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## PREFACE

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the Technical Education, UP to revise the existing curricula of 12 diploma programmes as per the needs of the industry and making them NSQF compliant, are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

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Coordinator  
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## 1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN INSTRUMENTATION & CONTROL ENGINEERING

- 1) Name of the Programme : Diploma Programme in Instrumentation & Control Engineering
- 2) Duration of the Programme : Three years (Six Semesters)
- 3) Entry Qualification : Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
- 4) Intake : 60 (or as prescribed by the Board)
- 5) Pattern of the Programme : Semester Pattern
- NSQF Level : Level - 5
- Ratio between theory and Practice : 45 : 55 (Approx.)

### Industrial Training:

Four weeks of industrial training is included after IV semester during summer vacation. Total marks allotted to industrial training will be 50.

### Ecology and Environment :

As per Govt. of India directives, a subject on Environmental Studies has been incorporated in the curriculum.

### Energy Conservation:

A subject on Energy Conservation has been incorporated in the curriculum.

### Entrepreneurship Development:

A full subject on Industrial Management and Entrepreneurship Development has been incorporated in the curriculum.

### 12) Student Centred Activities:

A provision of 3-6 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co-curricular activities such as expert lectures, self study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and safety etc.

### 13) Project work

A project work has been included in the curriculum to enable the student get familiarize with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

2. **EMPLOYMENT OPPORTUNITIES OF DIPLOMA HOLDERS IN Instrumentation Control ENGINEERING**

The diploma holders in Electronics Engineering find employment in the following organizations:

(A) EMPLOYMENT OPPORTUNITIES

Various Departments/ organizations/boards and corporations

Railways

Defence Services, Para-military Forces

Civil Aviation

Defence Research and Development Organizations

Electricity Boards and Corporations etc.

Research and Development Deptt.

Maintenance Deptt.

ISRO (Indian Space Research Organizations)

Industry

Consumer Electronics Industry

Electronic & Electrical Components and Devices Manufacturing and Installation Organizations

Computer Software Areas for Electronic & Instrumentation Design Manufacturing Industry

Instrumentation and Control Industries

Public Sector Undertakings ( like BHEL, BEL, HAL, IOCL, HPCL, ISRO etc)

Medical Electronics Industry

Automobile Industry

Automation and Control Industry (viz bottling plant, cement plant, automobile units, escalators etc.

Environmental Monitoring Instruments Industry

Development/Testing Laboratories/Organizations

Electronics Service Centres

Opto Electronics (Medical & Comm.)

Industrial Networks

Hospitals

Sales and Services of Electronic & I&C Gadgets from Small Scale Industries

Call Centres

Self Employment

- Marketing and Sales (Distributors - whole sale and retailers)

Service Sector( repair and Maintenance; job work)

Cable laying and jointing DBs etc.

Preparing Simulated Models

Manufacturing Unit (e.g.- Bulb manufacturing, chalk manufacturing, circuit manufacturing units etc)

Measuring Instruments Manufacturing / Maintenance

**3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN Instrumentation**  
**Control ENGINEERING**

At the end of the programme, the students will be able to:

1	Communicate effectively in English with others
2	Apply basic principles of Mathematics to solve single engineering problems
3	Apply basic principles of Physics and Chemistry to solve engineering problems
4	Prepare computerized reports, presentations using IT tools and computer application software
5	Prepare and interpret Engineering Drawings
6	Use cutting tools, equipment and tooling for fabrication of jobs by following safe practices at workplace
7	Use appropriate instruments to measure various engineering parameters .
8	Measure and compute parameters related to basic electrical engineering
9	Use appropriate procedures for preventing environmental pollution and energy conservation
10	Assemble, test and troubleshoot electronic circuits consisting of passive and active components by applying appropriate soldering, testing and measurement techniques at workplaces.
11	Understanding Different Types of Sensors and Transducers
12	Understand basic principles of digital electronics and design combinational and sequential circuits.
13	Write basic programmes using C /C++
14	Apply principles of various networks, filters and transmission lines and their associated parameters
15	Use various power controlled devices in industrial applications
16	Use microprocessor and microcontroller based system using assembly level language programming
17	Calibration of Different Measuring Instruments
18	Use different digital communication systems
19	Programme microcontroller for Embedded Systems Applications using C /C++
20	Understanding Working and Installation of Control Elements
21	Understand basic concepts of control systems
22	Understand Embedded systems and its applications
23	Understanding different types of controller's
24	Use biomedical instruments
25	Apply acquired knowledge and skill in solving a live problem or Industrial project
26	Future Trends in communication system
27	Understanding and Designing Instrumentation Diagrams of Different Process
28	Understanding Industrial Automation (PLC/DCS/DDC/SCADA)
29	Basic Concepts of Robotics



#### **4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME**

The following curriculum area subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1	Communicate effectively in English with others	Communication Skills
2	Apply basic principles of Mathematics to solve single engineering problems	Applied Mathematics
3	Apply basic principles of Physics and Chemistry to solve engineering problems	Applied Physics Applied Chemistry
4	Prepare computerized reports, presentations using IT tools and computer application software	Basics of Information Technology
5	Prepare and interpret Engineering Drawings	Engineering Drawing
6	Use cutting tools, equipment and tooling for fabrication of jobs by following safe practices at workplace	General Workshop Practice
7	Use appropriate instruments to measure various engineering parameters .	Electronic Instruments and Measurement
8	Measure and compute parameters related to basic electrical engineering	Electrical Engineering
9	Use appropriate procedures for preventing environmental pollution and energy conservation	Environmental Studies
10	Assemble, test and troubleshoot electronic circuits consisting of passive and active components by applying appropriate soldering, testing and measurement techniques at workplaces.	Electronic Devices and Circuits
11	Understand different types of Sensors & Transducers	Transducer & Applications
12	Understand basic principles of digital electronics and design combinational and sequential circuits.	Digital Electronics
13	Write basic programmes using C /C++	Programming in C
14	Apply principles of various networks, filters and transmission lines and their associated parameters	Network Filters and Transmission Line
15	Understand different Process Instrumentation	Process Instrumentation
16	Use microprocessor and microcontroller based system using assembly level language programming	Microprocessors Microcontrollers and Embedded System
17	Use different Neural networks for solving different problems.	Neural Network
18	Familiarize with Robots & its applications in the field of automation	Robotics
19	Programme microcontroller for Embedded Systems Applications using C /C++	Programming in C

20	Understand different displays, recorders & Signal transmission methods	STRD
21	Understand basic concepts of different types of control systems	Process Control Industrial Control
22	Understand Embedded systems and its applications	Microcontrollers and Embedded System
23	Understand working & installation of control Elements	Process Control
24	Understanding of Industrial Automation	Process Control
25	Apply acquired knowledge and skill in solving a live problem or Industrial project	Project Work
26	Use biomedical instruments	Biomedical instrumentation

## 5. ABSTRACT OF CURRICULUM AREAS

- a) General Studies
  - Communication Skills
  - Environmental Studies
  - Energy Conservation
  - Industrial Management & Entrepreneurship Development
- b) Applied Sciences
  - Applied Mathematics
  - Applied Physics
  - Applied Chemistry
- c) Basic Courses in Engineering/Technology
  - Engineering Drawing
  - General Workshop Practice
  - Basics of Information Technology
- d) Applied Courses in Engineering/Technology
  - Engineering Mechanics and Materials
  - Electrical Engineering
  - Electronic Components and Devices
  - Electronic Devices and Circuits
  - Electronics Workshop
  - Digital Electronics
  - Transducers & Applications
  - Network Filters and Transmission Line
  - Electronic Instruments and Measurement
  - Process Instrumentation
  - Microprocessors
  - Industrial Control
  - Signal Transmission Recording & Display
  - Programming in C
  - Process Control
  - Microcontrollers and Embedded System
  - Bio Medical Instruments
  - Industrial Training
28. Minor Project Work
29. Project Work
- Elective
30. Specialised Instruments
31. Robotics
32. Neural Networks

