counter data file, Control data file, Integer data file and Float data file.

UNIT IV

Ladder Programming Instructions

Introduction, Bit instructions, Timer instructions, Counter instructions, Reset instruction, Data handling instructions, Comparison Instructions, Sequencer instructions.

UNIT V

SCADA

Introduction, Project and Tag creation, Visibility and text animation, Numeric display and Numeric input, String display and String input, Concept of Label, Arrow, vertical slider, horizontal slider,Creationofvariousanimationslikecolor,fill,horizontalposition,verticalposition,height,widthandtouch.Alarming,DataLogging.

PRACTICAL EXERCISES

1. Show PLC modules and components in lab/industry or through online videos.
2. Demonstration of ladder diagram programming using NO, NC and OTE instructions.
3. Write a ladder diagram program for switching ON-OFF light.
4. Write a ladder diagram program for liquid level control.
5. Write a ladder diagram program for industry process control.
6. Write a ladder diagram program for main door control.
7. Write a ladder diagram program for vehicle parking control.
8. Write a ladder diagram program for bottling plant.
9. Write a ladder diagram program for drink dispenser.
10. Write a ladder diagram program for traffic light control.
11. Write a ladder diagram program for temperature control.
12. Show online videos to demonstrate the creation and animation of graphics for various

applications using SCADA.

13. Industrial visit to monitor the actual working of PLC and SCADA.

RECOMMENDE DBOOKS

1. Mehra, Rajesh and Vikrant Vij, “PLCs & SCADA Theory and Practices”, Laxmi Publication, Delhi.
www.amazon.in/PLCs-SCADA-Practice-Rajesh-Mehra-ebook/dp/B07568SYLK
2. Dunning, Gary, “Introduction to PLCs”, McGraw Hill.
3. Otter, Job Dan, “Programmable Logic Controller”, P.H. International, Inc, USA.

RECOMMENDED WEBSITES

1. https://swayam.gov.in/
2. http://www.bytronic.net/downloads/
3. https://download.rockwellautomation.com/esd/directdownload.aspx?sessionid=4mhxwrflrsz1tie1bacq5ewg637271102079911981

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. Demo version of LADSIM may be used to complete the practical tasks if no other software is available for programming. This subject contain five units of equal weightage.

5.4 OPTICAL FIBER COMMUNICATION

L	P
3	4

RATIONALE

Optical fiber communication has expanded our boundaries and is finding a good slot in communication system. It has replaced existing transmission media due to its various advantages. As a result, the electronics and communication students are supposed to have good knowledge of optical communication.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Learn about the need optical fiber communication

CO2: Study and evaluate various optical cables for losses

CO3: Perform tasks with different optical sources

CO4: Describe photo detector characteristics and noise

CO5: Explain principles and operations of optical amplifiers

DETAILEDCONTENTS

UNIT I
Introduction

- Historical perspective, basic communication systems, Optical communication, Electromagnetic spectrum, Optical fibre communication and its Advantages, disadvantages and applications.

- Principle of light penetration, reflection, critical angle.

UNIT II
Optical Fibers and Cables

- Constructional details of various optical fibers, multimode and mono-mode fibers, step index and graded index fibers, acceptance angle and types of optical fiber cables.

- Optical Fibers cable connectors and splicing techniques (Mechanical, fusion)

Optical Fiber Cable Losses

a) Absorption Losses: Scattering Losses, Radiation losses, Connector losses, Bending losses.

b) Dispersion: Types and its effect on data rate.

UNIT III

Optical Sources

Principle and Characteristics of LED and LASER used in optical communication, different types of LED structures used and their brief description Principle and operation of different injection laser diodes, comparison of LED and ILD.

UNIT IV

Optical Detectors

Characteristics of photo detectors used in optical communication; PIN diode and avalanche photo diode (APD), Noise in detectors

UNIT V

Optical Amplifiers

Types of optical amplifiers, semiconductor & fiber optical amplifiers, principle and operation of SOA, types of SOA. EDFA, Raman amplifiers. Comparison of SOA, EDFA and Raman Amplifiers.

PRACTICAL EXERCISES

1. To identify and use various components and tools used in optical fiber communication.
2. To set up fiber analog link
3. To set up optic digital link
4. To measure bending losses in optical fibers
5. To observe and measure the splice or connector loss
6. To measure and calculate numerical aperture of optical fiber
7. To observe characteristics of optical source
8. To observe characteristics of optical detector
9. To splice the available optical fiber

10. To connect a fiber with connector at both ends.

RECOMMENDED BOOKS

1. Optical fiber Communication by John M Senior, Prentice Hall of India, New Delhi
2. Optical fiber Communication by J. Gower , Prentice Hall of India, New Delhi
3. Optical fiber Communication by Gerd Keiser, McGraw Hill International Editions
4. Optical Communications – Components and Systems by JH Franz and VK Jain, Narosa Publishing House, New Delhi
5. Optical Fiber Communication by Yashpal & Sanjeev Kumar, North Publications, Ambala
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contain five units of equal weightage.

5.5 WIRELESS & MOBILE COMMUNICATION

L	P
2	4

RATIONALE

The wireless and mobile communication technology though complex but is spreading at a very fast rate. People use more of mobile phones in comparison to land line phones. Therefore, the students should know the functioning of wireless and mobile systems to keep themselves up-to-date of this latest communication application.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Understand the basics of mobile and wireless communication

CO2: Study the channel interference and its control

CO3: Describe various multiple access techniques for wireless communication

CO4: Define various communication systems in detail

CO5: Perform comparative analysis of 3G, 4G and 5G

DETAILED CONTENTS

UNIT-I

Wireless Communication

1.1 Basics

1.2 Advantages of wireless communication

1.3 Electromagnetic waves.

1.4 Frequency Spectrum used.

1.5 Cellular Network Systems.

1.6 Introduction to Propagation considerations – range and fading

UNIT-II

Cellular Concept

2.1. Introduction 2G
2.2 Cell area
2.3. Cell Site Structure
2.4. Capacity of cell
2.5. Concept of Frequency Reuse
2.6 Co-channel and Adjacent channel Interference
2.7 Power Control for reducing Interference
2.8 Fundamentals of Cell splitting and sectoring

UNIT III

Multiple Access Techniques for Wireless Communication

3.1 Introduction to Multiple Access.
3.2. Frequency Division Multiple Access (FDMA)
3.3. Time Division Multiple Access (TDMA)
3.4. Code Division Multiple Access (CDMA), WCDMA
3.5. Introduction to OFDMA

UNIT IV

Mobile Communication Systems

4.1.Introduction of Global Systems for Mobile Communication (GSM) and its architecture,
4.2.Introduction of GPRS, EDGE, Bluetooth and Wi-fi.