**6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS**

Sr. No.	Subjects	Distribution in Periods per week in Various Semesters					
		I	II	III	IV	V	VI
	Communication Skills	6	-	-	6	-	-
	Applied Mathematics	5	5	5	-	-	-
	Applied Physics	7	7	-	-	-	-
	Applied Chemistry	7	-	-	-	-	-
	Engineering Drawing	8	-	-	-	-	-
	Engineering Mechanics and Materials	4	-	-	-	-	-
	General Workshop Practice	8	8	-	-	-	-
	Basics of Information Technology	-	6	-	-	-	-
	Electrical Engineering	-	8	8	-	-	-
	Electronic Components and Devices	-	12	-	-	-	-
	Environmental Studies	-	-	5	-	-	-
	Electronic Devices and Circuits	-	-	12	-	-	-
	Electronics Workshop	-	-	6	-	-	-
	Transducer and Application	-	-	8	-	-	-
	Universal Human Values			3			
	Principles of Digital Electronics	-	-	-	8	-	-
	Network Filters and Transmission Line	-	-	-	8	-	-
	Electronic Instruments and Measurement	-	-	-	8	-	-
	Process Instrumentation	-	-	-	9	-	-
	Energy Conservation	-	-	-	5	-	-
	Industrial Management & Entrepreneurship Development	-	-	-	-	5	-
	Microprocessors	-	-	-	-	8	-
	Industrial Control	-	-	-	-	10	-
	Signal Transmission Recording & Display	-	-	-	-	5	-
	Programming in C	-	-	-	-	8	-
	Minor Project Work	-	-	-	-	6	-
	Process Control	-	-	-	-	-	10
	Microcontrollers and Embedded System	-	-	-	-	-	12
	Bio-Medical Instruments	-	-	-	-	-	08
	Elective	-	-	-	-	-	6
	Project Work	-	-	-	-	-	8
	Student Centred Activities (SCA)	3	2	1	4	6	4
	<b>Total</b>	<b>48</b>	<b>48</b>	<b>48</b>	<b>48</b>	<b>48</b>	<b>48</b>

**7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN  
INSTUMENTATION & CONTROL ENGINEERING**

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
1.1	*Communication Skills-I	4	-	2	4	20	10	30	50	2 ½	20	3	70	100	
1.2	*Applied Mathematics – I	5	-	-	4	20	-	20	50	2 ½	-	3	50	70	
1.3	*Applied Physics – I	5	-	2	5	20	10	30	50	2 ½	20	3	70	100	
1.4	*Applied Chemistry	5	-	2	5	20	10	30	50	2 ½	20	3	70	100	
1.5	*Engineering Drawing-I	-	-	8	2	-	40	40	60	3	-	-	60	100	
1.6	Engineering Mechanics and Materials	4	-	-	3	20	-	20	50	2 ½	-	-	50	70	
1.7	General Workshop Practice-I	-	-	8	2	-	40	40	-	-	60	4	60	100	
#Student Centred Activities (SCA)		-	-	3	1	-	30	30	-	-	-	-	-	30	
Total		23	-	25	26	100	140	240	310	-	120	-	430	670	

\* Common with other diploma programmes

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

IN Case of any Discrepancy for Common subjects with Electronics Engg. All the Common subjects of Electronics the details are same as in Electronics Engg syllabus.

## SECOND SEMESTER (INSTRUMENTATION &amp; CONTROL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
2.1	*Applied Mathematics – II	5	-	-	4	20	-	20	50	2 ½	-	-	50	70	
2.2	*Applied Physics –II	5	-	2	5	20	10	30	50	2 ½	20	3	70	100	
2.3	*Basics of Information Technology	-	-	6	2	-	40	40	-	-	60	3	60	100	
2.4	Electrical Engineering –I	4	-	4	5	20	30	50	50	2 ½	50	3	100	150	
2.5	Electronic Components and Devices	6	-	6	7	20	30	50	50	2 ½	50	3	100	150	
2.6	General Workshop Practice-II	-	-	8	2	-	40	40	-	-	60	4	60	100	
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30	
Total		20	-	28	26	80	180	260	200	-	240	-	440	700	

\* Common with other diploma programmes

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

IN Case of any Discrepancy for Common subjects with Electronics Engg. All the Common subjects of Electronics the details are same as in Electronics Engg syllabus.

## THIRD SEMESTER (INSTRUMENTATION &amp; CONTROL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
3.1	*Applied Mathematics-III	5	-	-	4	20	-	20	50	2 ½	-		50	70	
3.2	Electrical Engineering –II	4	-	4	6	20	30	50	50	2 ½	50	3	100	150	
3.3	*Environmental Studies	3	-	2	3	20	10	30	50	2 ½	20	3	70	100	
3.4	Electronic Devices and Circuits	6	-	6	7	20	30	50	50	2 ½	50	3	100	150	
3.5	Electronics Workshop	-	-	6	3	-	40	40	-	-	60	4	60	100	
3.6	Transducers and application	4	-	4	5	20	30	50	50	2 ½	50	3	100	150	
3.7	Universal Human Values	2	-	1	1	-	20	20	-	-	30	3	30	50	
# Student Centred Activities		-	-	1	1	-	30	30	-	-	-	-	-	30	
Total		24	-	24	30	100	190	290	250	-	260	-	510	800	

\* Common with other diploma programmes

\* Common course with Computer Science and Engineering

# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

## FOURTH SEMESTER (INSTRUMENTATION &amp; CONTROL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME										Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT							
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot			
4.1	*Communication Skill-II	4	-	2	4	20	10	30	50	2 ½	20	3	70	100		
4.2	**Principles of Digital Electronics	4	-	4	6	20	30	50	50	2 ½	50	3	100	150		
4.3	Network Filters and Transmission Line	4	--	4	5	20	30	50	50	2 ½	50	3	100	150		
4.4	Electronic Instruments and Measurement	4	-	4	5	20	30	50	50	2 ½	50	3	100	150		
4.5	PROCESS INSTRUMENTATION	5	-	4	5	20	30	50	50	2 ½	50	3	100	150		
4.6	*Energy Conservation	3	-	2	3	20	10	30	50	2 ½	20	3	70	100		
#Student Centred Activities (SCA)		-	-	4	1	-	30	30	-	-	-	-	-	30		
Total		24	-	24	29	120	170	290	300	-	240	-	540	830		

\* Common with other diploma programmes

\*\* Only for Instrumentation and control Engineering

# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

Industrial training of 4 weeks duration to be organised after 4<sup>th</sup> semester exams

IN Case of any Discrepancy for Common subjects with Electronics Engg. All the Common subjects of Electronics the details are same as in Electronics Engg syllabus.



## FIFTH SEMESTER (INSTUMENTATION &amp; CONTROL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
-	Industrial Training	-	-	-	2	-	-	-	-	-	50	3	50	50
5.1	*Industrial Management & Entrepreneurship Development	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
5.2	Microprocessors & Peripheral Devices	4	-	4	5	20	30	50	50	2 ½	50	3	100	150
5.3	INDUSTRIAL CONTROL	6	-	4	6	20	30	50	50	2 ½	50	3	100	150
5.4	SIGNAL TRANSMISSION RECORDING AND DISPLAY	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
5.5	Programming in C	4	-	4	5	20	30	50	50	2 ½	50	3	100	150
5.6	Minor Project Work	-	-	6	2	-	40	40	-	-	60	3	60	100
#Student Centred Activities (SCA)		-	-	6	1		30	30	-	-	-	-	-	30
Total		24	-	24	30	100	160	260	250	-	260	-	510	770

# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

IN Case of any Discrepancy for Common subjects with Electronics Engg. All the Common subjects of Electronics the details are same as in Electronics Engg syllabus.

## SIXTH SEMESTER (INSTUMENTATION &amp; CONTROL ENGINEERING)

Sr No.	SUBJECTS	STUDY SCHEME Periods/Week			Credi ts	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMEN T			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
6.1	PROCESS CONTROL	6	-	4	6	20	30	50	50	2 ½	50	3	100	150	
6.2	Microcontrollers and Embedded System	6	-	6	7	20	30	50	50	2 ½	50	3	100	150	
6.3	BIO-MEDICAL INSTRUMENTATION	4	-	4	6	20	30	50	50	2 ½	50	3	100	150	
6.4	*Elective	6	-	-	4	20	-	20	50	2 ½	-	-	50	70	
6.5	Project Work	-	-	8	3	-	50	50	-	-	100	4	100	150	
#Student Centred Activities (SCA)		-	-	4	1		30	30	-	-	-	-	-	30	
Total		22		26	27	80	170	250	200	-	250	-	450	700	

\*Elective: Any one out of the following:

6.4.1 SPECIALISED INSTRUMENTS

6.4.2 ROBOTICS

6.4.3 NEURAL NETWORK

# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

IN Case of any Discrepancy for Common subjects with Electronics Engg. All the Common subjects of Electronics the details are same as in Electronics Engg syllabus.

## **8. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)**

It was discussed and decided that the maximum marks for SCA should be 25 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

- i. 5 Marks for general behaviour and discipline  
(by HODs in consultation with all the teachers of the department)
- ii. 5 Marks for attendance as per following:  
(by HODs in consultation with all the teachers of the department)
  - a) 75% Nil
  - b) 75 - 80% 2 Marks
  - c) 80 - 85% 3 Marks
  - d) Above 85% 5 Marks
- iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:  
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)
  - a) 15 - National Level participation
  - b) 10 - Participation in two of above activities
  - c) 5 - Inter-Polytechnic level participation

Note: There should be no marks for attendance in the internal sessional of different subjects.

## COMMUNICATION SKILLS – I

L	T	P
4	-	2

## RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

## LEARNING OUTCOMES

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

- Understand the importance of effective communication
- Describe the process of communication
- Communicate effectively in different contexts
- Identify parts of speech
- Write correct sentences using appropriate vocabulary
- Reproduce and match words and sentences in a paragraph
- Write various types of paragraphs, notices for different purposes and composition on picture with appropriate format
- Read unseen texts with comprehension
- 

## DETAILED CONTENTS

- |     |   |              |
|-----|---|--------------|
| 1   | Basics of Communication   | (13 periods) |
| 1.1 | Definition and process of communication   |              |
| 1.2 | Types of communication - formal and informal, oral and written, verbal and non-verbal |              |
| 1.3 | Communications barriers and how to overcome them                                      |              |
| 1.4 | Barriers to Communication, Tools of Communication                                     |              |
| 2   | Application of Grammar  | (18 periods) |
| 2.1 | Parts of Speech (Noun, verb, adjective, adverb) and modals                            |              |
| 2.2 | Sentences and its types   |              |
| 2.3 | Tenses  |              |
| 2.4 | Active and Passive Voice  |              |
| 2.5 | Punctuation   |              |
| 2.6 | Direct and Indirect Speech  |              |
| 3   | Reading Skill   | (10 periods) |

Unseen passage for comprehension (one word substitution, prefixes, suffixes, antonyms, synonyms etc. based upon the passage to be covered under this topic)

4	Writing Skill	(15 periods)
	4.1 Picture composition	
	4.2 Writing paragraph	
4.3	Notice writing	

### LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a by product.

#### Listening and Speaking Exercises

Self and peer introduction  
 Newspaper reading  
 Just a minute session-Extempore  
 Greeting and starting a conversation  
 Leave taking  
 Thanking  
 Wishing well  
 Talking about likes and dislikes  
 Group Discussion  
 Listening Exercises.

### INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centred activities in class room and actively participate in listening exercises

### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-semester and end-semester written tests  
 Actual practical work, exercises and viva-voce  
 Presentation and viva-voce

### RECOMMENDED BOOKS

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CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION,U.P.,LUCKNOW IN MEETING HELD ON 10.07.2019 @RASHMI SONKAR

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.  
 Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.  
 High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.  
 Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra

The Functional aspects of Communication Skills – Dr. P. Prasad, S.K. Katria & Sons, New Delhi  
 Q. Skills for success – Level & Margaret Books, Oxford University Press.

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

Websites for Reference:

<http://www.mindtools.com/> page 8.html – 99k

<http://www.letstalk.com.in>

<http://www.englishlearning.com>

<http://learnenglish.britishcouncil.org/en/>

<http://swayam.gov.in>

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	13	24
2	18	32
3	10	16
4	15	28
Total	56	100

## 1.2 APPLIED MATHEMATICS - I

L	T	P
5	-	-

## RATIONALE

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D, curves in solving various engineering problems of all fields.

## LEARNING OUTCOMES

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

apply Binomial theorem to solve engineering problems  
 apply determinants properties and Crammer's rule to solve engineering problems  
 apply dot & cross product of vectors to find the solution of engineering problems  
 use complex numbers in various engineering problems  
 apply differential calculus and higher order to solve engineering problems  
 find velocity, acceleration, errors and approximation in engineering problems with application of derivatives.

## DETAILED CONTENTS

1. Algebra -I (12 Periods)
  - 1.1 Series : AP and GP; Sum, nth term, Mean
  - 1.2 Binomial theorem for positive, negative and fractional index (without proof).  
Application of Binomial theorem.
  - 1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Crammer's rule
2. Algebra- II (12 Periods)
  - 2.1 Vector algebra : Dot and Cross product, Scaler and vector triple product.
  - 2.2 Complex number.

Complex numbers, Representation, Modulus and amplitude Demoiivre theorem, its application in solving algebraic equations, Mod. function and its properties..

3. Trigonometry (10 Periods)
- 3.1 Relation between sides and angles of a triangle : Statement of various formulae showing relation ship between sides and angle of a triangle.
- 3.2 Inverse circular functions : Simple case only
4. Differential Calculus - I (18 Periods)
- 4.1 Functions, limits, continuity, - functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.
- 4.2 Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logarithmic differentiation, Differentiation of Inverse trigonometric function, Differentiation of implicit functions.
5. Differential Calculus - II (18 Periods)
- 5.1 Higher order derivatives, Leibnitz theorem (without proof). Simple applications.
- 5.2 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration, Errors and approximation.



### **INSTRUCTIONAL STRATEGY**

The basic instructional strategy to teach basic mathematics, Binomial theorem, trigonometry, differential equations etc. should be conceptual with real world applications of relevant branch. More numerical and theory examples can be used for clear understanding of the content.

### **MEANS OF ASSESSMENT**

Assignments and Quiz/Class Tests  
Mid-term and End-term Written Tests  
Model/Prototype Making

### **RECOMMENDED BOOKS**

Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi  
Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,  
3 Applied Mathematics-I by Chauhan and Chauhan, Krishna Publications, Meerut.  
4. Applied Mathematics-I (A) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1.	12	20
2.	12	20
3.	10	12
4	18	24
5	18	24
Total	70	100

## 1.3 APPLIED PHYSICS – I

L	T	P
5	-	2

## RATIONALE

Applied physics includes the study of a diversified topics related to 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 behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

## LEARNING OUTCOMES

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

Identify the use of S.I. system of measurement with accuracy and how it is used in engineering  
Represent physical quantities as scalars and vectors, applying the physical laws and concepts of linear and circular motion in everyday life.

Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)

Analyse and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.

Derive work, power and energy relationship and solve problems about work and power.

Define work, energy and power and their units.

Describe conservation of energy and its applications

Understand the concept of rotational motion of a rigid body and its applications

Apply the physical laws and concepts of gravity, its variation with longitude and latitude and its uses in space satellite etc.

Understand the concept of elasticity, surface tension, pressure and the laws governing movement of fluids.

Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin, Fahrenheit etc.)

Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses

Understand the laws of thermodynamics, Carnot cycle and their applications.

**DETAILED CONTENTS**

## 1. Units and Dimensions

(10 Periods)

Need of Measurement in engineering and science, unit of a physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)

Dimensions and dimensional formulae of physical quantities.

Principle of homogeneity of dimensions

Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities

### Limitations of dimensional analysis

Error in measurement, accuracy and precision of instruments, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures in calculation.

Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and non metallic blocks, wires, pipes etc (at least two each).

## 2. Force and Motion (10 periods)

Scalar and vector quantities – examples, representation of vector, types of vectors  
Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.

Resolution of Vectors and its application to lawn roller.

Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.

Impulse and its Applications

Circular motion (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.

Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)

Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist, Principle of centrifuge.

2.9 Application of various forces in lifts, cranes, large steam engines and turbines

## 3. Work, Power and Energy (10 periods)

3.1 Work: and its units, examples of zero work, positive work and negative work, conservative and non-conservative force,

3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications.

3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications

3.4 Energy and its units: Kinetic energy and potential energy with examples and their derivation, work energy theorem.

3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.