UNIT V

Introduction to 3G, 4G& 5G

5.1.Introduction to Architecture and Features of UMTS
5.2.Features and Architecture of LTE (Long Term Evolution)
5.3.Introduction to 5G, Concept of New Radio Technology.
5.4. Comparison of 4G with 5G

PRACTICAL EXERCISES

1. Study the features, specification and working of cellular mobile
2. Measurement of signal strength at various points from a transmitting antenna
3. Demonstration of Base Transceiver Station (BTS) with nearby cellular tower
4. Observing call processing of GSM trainer kit.
5. Visit to Mobile Switching Centre.
6. Troubleshooting of a GSM mobile phones.
7. Study and demonstration of AT Commands of GSM System using trainer kit
8. Study of LTE mobile communication using trainer kit
9. Study and demonstration of AT Commands of LTE using trainer kit

RECOMMENDED BOOKS

1. Wireless Communications, Principles and Practice, by Thedore S. Rappaport.
2. Wireless Communications by Singal, Tata McGraw Hill Education Pvt Ltd , New Delhi
3. Wireless Communications by Misra, Tata McGraw Hill Education Pvt Ltd , New Delhi
4. Introduction to Wireless and Mobile Systems, by Dharma Prakash Agarwal, Qing-Anzeng.
5. Wireless Communications and Networking, by William Stallings.
6. Mobile and Personal Communication Systems and Services, by Raj Pandya, Prentice Hall of India, New Delhi
7. Mobile Communication by John Schiller, Prentice Hall of India, New Delhi
8. Wireless Communications by Pahalwan, Pearson Publishers
9. Wireless and Mobile Communication VK Sangar, Ishan Publication, Ambala.
10. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contain five units of equal weightage.

5.6 MULTIDISCIPLINARY ELECTIVE

L	P
2	-

RATIONALE

Multidisciplinary electives are very important and play major role in implementation of National Education Policy. Multidisciplinary is a subject which is useful for two or more disciplines in which students are asked to understand the concept of multidisciplinary or interdisciplinary. It will help the students to gain an arsenal of skills that are easily transferable across work environments.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:
CO1: Apply critical thinking problem solving.
CO2: Demonstrate self and time management.
CO3: Display analytical and research abilities.
CO4: Integrate multiple knowledge domains.
CO5: Enhance the scope and depth of learning.

LIST OF MULTIDISCIPLINARY ELECTIVES

(The list is indicative and not exhaustive)

1. Introduction to Internet of Things.
2. Introduction to Robotics.
3. Introduction to Embedded System Design.
4. Fundamentals of Artificial Intelligence.
5. Digital Image Processing.
6. Introduction to Machine Learning.
7. Fundamentals of Artificial Intelligence.
8. The Joy of Computing Using Python.

9. Cloud Computing.
10. Introduction to Industry 4.0.
11. Industrial Internet of Things.
12. Object Oriented System Development using UML, Java and Patterns.

GUIDELINES

Multidisciplinary Elective shall be offered preferably in online mode. Online mode multidisciplinary elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, Khan Academy or any other online portal to promote self-learning. A flexible basket of large number of multidisciplinary electives is RECOMMENDED which can be modified depending upon the availability of courses at RECOMMENDED portals and requirements. For online multidisciplinary electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline multidisciplinary electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.

Assessment of MOOCs multidisciplinary elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable multidisciplinary elective is available online, only then the course may be conducted in offline mode. The assessment of offline multidisciplinary elective shall be internal and external. The offline multidisciplinary elective internal assessment of 40 marks shall be based on internal sessional tests, assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

RECOMMENDED WEBSITES

1. https://swayam.gov.in/
2. https://www.udemy.com/
3. https://www.upgrad.com/
4. https://www.khanacademy.org/

SIXTH SEMESTER

6.1 COMPUTER NETWORKS

L	P
3	4

RATIONALE

Global connectivity can be achieved through computer networks. After completing the diploma, student should have basic understanding of networking and its models. This subject will help the student in network setup and troubleshooting. It will further give exposure to the students about wireless networks and cloud computing.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Learn about the basic concepts of networking models.

CO2: Handle different IP address classes.

CO3: Connect various networking devices.

CO4: Troubleshoot networking related issues.

CO5: Describe wireless networks and cloud computing.

DETAILED CONTENTS

UNIT I

NETWORKS BASICS

- Concept of network
- Models of network computing
- Networking models
- Peer-to –peer Network
- Client-Server Network
- LAN, MAN and WAN
- Network Services
- Topologies
- Switching Techniques

NETWORKING MODELS

- OSI model: Definition, Layered Architecture

- Functions of various layers
- TCP/IP Model: Definition, Functions of various layers
- Comparison between OSI and TCP/IP model

UNIT II
TCP/IP ADDRESSING

- Concept of physical and logical addressing
- IPV4 addresses – Address space, Notations
- Classful Addressing- Different IP address classes, Classes & Blocks, Net-id & Host-Id, Masks, Address depletion
- Classless Addressing – Address blocks, Masks
- Special IP Addresses
- Subnetting and Supernetting
- Loop back concept
- Network Address Translation
- IPV4 Header
- IPV6 Header
- Comparison between IPV4 and IPV6

UNIT III
NETWORK ARCHITECTURE

- Ethernet specification and standardization: 10 Mbps (Traditional Ethernet), 10 Mbps (Fast Ethernet) and 1000 Mbps (Gigabit Ethernet)

NETWORK CONNECTIVITY

- Network connectivity Devices
- NICs
- Hubs, Switches, Routers, Repeaters, Modem, Gateway
- Configuration of Routers & Switches

UNIT IV
NETWORK ADMINISTRATION

- Network Security Principles, Cryptography, using secure protocols

- Trouble Shooting Tools: PING, IPCONFIG, IFCONFIG, NETSTAT, TRACEROOT, Wireshark, Nmap, TCPDUMP, ROUTEPRINT
- DHCP Server
- Workgroup/Domain Networking

UNIT V
INTRODUCTION TO WIRELESS NETWORKS

- Introduction to wireless LAN IEEE 802.11, WiMax ad Li-Fi
- Wireless Security
- Introduction to bluetooth - architecture, application
- Comparison between bluetooth and Wifi

CLOUD COMPUTING

- Definition of Cloud Computing and advantages of Cloud Computing.
- Cloud Computing service model- SaaS, PaaS, Iaas.
- Deployment model-Private Cloud, Public Cloud, Hybrid, Community cloud.

LIST OF PRACTICALS

1. Recognize the physical topology and cabling (coaxial, OFC, UTP, STP) of a network.
2. Recognition and use of various types of connectors RJ-45, RJ-11,BNC and SCST
3. Making of cross cable and straight cable
4. Install and configure a network interface card in a workstation.
5. Identify the IP address of a workstation and the class of the address and configure the IP Address on a workstation
6. Managing user accounts in windows.
7. Sharing of Hardware resources in the network.
8. Use of Netstat and its options.
9. Connectivity troubleshooting using PING, IPCONFIG, IFCONFIG
10. Installation of Network Operating System (NOS)
11. Demonstration of Cloud Computing in Labs or using Online Videos.

RECOMMENDED BOOKS

1. Computer Networks by Tanenbaum, Prentice Hall of India, New Delhi.
2. Data Communications and Networking by Forouzan, (Edition 2nd and 4th), Tata McGraw Hill Education Pvt. Ltd, New Delhi.
3. Data and Computer Communication by William Stallings, Pearson Education, New Delhi.
4. Local Area Networks by Peter Hudson.
5. Network+ Lab manual,- BPB Publications -by Tami Evanson.
6. Networking Essentials – BPB Publications New Delhi
7. Cloud Computing by Raj Kumar.

RECOMMENDED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. This subject contains five units of equal weightage.

6.2 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

L	P
3	-

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Comprehend the importance of entrepreneurship and its role in nation's development.
CO2: Classify the various types of business and business organizations.
CO3: Identify the various resources / sources and / or schemes for starting a new venture.
CO4: Explain the principles of management including its functions in an organisation.
CO5: Conduct market survey and prepare project report.

DETAILED CONTENTS

UNIT I

Entrepreneurship: Concept and definitions, classification and types of entrepreneurs, entrepreneurial competencies, Traits / Qualities of entrepreneurs, manager v/s entrepreneur, role of Entrepreneur, barriers in entrepreneurship, Sole proprietorship and partnership forms of business Organisations, small business vs startup, critical components for establishing a start-up, Leadership: Definition and Need, Manager Vs leader, Types of leadership

UNIT II

Definition of MSME (micro, small and medium enterprises), significant provisions of MSME Act, importance of feasibility studies, technical, marketing and finance related problems faced by new enterprises, major labor issues in MSMEs and its related laws, Obtaining financial assistance through various government schemes like Prime Minister Employment Generation Program (PMEGP) Pradhan Mantri Mudra Yogna (PMMY) , Make in India, Start up India,

Stand up India , National Urban Livelihood Mission (NULM); Schemes of assistance by entrepreneurial support agencies at National, State, District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

UNIT III

NATURE AND FUNCTIONS OF MANAGEMENT: Definition, Nature of Management, Management as a Process, Management as Science and Art, Management Functions, Management and Administration, Managerial Skills, Levels of Management; Leadership.

PLANNING AND DECISION MAKING: Planning and Forecasting - Meaning and definition, Features, Steps in Planning Process, Approaches, Principles, Importance, Advantages and Disadvantages of Planning, Types of Plans, Types of Planning, Management by Objective. Decision Making-Meaning, Characteristics.

UNIT IV

ORGANISING AND ORGANISATION STRUCTURE: Organising Process - Meaning and Definition, Characteristics Process, Need and Importance, Principles, Span of Management, Organisational Chart - Types, Contents, Uses, Limitations, Factors Affecting Organisational Chart.

STAFFING: Meaning, Nature, Importance, Staffing process. Manpower Planning, Recruitment, Selection, Orientation and Placement, Training, Remuneration.

CONTROLLING AND CO-ORDINATION Controlling - Meaning, Features, Importance, Control Process, Characteristics of an effective control system, Types of Control. Co-ordination - characteristics, essentials.

UNIT V

Market Survey and Opportunity Identification, Scanning of business environment, Assessment of demand and supply in potential areas of growth, Project report Preparation, Detailed project report including technical, economic and market feasibility, Common errors in project report preparations, Exercises on preparation of project report.

RECOMMENDED BOOKS

1. BS Rathore and Dr JS Saini, "A Handbook of Entrepreneurship", Aapga Publications, Panchkula (Haryana).

2. Entrepreneurship Development, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. CB Gupta and P Srinivasan, "Entrepreneurship Development in India", Sultan Chand and Sons, New Delhi.
4. Poornima M Charantimath, "Entrepreneurship Development - Small Business Enterprises", Pearson Education, New Delhi.
5. David H Holt, "Entrepreneurship: New Venture Creation", Prentice Hall of India Pvt. Ltd., New Delhi.
6. PM Bhandari, "Handbook of Small Scale Industry".
7. L M Prasad, "Principles and Practice of Management", Sultan Chand & Sons, New Delhi.

RECOMMENDED WEBSITES

1. https://ipindia.gov.in/

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment or seminar method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organizations on visit. Approach extracted reading and handouts may be provided. In addition, different activities like conduct of entrepreneurship awareness camp extension lecturers by outside experts, interactions sessions with entrepreneurs and industrial visits may also be organized. This subject contains five units of equal weightage.

6.3 PROGRAMME ELECTIVE - I
6.3.1 MICROWAVE AND RADAR ENGINEERING

L	P
2	2

RATIONALE

In microwaves industry, job opportunities are available in the area of assembly, production, installation, repair and maintenance of microwave transmitters and receivers. The knowledge of radar systems allows opportunities with civil and defence organizations dealing with aircraft and shipping. This subject will help in developing required competencies and skills related to microwave and radar engineering.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:
CO1: Learn the operating principles of various microwave devices
CO2: Perform tasks using different type of waveguides
CO3: Describe the utilize various microwave components
CO4: Study block diagram and working principle of microwave communication systems
CO5: Acquire knowledge about the working of different type of radars

DETAILED CONTENTS

UNIT I
INTRODUCTION

Introduction to microwaves and its applications, Classification on the basis of its frequency bands (HF, VHF, UHF, L, S, C, X, Ku, Ka, Sub mm).

MICROWAVE DEVICES

Construction, characteristics, operating principles and typical applications of the following devices (No mathematical treatment).

Reflex klystron, Magnetron, Traveling wave tube, Gunn diode and Impatt diode

UNIT II

Wave guides

Rectangular and circular wave guides and their applications. Mode of wave guide; Propagation constant of a rectangular wave guide, cut off wavelength, guide wavelength and their relationship with free space wavelength (no mathematical derivation).

UNIT III

Microwave Components

Constructional features, characteristics and application of tees, bends, matched termination, twists, detector, mount, slotted section, directional coupler, fixed and variable attenuator, isolator, circulator and horn antenna.

UNIT IV

Microwave Communication systems

Block diagram and working principles of microwave communication link, Troposcatter Communication-basic idea

UNIT V

Radar Systems

Introduction to radar, its various applications, radar range equation (no derivation), Block diagram and operating principles of basic pulse radar. Concepts of ambiguous range, radar area of cross-section and its dependence on frequency, Block diagram and operating principles of CW (Doppler) radars, and their applications, Block diagram and operating principles of MTI radar, Radar display- PPI

PRACTICAL EXERCISES

1. To measure electronics and mechanical tuning range of a reflex klystron
2. To measure VSWR of a given load.
3. To measure the Klystron frequency by slotted section method
4. To measure the directivity and coupling of a directional coupler.
5. To plot radiation pattern of a horn antenna in horizontal and vertical planes.
6. To verify the properties of magic tee.

7. To study isolator and circulator.
8. To study the attenuators (fixed and variable)

RECOMMENDED BOOKS

1. Microwave Devices and Components by Sylio; Prentice Hall of India, New Delhi
2. Electronics Communication by Roddy and Coolen; Pearson Publishers.
3. Electronics Communication System by KS Jamwal; Dhanpat Rai and Sons, Delhi
4. Microwave Engineering by Das; Tata McGraw Hill Education Pvt Ltd , New Delh
5. Microwave & Radar Engineering by Navneet Kaur; Ishan Publications, Ambala City
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. This subject contains five units of equal weightage.