3.6 Power and its units, calculation of power in numerical problems

3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.

## 4 Rotational Motion (10 periods)

4.1 Concept of translatory and rotatory motions with examples

4.2 Definition of torque with examples

- 4.3 Angular momentum, Conservation of angular momentum (quantitative) and its examples
- 4.4 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only). Concept of Fly wheel.
- 4.5 Rotational kinetic energy, Rolling of sphere on the slant plane,
- 4.6 Comparison of linear motion and rotational motion.
- 4.7 Application of rotational motions in transport vehicles, and machines
- 5 Motion of planets and satellites (08 periods)
- 5.1 Gravitational force, Kepler's law of planetary motion,
- 5.2 Acceleration due gravity and its variation,
- 5.3 Gravitational Potential and Gravitational potential energy,
- 5.4 Motion of satellite, orbital velocity and time period of satellite, Total energy and Binding energy of a satellite, Escape energy and escape velocity,
- 5.5 Types of satellites, Geo-stationary satellite, semi-synchronous, polar satellite (concept only) and their uses in science and technology,
- 5.6 Concept of Black Holes,
6. Properties of Matter (12 periods)
- 6.1 Elasticity: definition of stress and strain, different types of moduli of elasticity, Hooke's law, significance of stress strain curve
- 6.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
- 6.3 Surface tension: concept, its units, angle of contact, Capillary action and determination of surface tension from capillary rise method, applications of surface tension, effect of temperature and impurity on surface tension
- 6.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.
- 6.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and their applications.
7. Heat and Thermodynamics (10 periods)
- 7.1 Difference between heat and temperature
- 7.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
- 7.3 Different scales of temperature and their relationship
- 7.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
- 7.5 Heat conduction in a metal rod, Temperature gradient, Concept of Co-efficient of thermal conductivity, Uses and effects of Heat conduction in Daily life.
- 7.6 Isothermal and Adibatic process

7.7 Zeroth, First and second law of thermodynamics, Heat engine (concept Only), Carnot cycle.

7.8 Application of various systems of thermometry in refrigeration and air-conditioning etc.

LIST OF PRACTICALS (to perform minimum six experiments)

To find radius of wire and its volume and the maximum permissible error in these quantities by using both vernier calipers and screw gauge.

To find the value of acceleration due to gravity on the surface of earth by using a simple pendulum.

To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer

To verify parallelogram law of forces

To study conservation of energy of a ball or cylinder rolling down an inclined plane.

To find the Moment of Inertia of a flywheel about its axis of rotation

To determine the atmospheric pressure at a place using Fortin's Barometer

To determine the viscosity of glycerin by Stoke's method

To determine the coefficient of linear expansion of a metal rod

10 To determine force constant of spring using Hooks law

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSEMENTS

Assignment & Quiz,

Mid-Term and End-Term written test,

Model Making,

Actual Lab & Practical Work,

VivaVoice

RECOMMENDED BOOKS

Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi

Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi

Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi

B.Sc.Practical Physics by C L Arora, S. Chand Publication..

Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi

Engineering Physics by DK Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi

Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications

V. Rajendran, physics-I, Tata McGraw-Hill raw Hill publication, New Delhi

Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi

Physics Volume 1, 5<sup>th</sup> edition, Haliday Resnick and Krane, Wiley publication

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	10	15
3	10	15
4	10	15
5	08	10
6	12	16
7	10	14
<b>Total</b>	<b>70</b>	<b>100</b>

## 1.4 APPLIED CHEMISTRY

L	T	P
5	-	2

## RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.

## LEARNING OUTCOMES

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

- Classify various substances based on state of aggregation
- Substantiate the laws and principles on which structure of atom is established.
- Explain and predict properties of substances.
- Explain sources of water and various characteristics of water (quantitatively).
- Explain cause and factors which can adversely affecting natural water quality and remedial measures available for water purification
- Think critically, develop and adapt water conservation techniques.
- Explain corrosion of metal and their preventive measures.
- explain chemical nature and causes of corrosion
- apply correct and efficient methods of corrosion prevention.
- explain chemistry of fuels and their relative advantages.
- select most efficient fuel for the engine and engineering applications.
- suggest how to subside air pollution caused by the use of fossil fuels
- explain the chemistry of various polymers and plastics
- verify suitability and select polymer/rubber/plastic materials for engineering applications.

## DETAILED CONTENTS

1. Atomic Structure, Periodic Table and Chemical Bonding (14 periods)
  - 1.1 Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles.
  - 1.2 Bohr's model of atom and successes and limitations of atomic theory (qualitative treatment only).
  - 1.3 Atomic number, atomic mass number isotopes and isobars.



1.4 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,

1.5 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number ( $Z$ ) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).

1.6 Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded)

1.7 Chemical bonding and cause of bonding and types such as ionic bond in NaCl sigma ( $\sigma$ ) and pi ( $\pi$ ) covalent bonds in  $H_2$ , HCl,  $Cl_2$ , elementary idea of hybridization in  $BeCl_2$ ,  $BF_3$ ,  $CH_4$ ,  $NH_3$  and  $H_2O$ , VSEPR, Molecular orbital Theory

1.8 States of Matter: Solid, Liquid & Gas, Metallic bonding- explanation with the help of electron gas (sea) model.

## 2. Fuels and Lubricants (18 periods)

2.1 Definition of fuel, classification of fuels, characteristics of good fuel, relative merits of gaseous, liquid and solid fuels

2.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.

2.3 Coal - types of coal and proximate analysis of coal

2.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers

2.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas.

2.6 Elementary ideal on – hydrogen as future fuels, nuclear fuels.

2.7 Lubricants: Definition and properties, mechanism, industrial application and its function in bearings.

2.8 Synthetic lubricants and cutting fluids.

## 3. Water (14 periods)

3.1 Demonstration of water resources on Earth using pie chart.

3.2 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter ( $mgL^{-1}$ ) and part per million (ppm) and simple numerical, pH and buffer solutions and their applications.

3.3 Disadvantages caused by the use of hard water in domestic and boiler feed water.

Priming and foaming and caustic embrittlement in boilers.

3.4 Removal of hardness -Permutit process and Ion-exchange process.

3.5 Physico-Chemical methods for Water Quality Testing

a) Determination of pH using pH meter, total dissolved solids (TDS)

b) Testing and Estimation of- alkalinity, indicator their types and application total hardness by EDTA method and O'Hener's Method. (chemical reaction of EDTA method are excluded).

c) Understanding of Indian Water Quality standards as per WHO

3.6 Natural water sterilization by chlorine and UV radiation and reverse osmosis.

3.7 Municipality waste water treatment. Definition of B.O.D and C.O.D.

4. Electrochemistry (4 periods)

Redox Reaction, Electrode Potential, Nernst equation, Electrochemical cell (Galvanic and Electrolytic); Nernst equation.

5. Corrosion and its Control (10 periods)

5.1 Definition of corrosion and factors affecting corrosion rate.

5.2 Theories of

a) Dry (chemical) corrosion- Pilling Bedworth rule

b) Wet corrosion in acidic atmosphere by hydrogen evolution mechanism

5.3 Definition of passivity and galvanic series

5.4 Corrosion control:

Metal coatings – Cathodic protection, Cementation on Base Metal Steel –Application of Metal Zn (Sheradizing), Cr (Chromozing) and Al (Calorizing), Sacrificial protection and impressed current voltage

Inorganic coatings – Anodizing and phosphating,

Organic coatings - use of paints varnishes and enamels

Internal corrosion preventive measures- alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing)

6. Organic compounds, Polymers and Plastics (10 periods)

6.1 Classification of organic compounds and IUPAC Nomenclature

6.2 Definition of polymer, monomer and degree of polymerization

6.3 Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite)

6.4 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics

6.5 Applications of polymers in industry and daily life

#### LIST OF PRACTICALS

Estimation of total hardness of water using standard EDTA solution

Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution

3. Proximate analysis of solid fuel)

4. Estimation of temporary hardness of water sample by O' Hener's Method.

5. Determination of flash and fire point of given lubricating oil using Able's flash point apparatus

#### INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

#### MEANS OF ASSEMENTS

Assignment & Quiz,  
Mid-Term and End-Term written test,  
Model Making,  
Actual Lab & Practical Work,  
Viva Voice

#### RECOMMENDED BOOKS

Chemistry in Engineering by J.C. Kuricose & J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.

Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.

Eagle's Applied Chemistry - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.

Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.

Applied Chemistry - I by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.

Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, Meerut, India

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

#### SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
	14	20
	18	24
	14	20
	4	6

	10	15
	10	15
Total	70	100

## 1.5 ENGINEERING DRAWING - I

L T P  
- - 8

## RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing 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.

Note:

- i) First angle projection is to be followed
- ii) Minimum of 18 sheets to be prepared and atleast 2 sheets on AutoCAD
- iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

## LEARNING OUTCOMES

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

Identify and use of different grades of pencils and other drafting instruments which are used in engineering field

Draw free hand sketches of various kinds of objects.

Utilize various types of lines used in engineering drawing.

Read and apply different dimensioning methods on drawing of objects.

Use different types of scales and their utilization in reading and reproducing drawings of objects and maps.

Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)

Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view

To make projections of Solid

Generate isometric (3D) drawing from different 2D (orthographic) views/sketches

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

Use basic commands of AutoCAD.

## DETAILED CONTENTS

1. Introduction to Engineering Drawing (03 sheets)

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

- 1.2 Different types of lines in Engineering drawing as per BIS specifications

1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.

1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4

2. Dimensioning Technique (01 sheet)

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

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

3. Scales (02 sheets)

3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale

3.2 Drawing of plain and diagonal scales

4. Orthographic Projections (06 sheets)

4.1 Theory of orthographic projections (Elaborate theoretical instructions)

4.2 Projection of Points in different quadrant

4.3 Projection of Straight Line (1<sup>st</sup> and 3<sup>rd</sup> angle)

4.3.1. Line parallel to both the planes

4.3.2. Line perpendicular to any one of the reference plane

4.3.3. Line inclined to any one of the reference plane.

4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1<sup>st</sup> angle only

4.5 Three views of orthographic projection of different objects. (At least one sheet in 3<sup>rd</sup> angle)

4.6 Identification of surfaces

5. Projection of Solid (02 sheets)

5.1. Definition and salient features of Solid

5.2. Types of Solid (Polyhedron and Solid of revolution)

5.3 To make projections, sources, Top view, Front view and Side view of various types of Solid.

6. Sections (02 sheets)

- 6.1 Importance and salient features
- 6.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
- 6.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
- 6.4 Orthographic sectional views of different objects.
7. Isometric Views (02 sheets)
- 7.1 Fundamentals of isometric projections and isometric scale.
- 7.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.
8. Common Symbols and Conventions used in Engineering (02 sheets)
- 8.1 Civil Engineering sanitary fitting symbols
- 8.2 Electrical fitting symbols for domestic interior installations
- \*9. Introduction to AutoCAD (02 sheets)

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

\* Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.

#### 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. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

#### MEANS OF ASSESSMENT

Sketches  
Drawing  
Use of software

#### RECOMMENDED BOOKS

A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi  
Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi

Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand

Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar

Engineering Drawing I by DK Goel, GBD Publication.

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

## 1.6 ENGINEERING MECHANICS AND MATERIALS

L T P  
4 - -

### RATIONALE

Engineering Mechanics & Materials Subject is quite essential for a student of electronics engineering diploma programme. The subject will expose the concept like force analysis, condition of equilibrium, types of materials to be used in electronic application. Lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements.

### LEARNING OUTCOMES

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

Understand the basic laws and principles of mechanics.

Able to analyze and solve simple problems related to engineering mechanics.

Understand the characteristics and properties of different materials used in electronics.

### DETAILED CONTENTS

1. Introduction

(08 Periods)

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Mechanics and its utility, Concept of scalar and vector quantities, Effect of a force, Tension & compression, Rigid body, Principle of physical independence of force, Principle of transmissibility of a force.

2. Force Analysis (13 Periods)

Concept of coplanar and non-coplanar forces including parallel forces, Concurrent and non-concurrent forces, Resultant forces, Equilibrium of forces, Law of parallelogram of forces, Law of triangle of forces and its converse. Law of polygon of forces. Solution of simple engineering problems by analytical and graphical methods such as simple wall crane, jib crane and other structures. Determination of resultant of any number of forces in one plane acting upon a particle, condition of equilibrium of coplanar concurrent force system.

3. General Condition of Equilibrium: (11 Periods)

General condition of equilibrium of a rigid body under the action of coplanar forces, statement of force law of equilibrium, moment law of equilibrium, application of above on body.

4. Stresses and strains (12 Periods)

Concept of stress and strain, Concept of various types of stresses and strains, Definitions of tension, compression, shear, bending, torsion. Concept of volumetric and lateral strains, Poisson's ratio. Mechanical properties of MS, SS, etc.

5. Materials & Concept Used In Electronics (12 Periods)

(A) Soldering materials-

Type, chemical composition and properties, Soldering alloy – Tin lead, Tin antimony, Tin silver, Lead silver, Tin zinc, Different types of flux and their properties, Properties of plastics materials, Epoxy materials for PCB (Single and multi-layer board), Emulsion parameters, Film emulsion, Type of laminates (Phenolic, Epoxy, Polyester, Silicon, Melamine, Polyamide), Properties of copper clad laminates, Materials (Filler, Resin, Copper Foil) Photo printing basics for double sided PCB, photo resin materials coating process materials, Screen printing and its materials Etching agent, Film processing and used materials.

(B) Soldering & Brazing

For black Galvanized and Tin Coated Iron sheet, Brass and copper sheets only.

Its concept, comparison with welding as joining method and classification, electric soldering and forge soldering.

Soldering operation – edge preparation of joints, pickling and degreasing, Fluxing, Tinning and Soldering. Wave soldering, solder mask, Dip soldering, Drag soldering,

Materials Used-Common fluxes, soft and hard solder, solder wire (Plain and Resin core) and sticks, spelters and their specifications and description (For Identification Only), forge soldering bits.

Electric soldering iron, other soldering tools.

Common defects likely to occurs during and after soldering.

Safety of Personnel, Equipment & Tools to be observed.

**INSTRUCTIONAL STRATEGY**

Engineering mechanics and materials needs to be handled very carefully in such a manner that students develop clear understanding of basic laws and principles of mechanics. The teacher may lay more emphasis on numerical analysis and give assignments to inculcate self-study.

**MEANS OF ASSEMENTS**

Class Tests

Home Assignments

Attendance

Sessional Test

**RECOMMENDED BOOKS**

1. R.K. Khurmi – “A Text Book of Engineering Mechanics (Applied Mechanics) - S.Chand and Co. Ltd. New Delhi
2. R.K. Rajput – “A Text Book of Applied Mechanics” – Laxmi Publications..
3. R.K. Rajpur – “ A Text Book of Materials Science”-Katson Publications Ludhiana
4. Hazara Chaudhary - “Material Science and processes”. Indian book distributors e-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

**SUGGESTED DISTRIBUTION OF MARKS**

Topic No.	No. of Periods	Marks (%)
	8	14
	13	24
	11	20
	12	21
	12	21
<b>Total</b>	<b>56</b>	<b>100</b>

## 1.7 GENERAL WORKSHOP PRACTICE – I (For Electronics Engineering)

L T P  
- - 8

### RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are 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.

### LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

### DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: 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 various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

- Fitting Shop
- Sheet Metal Shop
- Welding Shop
- Plumbing Shop

## FITTING SHOP

- 1.1 Use of personal protective equipment and safety precautions while working.
- 1.2 Basic deburring processes.
- 1.3 Introduction to fitting shop tools, marking and measuring devices/equipment.
- 1.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)
- 1.5 Identification of various steel sections (flat, angle, channel, bar etc.).
- 1.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).

### 1.7 Job Practice

Job I Marking of job, use of marking tools, filing and use of measuring instruments. (Vernier caliper, Micrometer and Vernier height gauge).

Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of  $\pm .25$  mm.

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

Job IV Drilling and tapping practice on MS Flat.

## SHEET METAL SHOP

2.1. Introduction to sheet metal shop, 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.

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

2.3 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,

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.

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

Job Practice

Job I: Shearing practice on a sheet using hand shears.

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

Job III: Practice on making Single cover plate chain type, zig-zag type and single rivetted Butt Joint.