6.3.2 CONSUMER ELECTRONICS

L	P
2	2

RATIONALE

This subject will introduce the students with working principles, block diagram, main features of consumer electronics items like audio-systems, DVD systems. TV and other items like cable TV, DTH etc. It will develop skills among the students of assembling, fault diagnosis and rectification in a systematic way.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:
CO1: Study about various audio and recording systems
CO2: Explain block diagram and function of each block of TV receiver
CO3: Differentiate PAL, NTSC and SECAM
CO4: Describe the principle and working of LCD and LED
CO5: Explain about digital and video compression techniques

DETAILED CONTENTS

UNIT I
Audio Systems:

1.1. Microphones and Loudspeakers

a) Carbon, moving coil, cordless microphone
b) Direct radiating and horn loudspeaker
c) Multi-speaker system
d) Public Address system

1.2 Sound Recording

Optical Recording (CD system and DVD)

UNIT II

Television

2.1.Monochrome TV

e) Elements of TV communication system
f) Scanning and its need
g) Need of synchronizing and blanking pulses, VSB
h) Composite Video Signal
i) TV Receiver: Block diagram, function of each block, waveform at input and output of each block.

UNIT III

Colour Television:

j) Primary, secondary colours
k) Concept of Mixing, Colour Triangle
l) Camera tube
m) PAL TV Receiver
n) Concept of Compatibility with Monochrome Receiver
o) NTSC, PAL, SECAM system (brief comparison)

UNIT IV

LCD and LED Television: Basic principle and working of LCD and LED TV.

UNIT V

Basic idea of digital audio and digital video compression techniques.
Working of Cable TV, DTH**,** CCTV

PRACTICAL EXERCISES

1. To plot the frequency response of a Microphone
2. To plot the frequency response of a Loud Speaker

3. To study and use a Public address system and its components.
4. To observe the waveforms and measure voltages of colour TV Receiver at different points
5. Fault finding of colour T.V
6. Fault Finding of LED TV.
7. To use a Colour Pattern Generator with a colour TV.
8. Demonstration and operation of DTH System
9. Demonstration and operation of CCTV
10. To visit the control room of a Cable TV station and identify its different components.

RECOMMENDED BOOKS

1. Audio and Video Systems by RG Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Colour Television-Principles and Practice by R.R Gulati , Wiley Eastern Limited, New Delhi
3. Complete Satellite and cable Television R.R Gulati New age International Publisher, New Delhi
4. Colour Television Servicing by RC Vijay BPB Publication, New Delhi
5. Colour Television and Video Technology by A.K. Maini CSB Publishers
6. Consumer Electronics Yagnik & Jain by Ishan Publication, Ambala.
7. Colour TV by A.Dhake
8. Service Manuals, BPB Publication, New Delhi

SUGGESTED WEBSITES

1. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. This subject contains five units of equal weightage.

6.4 PROGRAMME ELECTIVE - II

6.4.1 EMBEDDED SYSTEMS

L	P
2	2

RATIONALE

This subject plays very important role in designing embedded systems for various processes for industries. Diploma students at this level must have the required knowledge of PIC microcontroller and its programming for automation of different processes. This subject will give exposure to the students about the architecture of PIC microcontroller along with its interfacing with various peripheral devices.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Understand the concept of Embedded System.
CO2: Explain the architecture of PIC microcontroller.
CO3: Implement C programming for interfacing PIC microcontroller with various peripherals.
CO4: Develop complete system using PIC microcontroller.

DETAILED CONTENTS

UNIT I

Introduction

Embedded system, history of embedded systems, embedded system architecture, Functional structure of embedded system.

UNIT II

PIC Microcontroller

Introduction to PIC Microcontroller: History and Features, Architecture, Pin Diagram of PIC18F458, I/O port pins and their functions, PIC18 Configuration Registers.

UNIT III

PIC Programming in C

Data types and time delays in C, I/O Programming in C, Logic operations in C, Data conversion programs in C, Data serialization in C, Program ROM allocation in C18, Data RAM allocation in C18, PIC18 timer programming in C, PIC18 serial port programming in C.

UNIT IV

Real World Interfacing with PIC18

LCD and keyboard Interfacing, ADC, DAC and Sensor Interfacing.

UNIT V

Motor Control Using PIC 18

Relays and optoisolators, Stepper motor Interfacing with PIC18, DC Motor Interfacing with PIC18.

PRACTICAL EXERCISES

1. Performing experiments on PIC microcontroller kits
2. Interfacing LCD and keyboard with PIC microcontroller
3. Interface PIC microcontroller with Sensors
4. Interface PIC microcontroller with stepper motor
5. Control speed of DC motor using PIC microcontroller
6. Development of a complete system using PIC microcontroller

RECOMMENDED BOOKS

1. PIC Microcontroller and Embedded systems using assembly and C for PIC18, Muhammad Ali Mazidi, Rolin D and Danny Causey, Pearson Education,
2. PIC Microcontroller: An Introduction to Software & Hardware Interfacing, Han-Way Huang, Course Technology

3. Programming and customizing the PIC Microcontroller, Myke Predko, Tata McGraw Hill Education Pvt Ltd.

4. Programmable Digital Signal Processors: Architecture: Programming, and Applications, Yu Hen Hu, CRC Press

SUGGESTED WEBSITES

1. https://swayam.gov.in
2. https://nptel.ac.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

6.4.2 MEDICAL ELECTRONICS

L	P
2	2

RATIONALE

A large number of electronic equipment are being used in hospitals for patient care and diagnosis or carry out advanced surgeries. Electronics and communication diploma holders are expected to have exposure about various medical electronic equipment like electrodes, sensors, recorders along with knowledge of monitoring and imaging systems. This subject will enable the students to learn the basic principles of these different instruments used in medical science.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:
CO1: Classify various equipment used in medical science
CO2: Differentiate various electrodes used for ECG, EEG and EMG
CO3: Describe different bio transducers, sensors and medical recorders
CO4: Learn about various patient monitoring systems and safety aspects
CO5: Study about various imaging systems

DETAILED CONTENTS

UNIT I

Introduction

Overview of Medical Electronics, classification of medical Equipments, application and specifications of diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments, typical waveforms & signal characteristics.

UNIT II

Electrodes

Origin of Bioelectric signals, Bio electrodes, Electrode tissue interface, contact impedance, Types of Electrodes, Electrodes used for ECG, EEG, EMG. Biological Amplifiers.

UNIT III

Bio Transducers, Biosensors

Typical signals from physiological parameters, Classification of Bio transducers, pressure transducer, Photoelectric transducer, Transducer for body temperature measurement, pulse sensor, respiration sensor.

Bio Medical Recorders

Block diagram description and application of following instruments

- Electrocardiograph (ECG) Machine
- Electroencephalograph (EEG) Machine
- Electromyography (EMG) Machine
- Phonocardiogram (PCG)
- Vector cardiogram (VCG)
- Digital Stethoscope

UNIT IV

Patient Monitoring Systems

- Heart rate measurement
- Pulse rate measurement
- Respiration rate measurement
- Blood pressure measurement
- Need of defibrillator and Cardiac Pace maker
- Bedside patient monitoring System

Patient Safety

- Electric shock hazards
- Leakage currents
- Electrical safety analyser
- Safety standards.

UNIT V

Modern Imaging System

- X-Ray Machine
- Magnetic Resonance Imaging System
- Ultrasonic Imaging System

PRACTICAL EXERCISES

1. To operate and familiarization with:
    a) B.P. Apparatus
    b) ECG Machine
2. To operate and familiarization with:
    a) Ventilator
    b) Incubator
3. To measure the concentration of blood sugar with Glucometer (fasting, P.P., Random)
4. To measure
    a) Respiration rate and interface to PC
    b) Pulse rate
5. To Measure The EMG Signals and interface with PC
6. Body Temperature measurement and recording in excel form in pc.
7. To study the Body positions and interfacing of body position sensor and data recording
8. Installation of small medical equipment in laboratories of Hospital precautions to be taken.
9. Study of large medical equipment in Hospital / Nursing home.
10. Operation and use of Electro-physiotherapy
11. Maintenance schedule for different equipment and their records in a hospital
12. Getting body parameters from Bluetooth to android App and PC
13. Logging of various body parameters in SD card as excel format.

RECOMMENDED BOOKS

1. Handbook of Biomedical Instrumentation by RS Khandpur; Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Biomedical Instrumentation by Cromwell
3. Modern Electronics Equipment by RS Khandpur; TMH, New Delhi
4. Introduction to Biomedical Electronics by Edward J. Perkstein; Howard Bj, USA
5. e-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE /NITTTR.

RECOMMENDED WEBSITES

1. https://swayam.gov.in
2. https://nptel.ac.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

6.4.3 MAINTENANCE OF COMPUTER SYSTEMS

L	P
2	2

RATIONALE

Personal Computers have become a necessity in Industry, offices and becoming popular in homes too. This course gives organization structure and principles of working of various components like visual display, keyboard drives and printers etc. This subject will help the students in repair and maintenance computers.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Study about motherboards, buses and ports

CO2: Learn about different types of memories and input devices

CO3: Describe various types of computer displays

CO4: Setup and install different printers with PC

CO5: Connect various network devices with PC

DETAILED CONTENTS

UNIT I

Mother Board

Introduction to different type of mother boards, Single Board Based System, Block diagram of motherboard. Installation of Computer System.

Buses and Ports

Different type of Buses PCI, SCSI and Serial and Parallel ports (COM ports) Ports COM 1, LPTI,

UNIT II

Memory

Principle and construction of Hard Disk Drive (HDD). Hard Disk Controller. Pen Drives, common faults with hard disk drive, RAM Module, SSD USB. RS 232 C, HDMI.

Input Devices
Block Diagram of keyboard Controller, keyboard types and faults, Types of mouse and its common faults. Introduction to scanner, digitizer and webcam.

UNIT III

Display Devices

Block Diagram, Principle of operation of Computer Monitor, Video display Adaptors, Types of display.

UNIT IV

Printers

Printing Mechanism, Construction and working principles of Inkjet Printer, Laser Printer, Thermal printer, Interfacing of PC with printer.

UNIT V

Networking Devices
Introduction to networking devices. Idea about

a) LAN, WAN, Wi-Fi
b) ROUTER, SWITCH, HUB

PRACTICAL EXERCISES

Operation, Maintenance, Installation and Testing of the following devices:

1. Monitors (LCD and LED)
2. HDD, Partitioning and Formatting
3. Inkjet Printer
4. Laser Printer
5. Mother board based on latest microprocessor and chipset CMOS Set up.
6. SSD
7. Network Connectors and Cables
8. Router and Switch
9. Installation of any operating system.
10. Establish LAN,WLAN, using Networking Devices

RECOMMENDED BOOKS

1. PC Organisation by S. Chowdhury, Dhanpat Rai & Sons, Delhi

2. IBM PC Colons by Govinda Rajalu, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Text Book by Mark Minasi
4. Computers by P.Norton
5. Troubleshooting and maintenance of Computers by prof. S.P.S. Saini Vayu Education of India, New Delhi

SUGGESTED WEBSITES

1. https://swayam.gov.in
2. https://nptel.ac.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age

6.5 MAJOR PROJECT / INDUSTRIAL TRAINING

L	P
-	16

RATIONALE

Industrial Internship / Major project work will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get acquainted with desired attributes for industrial environment. For this purpose, students are required to be involved in industrial training / Major Project Work in different establishments.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Define the problem statement of the Industrial training / Major project according to the need of industry.

CO2: Work as a team member for successful completion of Industrial training / Major project.

CO3: Write the Internship / Major project report effectively.

CO4: Present the Internship / Major project report using PPT.

GUIDELINES

Depending upon the interest of the students, they can go for Industrial training / Major project as per present and future demand of the industry. The supervisors may guide the students to identify their project work and chalk out their plan of action well in advance. As an Industrial training / Major project activity each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes/activities. The supervisor may create a group of 4-5 students as per their interest to work as a team for successful completion of the Industrial training / Major Project.

The supervisor shall evaluate the students along with one external industry / academic expert by considering the following parameters:

	Parameter	**Weightage**
I	Defining problem statement, focus and approach	20%
ii	Innovation / creativity	20%
iii	Report Writing	20%
iv	Power Point Presentation	20%
v	Viva - voce	20%

24. ASSESMENT TOOLS AND CRITERION

The assessment is carried out by conducting:

1. Formative assessments
2. Summative assessments

1. FORMATIVE ASSESSEMENT

The formative assessment will be evaluated on the basis of the internal assessments for theory subjects and practical by the concerned teachers for evaluating the knowledge and skill acquired by students and the behavioral transformation of the students. This internal assessment is primarily carried out by collecting evidence of competence gained by the students by evaluating them at work based on assessment criteria, asking questions and initiating formative discussions to assess understanding and by evaluating records and reports, and sessional marks are awarded to them.

2. SUMMATIVE ASSESSMENT

The summative assessment will include end semester examination for theory part for each candidate and practical examination with viva voice. Each Performance Criteria will be assigned marks proportional to its importance and proportion of marks for Theory and Skills Practical for each subject should be laid down. The following assessment tools are used for effective student evaluation:

1. Theory
2. Practical
3. Minor & Major Project
4. Massive Open Online Courses (MOOCs)
5. Viva Voce
6. Industrial / In House Training
7. Professional Industrial Training

1. Theory Assessment

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve

problems.

The formative evaluation for theory subjects may be caused through

i. Sessional /class-tests,
ii. Quizzes,
iii. Assignments,
iv. Seminars / Presentations
v. Attendance
vi. Case Studies

For Summative evaluation of theory, the question paper may comprise of three sections.

i. It should contain objective type question and multiple choice questions. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

ii. It should contain short answer questions.

iii. Descriptive type questions, with some internal choice of the questions set may be given in this section

2. Practical Assessment

Evaluation of students performance in practical work (Laboratory experiments, Workshop practical /field exercises) aims at assessing students ability to apply or practice the concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. This will comprise of a creation of mock environment, wherever applicable in the skill lab which is equipped with all required equipment for development of desired skills. Candidate's soft skills, communication, aptitude, safety consciousness, quality consciousness etc. will be ascertained by observation and will be marked in observation checklist along with the assessment of Job carried out in labs and maintenance of Lab Record Files.