## WELDING SHOP – I

Introduction and importance of welding as compared to other material joining processes.

Specifications and type of welding machines, classification and coding of electrodes, welding parameters, welding joints and welding positions. Materials to be welded, safety precautions.

## Job Practice

Job I Practice of striking arc (Minimum 4 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).

Job III Preparation of lap joint using arc welding process.

Job IV Preparation of T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

## 4. PLUMBING SHOP

4.1. Use of personal protective equipments, safety precautions while working and cleaning of shop.

4.2. Introduction and demonstration of tools, equipment and machines used in plumbing shop.

4.3. Introduction of various pipes and pipe fittings of elbow, nipple, socket, union etc.

4.4. Job Practice

Job 1 : Preparation of job using elbow, bend and nipple

Job II: Preparation of job using Union, Tap, Plug and Socket.

Job III: Threading practice on pipe with die

## MEANS OF ASSESSMENT

Workshop jobs

Report writing, presentation and viva voce

### RECOMMENDED BOOKS

Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.

Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.

Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.

Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi

Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi

Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi

Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

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

## 2.1 APPLIED MATHEMATICS - II

L	T	P
5	-	-

## RATIONALE

Basic elements of integral calculus, differential calculus, numerical methods, differential equations included in this course will play a vital role in understanding engineering problem mathematically. This will also develop analytical as well as conceptual abilities among students.

## LEARNING OUTCOMES

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

Calculate simple integration by methods of integration

Evaluate the area under curves, surface by using definite integrals.

Calculate the area and volume under a curve along areas

Solve the engineering problems with numerical methods.

Understand the geometric shapes used in engineering problems by co-ordinate geometry.

## DETAILED CONTENTS

## 1. Integral Calculus - I (12 Periods)

Methods of Indefinite Integration:-

- 1.1 Integration by substitution.
- 1.2 Integration by rational function.
- 1.3 Integration by partial fraction.
- 1.4 Integration by parts.
- 1.5 Integration of special function

## 2. Integral Calculus – II (12 Periods)

2.1 Meaning and properties of definite integrals, Evaluation of definite integrals..

2.2 Application : Length of simple curves, Finding areas bounded by simple curves  
Volume of solids of revolution, centre of mean of plane areas.

2.3 Simpsons 1/3rd and Simpsons 3/8th rule and Trapezoidal Rule : their application in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton-Raphson's method(without proof), Numerical solutions of simultaneous equations; Gauss elimination method(without proof)

## 3. Co-ordinate Geometry (2 Dimension) (10 Periods)

## 3.1 Circle

Equation of circle in standard form. Centre - Radius form, Diameter form, Two intercept form.

#### 4. Co-ordinate Geometry (3 Dimension) (08 Periods)

##### 4.1 Straight lines and planes in space

Distance between two points in space, direction cosine and direction ratios, Finding equation of a straight line (without proof)

#### INSTRUCTIONAL STRATEGY

Basic elements of Differential Calculus, Integral Calculus and differential equations can be taught conceptually along with real engineering applications in which particular algorithm and theory can be applied. Numerical examples will be helpful in understanding the content of the subject.

#### MEANS OF ASSESSMENT

Assignments and Quiz/Class Tests  
Mid-term and End-term Written Tests  
Model/Prototype Making

#### RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
  2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
  3. Applied Mathematics-II by Chauhan and Chauhan, Krishna Publications, Meerut.
  4. Applied Mathematics-I (B) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut
- e-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

#### SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	12	28
2.	12	28
3.	10	24
4	08	20
Total	42	100

## 2.2 APPLIED PHYSICS – II

L	T	P
5	-	2

## RATIONALE

Applied physics includes the study of a diversified topics related to 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 behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

## LEARNING OUTCOMES

After undergoing this subject, the student will be able to;

Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.

Define the terms: frequency, amplitude, wavelength, velocity of a wave.

Explain various Engineering, Medical and Industrial applications of Ultrasonics.

Apply acoustics principles to various types of buildings to get best sound effect

Explain diffraction, interference, polarization.

Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using  $C=Q/V$

Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.

Explain the concept of electric current, resistance and its measurement.

List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, distinguish between AC and DC electricity

Explain Biot-Savart Law, Ampere's law, Lorenz Force.

State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field

Explain operation of moving coil galvanometer, simple DC motor

Apply the knowledge of diodes in rectifiers, adapters IC's and various electronic circuits. Apply the concept of light amplification in designing of various LASER based instruments and optical sources.

Explain total internal reflection and apply this concept for optical fibre and its uses in Medical field and Communication.

## DETAILED CONTENTS

1. Wave motion and its applications (12 periods)

1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application

1.2 Wave equation  $y = r \sin wt$ , phase, phase difference, principle of superposition of waves

1.3 Simple Harmonic Motion (SHM): definition and characteristic, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body

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executing S. H. M., simple pendulum, concept of simple harmonic progressive wave,

- 1.4 Free, Damped and forced oscillations, Resonance with examples, Q-factor
- 1.5 Definition of pitch, loudness, quality and intensity of sound waves, intensity level, Echo and reverberation, Sabine formula for reverberation time(without derivation), coefficient of absorption of sound, methods to control reverberation time and their applications, Acoustics of building defects and remedy.
- 1.6 Ultrasonics –production, detection, properties and applications in engineering and medical applications.

## 2. Wave Optics (6 periods)

- 2.1 Dual nature of light, wave theory of light, laws of reflection and refraction, Snell's law, Power of lens, magnification.
- 2.2 ,Two-Source Interference, Double-Slit interference, Interference due to thin films, Fresnel's biprism.
- 2.3 use of interference making highly efficient solar panel.
- 2.4 diffraction, Single Slit diffraction, Intensity calculation etc
- 2.5 Polarization of electromagnetic waves, polarizing sheets, polarizing by Reflection (Brewster's law), Malus law, use of polaroids.

## 3. Electrostatics (12 periods)

- 3.1 Concept of charge, Coulombs law, Electric field of point charges, Electric lines of force and their properties, Electric flux, Electric potential and potential difference.
- 3.2 Gauss law of electrostatics: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.
- 3.3 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numericals), charging and discharging of a capacitor.
- 3.4 Dielectric and its effect on capacitance, dielectric break down.
- 3.5 Application of electrostatics in electrostatic precipitation of microbes and moisture separation from air and gases in industry for pollution control (Brief explanation only)

## 4. Current Electricity (12 periods)

- 4.1 Electric Current, Resistance, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Colour coding of carbon Resistances, Ohm's law. Superconductivity.
- 4.2 Kirchhoff's laws, Wheatstone bridge and its applications (meter bridge and slide wire bridge)
- 4.3 Concept of terminal potential difference and Electro motive force (EMF), potentiometer.
- 4.4 Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy
- 4.5 Examples of application of DC circuits in various electrical and electronics equipment such as C.R.O, T.V., Audio-Video System, Computers etc.

5. Magneto Statics and Electromagnetism (12 periods)

5.1 Magnetic poles, force on a moving charge, circulating charges, force on a current carrying wire, Hall effect, torque on a current loop.

5.2 Magnetic field due to moving charge(Biot-Savart Law), due to current (Biot-Savart Law), parallel currents, field of a solenoid, Ampere's law.

5.3 Faraday's law, Lenz' law, motional emf, induced electric fields.

5.4 Magnetic dipole and force on a magnetic dipole in a non-uniform field, Magnetization, Gauss' law for magnetism.

5.5 Types of magnetic materials. Dia, para and ferromagnetic materials with their properties,

5.6 Application of electromagnetism in ac/dc motors and generators.

6. Semiconductor physics (8 periods)

6.1 Types of materials (insulator, semi conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics

6.2 Diode as rectifier – half wave and full wave rectifier (centre taped),

6.3 Semiconductor transistor, pnp and npn (concepts only)

6.4 Application of semiconductor diodes (Zener, LED) and that of transistor as amplifier and oscillator.

7. Modern Physics (8 Periods)

7.1 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; laser and its characteristics, population inversion, Types of lasers; Ruby and He-Ne lasers, engineering and medical applications of lasers.

7.2 Fibre optics: Total internal reflection and its applications, Critical angle and conditions for total internal reflection, introduction to optical fibers, light propagation, types, acceptance angle and numerical aperture, types and applications of optical fibre in communication.