Formative and summative evaluation may comprise of weight ages to performance on task, quality of product, general behavior and it should be followed by viva-voce of the

relevant subject. The end product will be measured against the specified dimensions and standards to gauge the level of skill achievements

3. Minor and Major Project Assessment

The purpose of evaluation of project work is to assess student's ability to apply, in an integrated manner, knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The project work assigned should be of relevance to the core skill, state of the art topics and the project areas that are pertaining to enhance job skill and enhance occupational opportunities. For both, minor and major project, Formative and summative evaluation may comprise of weight ages to performance on task, quality of product, nature and relevance of project and general behavior.

The formative assessment should include the continuous assessment based on the work allocated and mid semester viva voice or presentation. The final assessment will be the combination of the project undertaken, report submission and should be followed by viva-voce of the relevant subject.

In case of the assessment of this component, the team of examiners should be constituted and half of the examiners in the team should be invited from outside of the institute as expert for conducting the examination.

4. Massive Open Online Courses (MOOCs) Assessment

Open Elective and Multi-Disciplinary Elective may be covered through Massive Open Online Courses (MOOCs) to promote self learning. These platforms promise open, online courses to massive numbers of students as they are free to join; they provide a wide range of courses. They allow for space and time flexibility and their participants can benefit from various online communication tools and access to quality content.

The coordinating Department/Centre/Office shall monitor every student to adopt the courses online of their choice and preference on Swayam portal. The duration of courses will vary depending on the level and credit points. Courses offered in the duration of 4-10 weeks for 2 to 3 credits at diploma level are to be opted. Students can get a certificate after registering and attending the classes and submitting the assignments/quizzes and qualifying nationwide conducted written exam.

On successful completion of each course, the institution offering the MOOCs course would issue the certificate, along with the number of credits and grades, through which the student can get credits transferred into his marks certificate issued by the parent institution. There may be standard norms for the host Institution to conduct the course that may include continuous evaluation through assignments, online quizzes, case studies, online writing exercises, term examinations, student feedback, online forum management, etc. The coordinating Department/Centre/Office of the respective department shall monitor every student and submit to the Office of Examinations, a score sheet before the close of the even semester.

5. Viva Voce Assessment

This tool will be used to assess the conceptual understanding and the behavioral aspects as regards the job role and the specific task at hand. It will also include questions on safety, quality, environment and equipment's etc. Ask questions on non-prescribed tasks to ensure that the learners have complete knowledge on the assessment

6. Industrial / In-house Training Assessment

The two mandatory internships after First and Second Year of are to be assessed in 3rd and 5th semester subsequently. The trainng should be preferably done in the industry but can also be in house depending upon the stream and availability of resources in and around the institute. Faculty should be assigned each student and made responsible for the evaluation and assessment of the training. Formative assessment should be taken from the industry/institute/ department on the basis of performance, behavior and learning capabilities. Summative evaluation may comprise of weight ages on the basis of report submission / presentation followed by viva-voce of the relevant subject.

7. Professional Industrial Training Assessment

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. Formative and summative evaluation may comprise of weight ages to performance on task, quality of product, general behavior and it should be followed by viva-voce of the relevant subject.

The formative assessment should include the evaluation from the employer where the student is doing his training in the ratio of 40:60. The final assessment will be the combination of the

employer assessment and evaluation by the faculty of the institute which shall include report submission/ presentation/ seminar followed by viva-voce of the relevant subject.

SGPA AND CGPA ASSESSMENT

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the marks scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA\ (Si) = \sum(Ci \times Gi) / \sum Ci$$

where Ci is the number of credits of the ith course and Gi is the marks scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \sum(Ci \times Si) / \sum Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

25. TEACHING LEARNING TOOLS FOR EFFECTIVE IMPLEMENTATION

For effective implementation of curriculum, the faculty and staff of institutions have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that only a proper mix of different teaching methods in all these places of instruction can bring the changes in students behaviour as stipulated in the curriculum document. It is important to understand curriculum document holistically and further be aware of intricacies of Teaching-Learning Tools for achieving curriculum objectives. Given below are certain recommendations which may help in carrying out teaching-learning effectively:

PROGRAMME LEVEL RECOMMENDATIONS

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared at institute level. The Head of the institute has a great role to play in its dissemination and percolation up to grass-root level.

3. Heads of Department are required to prepare academic plan at department level referring to institutional academic plan.

COURSE LEVEL RECOMMENDATIONS

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives. Teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practical's, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practical's and field experiences. Teachers are also required to do all these activities within a stipulated period which is made available to them in the academic plan at Board level. With the amount of time to their credit, it is essential for them to use it judiciously by planning all above activities properly and ensure

execution of the plan effectively. Following is the gist of suggestions for subject teachers for effective utilization of Teaching Learning Tools to achieve the course objectives:

1. Teachers need to ensure attainment of course outcomes so as to help the students achieve program outcomes and also meet the desired learning outcomes in five domains of NSQF i.e. Process, Professional knowledge, Professional skills, Core skills and Responsibility.

2. Teachers are required to prepare a course plan, taking into account number of weeks available and courses to be taught.

3. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan.

4. Teachers are required to plan for expert lectures from field/industry. For this, necessary steps need to be taken such as planning in advance, identifying field experts, making correspondence to invite them, taking necessary budgetary approval etc.

5. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.

6. Concept based industrial/field visits may be planned and executed for such contents of course which are abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

7. Lot of focus needs to be laid on skill development. There is need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning and experiential learning effectively. The development and use of lab manuals will enable the institutes to provide lab experiences effectively.

8. Emphasis should to laid on developing soft skills like communication skills, personality Development, self-learning, inter personal skills, problem solving, and creativity etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time. While teaching, the teacher should make extensive use of audio visual aids such as video films, power point presentations and IT tools.

10. Teachers may take an initiative in establishing liaison with industries and field organizations for imparting field experiences to the students.

11. To enhance digital learning, open electives and multi-disciplinary electives have been provided in the curriculum to be taken up in the form of MOOCs. For Open electives, some courses may be identified out of the prescribed list given in the curriculum keeping in mind the interest of students. Similarly, for multi-disciplinary electives, courses to be offered may be identified by considering their relevance and utility. Every year SWAYAM is notifying the list of courses which are going to be offered in forthcoming even and odd semester. The institute needs to select the courses that are offered on SWAYAM platform or any other online platform.

12. For effective implementation of Massive Open Online Courses (MOOCs), a faculty member in the department may be identified and given the responsibility to coordinate various activities related to MOOCs. The concerned faculty member will facilitate in registration of students for MOOCs. The faculty member will also be responsible for compiling the result of students on the completion of MOOCs and pass on the information to the concerned authority.

13. Flexibility has been provided in the curriculum for the students to choose a course related to the discipline as per their interest. For effective implementation of discipline-specific electives, the institute should identify some courses from the list of courses prescribed in the curriculum. The courses should be selected and offered keeping in mind the interest of students, infrastructure and expertise available in and around the institute related to the courses. Option for discipline-specific elective may be taken from students through a form and a course, with more than 10 students opting for it, may be run.

14. Students should be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

15. Any relevant contents beyond the syllabus may be covered by the teacher or experts in extra time.

16. Minor project should be identified and allocated taking into consideration the inputs from industry stake-holders, and departmental faculty. The minor project work should be such

that it enhances the fundamental skill-sets of the students from industry perspective and subsequently helps them to handle major project.

17. For major project work, students may be given relevant and well thought out problems, which are purposeful and develop practical skills. This will help the students in developing creativity and confidence for their gainful employment.

18. A Project bank may be developed in consultation with related industry, research institutes and other relevant field organizations. It may be ensured that that the students take up some live problems being faced by industry as part of project work.

26. LIST OF EXPERTS

1. Controller of Examination, Haryana State Board of Technical Education, Panchkula.
2. Controller of Administration & Finance, Haryana State Board of Technical Education, Panchkula.
3. Joint Secretary, Haryana State Board of Technical Education, Panchkula.
4. Deputy Secretary, Training & Placement, Haryana State Board of Technical Education, Panchkula.
5. Deputy Secretary, Examination, Haryana State Board of Technical Education, Panchkula.
6. Deputy Secretary, Academic, Haryana State Board of Technical Education, Panchkula.
7. Assistant Secretary, Academic, Haryana State Board of Technical Education, Panchkula.
8. Mr. KP Sharma, Electronics Sector Skills Council, Okhla Industrial Estate, New Delhi-110020.
9. Mr. Virender Dhiman, Regional Manager, Department of Business, Electronics Sector Skills Council, Okhla Industrial Estate, New Delhi- 110020.
10. Mr. Pankaj Jain, Manager, Department of Human Resource, Napino Auto & Electronics Pvt. Ltd., Plot No-7, Sector 3, Manesar, Gurugram.
11. Ms. Jahida, Senior Executive, Human Resource, Communication Test Design India Pvt. Ltd., Mansesar.
12. Mr. Varun Bhatia, Head Standards, Electronic Sector Skills Council of India. Bhikaji Cama Place, Rama Krishna Puram, New Delhi.
13. Dr. Rajesh Garg, Lecturer, Department of Electronics & Communication Engineering, Seth Jai Parkash Polytechnic, Damla.
14. Mr. Sanjay Puri, Lecturer, Department of Electronics & Communication Engineering, Seth Jai Parkash Polytechnic, Damla.

15. Mr. Inderjeet Singh Dhindhsa, Lecturer, Department of Electronics & Communication Engineering, Government Polytechnic, Ambala.

16. Mr. Ravinder Singh Punia, Lecturer, Department of Electronics & Communication Engineering, Government Polytecnic, Ambala.

17. Mr. Vipin Kumar, Lecturer, Department of Electronics & Communication Engineering, Seth Jai Parkash Polytechnic, Damla.

18. Er. Yogindra Kaushik, Assistant General Manager, Hartron, Gurgaon.

19. Dr. Amandeep Singh, Assistant Professor, Department of Electronics & Communication Engineering, National Institute of Technology, Srinagar.

20. Dr. Bhajan Lal, Lecturer, Applied Science Department, Government Polytechnic for Women, Sirsa, Haryana.

21. Sh. Anil Nain, Lecturer, Applied Science Department, Government Polytechnic, Hisar, Haryana.

22. Dr. Sarita Mann, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.

23. Smt. Bindu Verma, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.

24. Smt. Pushpa Rani, Senior Lecturer, Applied Science Department, Government Polytechnic, Sonipat, Haryana.

25. Smt. Krishna Bhoria, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.

26. Smt. Preetpal Kaur, Guest Faculty, Applied Science Department, Government Polytechnic, Ambala, Haryana.

27. Ms. Monika, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.

28. Dr Neena Sharma, English Department, MCM College, Chandigarh.

29. Mr. Satyawan Dhaka, Senior Lecturer, Applied Science Department, Government Polytechnic, Nilokheri.

30. Mrs. Sapna Sang, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla.

31. Mr. Ravi Bansal, Lecturer, Applied Science Department, Government Polytechnic, Manesar.

32. Mrs. Kiran, Lecturer, Applied Science Department, Government Polytechnic, Sonepat.

33. Dr. Naveen Jha, Assistant Professor, Department of Mathematics, Government Engineering College, Bharatpur.

34. Dr. Vidhi Grover, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla.

35. Mr. Tavinder Singh, Lecturer, Applied Science Department, Government Polytechnic, Sirsa.

36. Ms. Sunita Rani, Lecturer, Applied Science Department, Government Polytechnic, Ambala.

37. Mr. Subhash Chandra Bhoria, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Hisar.

38. Mr. Jagjit Singh Narang, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Ambala.

39. Mr. Pardeep Kumar, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Nilokheri.

40. Mr. KG Srinivasa, Professor CSE, IIIT-Naya Raipur.

41. Dr. Pankaj Sharma, Professor, Applied Science Department, NITTTR, Chandigarh.

42. Dr. Balwinder Raj, Associate Professor, NIT Jalandhar, Punjab.

43. Dr. Ashok Kumar, Associate Professor, Applied Science Department, NITTTR, Chandigarh.

44. Dr. KC Lachhwani, Assistant Professor, Applied Science, NITTTR, Chandigarh.

45. Dr. T Kishor, Professor, ECE, NIT Warangal.

46. Dr. Vishal Bhatnagar, Professor, CSE, AIT delhi.

47. Dr. KG Sharma, Professor, ECE, CCET, Chandigarh.

48. Dr. Sunil Aggarwal, Professor, ECE, UIET, Chandigarh.

49. Dr. Balwinder Singh, Joint Director, CDAC, Mohali Punjab.

50. Dr. Kanika Sharma, Assistant Professor, ECE, NITTTR, Chandigarh.

51. Dr. Garima Saini, Assistant Professor, ECE, NITTTR, Chandigarh.

52. Dr. Rajesh Mehra, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh.

53. Dr. AB Gupta, Professor and Head, Education & Educational Management Department, NITTTR, Chandigarh.

54. Er. P.K. Singla, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh

55. Dr. SK Gupta, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.

56. Dr. Meenakshi Sood, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.

27. APPENDIX

Sr. No.	LIST OF EQUIPMENT
1.	DC regulated low voltage variable power supply
2.	DC regulated multiple output power supply
3.	Audio oscillator
4.	Wide band RC Oscillator
5.	RF Signal Generator
6.	Pulse Generator
7.	Function Generator
8.	Dual trace CRO with accessories
9.	Electronic Multimeter DC and AC with different ranges
10.	Electronics digital Multimeter three and a half digit
11.	Digital LCR- Q meter
12.	Audio output power meter
13.	Mains Voltage stabilizer(3 KVA)
14.	AC Millivoltmeters
15.	DC Millivoltmeters
16.	Voltmeter
17.	DC Ammeter
18.	Battery of different voltage and Ampere hour
19.	Single Phase variac
20.	Rheostat of different wattage and resistance
21.	Servo stabilizer power supply
22.	IC Bread Boards
23.	Distortion factor meter
24.	Decade resistance, capacitance and inductance
25.	Transducers: Pressure type, thermocouple, LVDT, opto Pick-up, electromagnetic pick-up, ultrasonic pick-up and potentiometer etc
26.	Thyristor control experimental kits Instrumentation/Transducer experimental kit. Basic electronic experiment kit
27.	Digital thermometer
28.	Digital load indicator with load Cells
29.	Digital Lux meter
30.	Function Generators Audio Frequency