7.3 Introduction to nanotechnology, nanoparticles and nano materials,

LIST OF PRACTICALS (To perform minimum six experiments)

To determine the velocity of sound with the help of resonance tube.

To find the focal length of convex lens by displacement method.

To find the refractive index of the material of given prism using spectrometer.

To find the wavelength of sodium light using Fresnel's biprism.

To verify laws of resistances in series and parallel combination

To verify ohm's laws by drawing a graph between voltage and current.

To measure very low resistance and very high resistances using Slide Wire bridge

Conversion of Galvanometer into an Ammeter and Voltmeter of given range.

To draw hysteresis curve of a ferromagnetic material.

To draw characteristics of a pn junction diode and determine knee and break down voltages.

To find wave length of the laser beam.

To find numerical aperture of an optical fiber.

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

#### MEANS OF ASSESSMENT

Assignment & Quiz,  
Mid-Term and End-Term written test,  
Model Making,  
Actual Lab & Practical Work,  
Viva-Voice

#### RECOMMENDED BOOKS

Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi  
Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi  
A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi  
Practical Physics, by C. L. Arora, S Chand publications  
Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi  
Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications.  
Physics Volume 2, 5<sup>th</sup> edition, Haliday Resnick and Krane, Wiley publication  
Fundamentals of Physics by Haliday, Resnick & Walker 7<sup>th</sup> edition, Wiley publication  
e-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	18
2	6	8
3	12	18
4	12	16
5	12	16
6	8	12
7	8	12
Total	70	100

## 2.3 BASICS OF INFORMATION TECHNOLOGY

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-	-	6

## RATIONALE

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. 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 concept of information technology and its scope; operating a computer; use of various tools using MS Office/Open Office/Libre Office using internet etc., form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:

Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.

## LEARNING OUTCOMES

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

- Identify Computer Hardware Components, Network Components and Peripherals.
- Explain the role of an Operating System.
- Install System and Application Software.
- Explain the function of the system components including Processor, Motherboard and Input-output devices.
- Use Word Processing Software to prepare document.
- Use Spreadsheet Software to create workbooks and automate calculation.
- Use Presentation Software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, scan, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install Antivirus.
- Safeguard against Online Frauds, threats and crimes.
- Use online office tools(Google suits)

## TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

### 1. Introduction to Computers and Peripherals.

Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, CD, DVD, Blue ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.

### 2. Operation System and Application Software

System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/Libreoffice, Working with window, Desktop components, Menu bars, creating shortcut of program. Installation of Application softwares, Antivirus and Drivers.

### 3. Word Processing, Spreadsheet and Presentation

Usage and creation of word document, spreadsheets and presentation, Google Suits (Google drive, google sheet, google doc. Google presentation)

### 4. Internet

Basics of Networking – LAN, WAN, Wi-Fi technologies, Concept of IP Addrsses, DNS, Search Engines, e-mail, Browsing and cyber laws.

## LIST OF PRACTICAL EXERCISES

Identify various components, peripherals of computer and list their functions.

Installation of various application software and peripheral drivers

Installation of operating system (windows/linux/others)

Creation and Management (Rename, delete, search of file and folders)

Installation of Antivirus and remove viruses

Scanning and printing documents

Browsing, Downloading, Information using Internet

E-Mail ID creation, comparing, sending and receiving e-mail. Attaching a file with e-mail message.

### 9. Word Processing (MS Office/Open Office)

#### a) File Management:

Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file

Page set up:

Setting margins, tab setting, ruler, indenting

Editing a document:

Entering text, cut, copy, paste using tool- bars

d) Formatting a document:

Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods

Aligning of text in a document, justification of document, inserting bullets and numbering

Formatting paragraph, inserting page breaks and column breaks, line spacing

Use of headers, footers: Inserting footnote, end note, use of comments, autotext

Inserting date, time, special symbols, importing graphic images, drawing tools

e) Tables and Borders:

Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table

Print preview, zoom, page set up, printing options

Using find, replace options

Using Tools like:

Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels

Using shapes and drawing toolbar,

Working with more than one window.

## 10. Spread Sheet Processing (MS Office/Open Office/Libre Office)

Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets

Menu commands:

Create, format charts, organise, manage data, solving problem by analyzing data. Programming with Excel Work Sheet, getting information while working

Work books:

Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations

Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting

Creating a chart:

Working with chart types, changing data in chart, formatting a chart, use chart to analyze data

Using a list to organize data, sorting and filtering data in list

Retrieve data with query:

Create a pivot table, customizing a pivot table. Statistical analysis of data

Exchange data with other application:

Embedding objects, linking to other applications, import, export document.

#### 11. PowerPoint Presentation (MS Office/Open Office/Libre office)

- a) Introduction to PowerPoint
  - How to start PowerPoint
  - Working environment: concept of toolbars, slide layout & templates.
  - Opening a new/existing presentation
  - Different views for viewing slides in a presentation: normal, slide sorter.
- b) Addition, deletion and saving of slides
- c) Insertion of multimedia elements
  - Adding text boxes
  - Adding/importing pictures
  - Adding movies and sound
  - Adding tables and charts etc.
  - Adding organizational chart
  - Editing objects
  - Working with Clip Art
- d) Formatting slides
  - Using slide master
  - Text formatting
  - Changing slide layout
  - Changing slide colour scheme
  - Changing background
  - Applying design template

#### 12. Google Suits

Using Google drive, Google shut, Google docs, Google slides.

### INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office/Libre office/Google Suit in addition to working on internet. The student should be made capable of working on computers independently.

### MEANS OF ASSESSMENT

Class Tests/Quiz

Software Installation and Use

Viva-Voce  
Presentation

#### RECOMMENDED BOOKS

Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi  
 Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi  
 Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi  
 Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.  
 Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi  
 A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi  
 Computer Fundamentals by PK Sinha; BPB Publication, New Delhi  
 Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi  
 On Your Marks - Net...Set...Go... Surviving in an e-world by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi  
 Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar  
 e-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Online Resources  
[www.tutorialspoint.com](http://www.tutorialspoint.com)  
[www.sf.net](http://www.sf.net)  
[Gsuite.google.com](http://Gsuite.google.com)  
[Spoken-tutorial.org](http://Spoken-tutorial.org)  
[Swayam.gov.in](http://Swayam.gov.in)



## 2.4 ELECTRICAL ENGINEERING-I

L	T	P
4	-	4

## RATIONALE

The objective of this subject is to impart fundamental knowledge and skills regarding basic electrical engineering, which diploma holders will come across in their professional life. This course will provide the student to understand the basic concept and principles of dc and ac fundamentals, electromagnetism, batteries, electrical materials, electrical safety etc.

## LEARNING OUTCOMES

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

- Classify various materials into conductor, semiconductor and insulator.
- Describe the properties of conducting, insulating and magnetic materials.
- Understand Kirchoff's laws to solve simple DC circuit.
- Understand various network theorems such as Thevenin's theorem, Norton theorem, and superposition theorem to solve simple circuit problems.
- Understand AC Circuit Theory.
- Understand construction, rating & safety measures for batteries.

## DETAILED CONTENTS

1. Classification (2 Periods)  
Classification of materials into conducting materials, insulating materials and Semi-conducting materials with reference to their atomic structures.
2. Conducting Materials (6 Periods)
  - 2.1 Resistivity and factors affecting resistivity such as temperature, alloying and mechanical stressing.
  - 2.2 Classification of conducting materials into low resistivity and high resistivity materials. Some examples of each and their typical applications.
3. Insulating Materials (10 Periods)
  - 3.1 Electrical Properties:  
Volume resistivity, surface resistance, Dielectric loss, Dielectric strength (Break down voltage) and Dielectric constant.
  - 3.2. Chemical Properties:  
Solubility, Chemical resistance and Weatherability.
  - 3.3 Physical Properties:  
Hygroscopicity, Tensile and Compressive strength, Abrasive resistance, Brittleness.
  - 3.4 Thermal Properties:

Heat resistance, classification according to permissible temperature rise, Effect of electrical overloading on the life of an electrical appliance.

### 3.5 Plastic Insulating Materials:

Classification into thermoplastic and thermosetting categories, example of each and their typical applications.

## 4. Magnetic Materials (4 Periods)

4.1 Ferromagnetism, Domains, permeability, hysteresis loop-(including coercive force and residual magnetism) and magnetic saturation.