31.	Multimeter (Digital)
32.	Rectifier Kits
33.	Filter Circuit Kit
34.	Transistor Kits (a) CB (b) CE
35.	FETs
36.	Operational Amplifier Kits
37.	RF Signal Generator
38.	Radio Receiver Trainer Kits/Deconstruction Models
39.	AM/FM signal generator
40.	Super heterodyne Receiver radio Demonstration model
41.	Communication receiver
42.	Optical fibre bench
43.	Digital frequency meter
44.	Types of microphones and other accessories
45.	Advanced Communication Trainer
46.	Cellular Mobile Kit
47.	Pulse Modulation and Demodulation
48.	Pulse Amplitude Modulation and Demodulation
49.	Pulse Width Modulation and Demodulation
50.	Data Formatting and Carrier Modulation Transmitter / Receiver Trainer Kit
51.	AM Transmitter and Receiver Trainer Kit
52.	FM Communication Trainer kit
53.	Sampling Reconstruction Trainer
54.	Pulse Code Modulation Transmitter and Receiver
55.	Delta Adaptive Delta Sigma Modulation and Demodulation Trainer
56.	RF Signal Generator
57.	Radio Receiver Trainer Kits/Deconstruction Models
58.	AM/FM signal generator
59.	Super heterodyne Receiver radio Demonstration model
60.	Communication receiver
61.	Optical fibre bench
62.	Digital frequency meter

63.	Types of microphones and other accessories
64.	Advanced Communication Trainer
65.	Cellular Mobile Kit
66.	Pulse Modulation and Demodulation
67.	Pulse Amplitude Modulation and Demodulation
68.	Pulse Width Modulation and Demodulation
69.	Data Formatting and Carrier Modulation Transmitter / Receiver Trainer Kit
70.	AM Transmitter and Receiver Trainer Kit
71.	FM Communication Trainer kit
72.	Sampling Reconstruction Trainer
73.	Pulse Code Modulation Transmitter and Receiver
74.	Delta Adaptive Delta Sigma Modulation and Demodulation Trainer
75.	Superhetrodyne transmitter and receiver kit
76.	Kit – Amplitude Modulation Demodulation (DSB)
77.	Kit Double Balanced Modulator/Demodulator
78.	Kit – Frequency Modulator Demodulator (Transistorized)
79.	Kit – Frequency Demodulation (IC Based)
80.	Kit –Sample and Hold (S/H) function for Digital Study
81.	IF Amplifer (IC Based)
82.	Frequency Synthesizer
83.	Audio signal generator
84.	RF Oscillator
85.	AF output power meter
86.	Signal tracer
87.	Signal Injector
88.	Colour TV training model
89.	LED TV Trainer
90.	CCTV System PAL Based
91.	Field Strength meter
92.	DTH System
93.	RF power meter
94.	PA system with microphone
95.	Mixing pre-amplifier
96.	Microphone
97.	Loud Speaker

98.	Audio Test System
99.	Digital Frequency Counter
100.	Pattern generator
101.	TV Trainer Kit (Colour)
102.	Digital Storage Oscilloscope
103.	Pattern Generators Colour
104.	Hand Tools Set
105.	Soldering Set`
106.	Hand Drill
107.	PCB Etching Machine
108.	Silk Screen Printing
109.	Drafting Equipment
110.	PCB Drilling Machine
111.	Sheet metal folding and binding machine
112.	Sheet metal cutting machine
113.	Centre Lathe
114.	Grinder
115.	Circular saw
116.	DC regulated low voltage variable power supply
117.	Digital LCR-Q meter
118.	Soldering stations temperature controlled
119.	Solder suckers with accessories
120.	Digital IC power supply
121.	Universal Counter timer
122.	Pulse Generator
123.	Logic probes (TTL and CMOS)
124.	Digital logic trainer (TTL)
125.	Logic Trainer Boards
126.	8051 Microcontroller Trainer Kits with peripherals
127.	PIC18F458 Microcontroller Trainer Kits with peripherals
128.	Digital IC Tester
129.	Universal Programmer
130.	EPROM Eraser
131.	Ink jet Printers
132.	Laser Printers

133.	Scanners
134.	Light Measurement (Photocells) Kit
135.	LVDT Kit
136.	Pressure Measurement Kit
137.	Strain Measurement Kit
138.	Water Level Measurement Kit
139.	Velocity Measurement Kit
140.	RPM Measurement Kit
141.	Temperature Measurement Kit
142.	Maxwell's Bridge Kit
143.	Wein's Bridge Kit
144.	Anderson Bridge Kit
145.	Flux Meter (Digital) Kit
146.	Q. Meter (Digital) Kit
147.	Flow Meter
148.	Ammeter, Voltmeter, Wattmeter and Energy Meters (3- phase and 1- phase)
149.	3-Phase Resistive load
150.	LCR/Q Bridge
151.	Tong tester
152.	Transformer (single phase)
153.	Watt meter, Volt meter, Ammeter,
154.	DC Shunt Motor,2 hp with loading arrangement
155.	Induction Motor (Single phase)
156.	Induction Motor (Three phase)
157.	Slipring Induction Motor 3 HP with loading facility
158.	Alternator and Load for Alternators
159.	DC generator with prime-mover motor
160.	DC Regulated Power Supply
161.	Starters (DOL and Star Delta)
162.	Rheostats
163.	Tacho meters (digital)
164.	Maggar (Insulation Tester)
165.	Earth Tester
166.	Digital Multi-meter
167.	Rectifier, Inverter Set

168.	Series Inverter
169.	Parallel Inverter
170.	Speed Control of dc motor (Thyristorized)
171.	Gate Triggering Characteristics of SCR
172.	AC Phase Control Trainer Kit
173.	UJT Characteristics and its Application as Relaxation Oscillator
174.	Diac and Triac characteristics trainer kits
175.	Solar Cell Characteristics trainer kit
176.	B P Appratus
177.	Glucometer
178.	SPO 2 Meter
179.	ECG and EMG Trainer Kit
180.	Digital thermometer
181.	Bluetooth based trainer kit for body parameters
182.	PLCs with Digital and Analog Input and output
183.	GSM and LTE Trainer Kits


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