4.2 Soft and Hard magnetic materials, their examples and typically applications.

## 5. Electro Magnetism (8 Periods)

5.1 Concept of mmf, flux, reluctance and permeability.

5.2 Energy stored in a magnetic field and an inductor.

5.3 Solution of problems on magnetic circuits.

5.4 Faraday's laws of electromagnetic induction, Lenz's law, Physical explanation of self and mutual inductance.

5.5 B-H curve, Hysteresis, Eddy currents-elementary ideas and significance.

5.6 Growth and decay of current in an inductive circuit.

5.7 Force between two parallel current carrying conductors and its significance.

5.8 Current carrying conductors in magnetic field and its significance

## 6. D.C Circuits (11 Periods)

6.1 Ohm's law, resistivity, effect of temperature on resistances, heating effect of electric current, conversion of mechanical units into electrical units.

6.2 Kirchhoff's laws, application of Kirchhoff laws to solve simple dc circuits.

6.3 Thevenin's theorem, maximum power transfer theorem, Norton's theorem and super position theorem, simple numerical problems.

## 7. A.C Theory (11 Periods)

7.1 Concept of alternating voltage and current, difference between AC and DC .  
Generation of alternating voltage, equation of sinusoidal waveform.

7.3 Definition and concept of cycle, frequency, Time period, amplitude, instantaneous value, average value, RMS value, peak value, form factor, Peak factor.

7.4 Phase and phase difference, representation of alternating quantities by phasor, addition and subtraction of alternating quantities.

## 8. Batteries (4 Periods)

8.1 Construction of lead acid and nickel cadmium batteries.

8.2 Charging and maintenance of batteries.

8.3 Rating of batteries.

8.4 Back up batteries (Lithium & Silver Oxide batteries).

8.5 Shelf life of batteries.

## LIST OF PRACTICALS

Ohm's law verification.

To verify the laws of series and parallel connection of resistance i.e. to verify:-

Total resistance in series connections.

$$R_T = R_1 + R_2 + R_3 \dots$$

Where  $R_T$  is total resistance and  $R_1, R_2, R_3$  etc. are the resistances connected in series.

Total resistance in parallel connections.

$$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 \dots$$

Where  $R_T$  is total resistance and  $R_1, R_2, R_3$  etc. are the resistances connected in parallel circuit.

To verify the laws of series and parallel connection of capacitance i.e. to verify:-

Total capacitance in series connections.

$$1/C_T = 1/C_1 + 1/C_2 + 1/C_3 \dots$$

Where  $C_T$  is total capacitance and  $C_1, C_2, C_3$  etc. are the capacitances connected in series.

Total capacitance in parallel connections.

$$C_T = C_1 + C_2 + C_3 \dots$$

Where  $C_T$  is total capacitance and  $C_1, C_2, C_3$  etc. are the capacitances connected in parallel.

4. To verify Kirchhoff's following laws:-

The algebraic sum of the currents at a junction is zero.

The algebraic sum of the emf in any closed circuit is equal to the algebraic sum of IR products (drops) in that circuit.

5. To measure the resistance of an ammeter and a voltmeter and to conclude that ammeter has very low resistance whereas voltmeter has very high resistance.

6. To verify Thevenin's and maximum power transfer theorems.

7. To find the ratio of inductance values of a coil having air core and iron core respectively and thus see that by the introduction of magnetic material inside the coil, the induction value of coil is substantially increased.

8. To test a battery for charged and discharged condition and to make connections for its charging.

9. To show that the range of an ammeter (dc and ac) and a voltmeter (dc and ac) can be extended with the use of shunts and multipliers.

10. To convert the given galvanometer into voltmeter and an ammeter.

## INSTRUCTIONAL STRATEGY

The teachers should give emphasis on understanding of concept and various terms used in the Electrical Engineering. Practical exercises will reinforce various concepts.

## ASSESSMENT TOOLS

Class Tests

Home Assignments

Attendance

Sessional Test

## RECOMMENDED BOOKS

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CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION, U.P., LUCKNOW IN MEETING HELD ON 10.07.2019 @ RASHMI SONKAR

Electrical Technology by B L Thareja; S Chand & Co.

Basic Electrical Engineering by J B Gupta; S K Kataria and Sons, New Delhi

Basic Electrical Engineering by J S Katre; Technical Max. Publication Pune

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

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	No. of Periods	Marks (%)
1.	02	04
2.	06	11
3.	10	18
4.	04	07
5.	08	13
6.	11	20
7.	11	20
8.	04	07
Total	56	100

## 2.5 ELECTRONIC COMPONENTS &amp; DEVICES

L T P

6 - 6

## RATIONALE

Knowledge of Electronic components & devices is quite essential for a student of electronic engineering diploma programme. With the knowledge of these active and passive components he will work successful in every field of the branch. Therefore a diploma student in electronics engineering must be equipped with the fundamental knowledge about electronic components, voltage and current source, semi conductor diode, transistors and FET for successful handling of industrial problems.

## LEARNING OUTCOMES

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

Identify and distinguish between active components (BJT, FET etc) and passive components (Resistor, Capacitor, inductor etc).

Understand voltage and current sources as well as their interconversions.

Understand the working and application of semiconductor diode including half wave rectifier & Full wave rectifier.

Understand the working of BJT and hence able to design amplifier using it.

Compare various transistors biasing circuit and stabilize their operating points.

Understand the working of FET and hence able to design amplifier using it.

Compare BJT, JFET, MOSFET & CMOS.

## DETAILED CONTENTS

1. Introduction to Electronics (06 Periods)
  - 1.1 Application of electronic in different fields.
  - 1.2 Brief introduction to active components and devices.
2. Passive Components (12 Periods)
  - 2.1. Resistor- Working characteristics/properties, Resistors-Carbon film, metal-film, carbon composition, wire wound and variable type (presets and potentiometers) constructional details, characteristics (size, voltage, tolerance temperature and frequency dependence) , noise consideration, specification, Testing, mutual comparison and typical applications, Voltage Dependent Resistor (VDR).
  - 2.2. Capacitors- Working characteristics/properties, Capacitors-polyester, Metalized polyester, ceramic paper mica and electrolytic tantalum and solid aluminium types; construction details and testing, specifications, mutual comparison & typical applications.
  - 2.3. Inductors, Transformers and RF coils- Working characteristics/properties Methods of manufacture of inductors, RF coils and small power and AF transformer and their testing, Properties of cores, Needs and type of shielding.
3. Voltage And Current Sources (06 Periods)
  - 3.1. Concept of constant voltage sources, symbol and graphical representation, characteristics of ideal and practical voltage sources.

3.2. Concept of constant current source, symbol and graphical representation, characteristics of ideal and practical current sources.

3.3 Conversion of voltage sources into a current sources and vice-versa.

3.4 Concept of floating and grounded D.C. supplies.

#### 4. Semiconductor Diode (12 Periods)

4.1. P-N junction diode, Mechanism of current flow in P-N junction, drift and diffusion currents, depletion layer, potential barriers, P-N junction diode characteristics, Zener & avalanche breakdown, Concept of junction capacitance in forward & reverse bias conditions.

4.2. Semiconductor diode characteristics, dynamic resistance & their calculation from diode characteristics, dynamic resistance of diode in terms of diode current, Variation of leakage current and forward voltage with temperature (No derivations).

4.3 Diode (P-N Junction) as rectifier, Half wave rectifier, full wave rectifier including bridge rectifier, relationship between D.C output voltage and A.C input voltage, rectification efficiency and ripple factor for rectifier circuits, filter circuits- shunt capacitor, series inductor, bleeder resistance, working of the filter and typical application of each type

4.4. Different types of diodes, characteristics and typical application of power diodes, zener diodes, varactor diodes, point contact diodes, tunnel diodes, LEDs and photo diodes

4.5. Important specification of rectifier diode and zener diode.

#### 5. Introduction to Bipolar Transistor: (12 Periods)

5.1. Concept of bipolar transistor as a two junction three terminal device having two kinds of charge carriers, PNP an NPN transistor, their symbol and mechanism of current flow, explanation of fundamental current relations, Concept of leakage current, effect of temperature on leakage current, Standard notation for current and voltage polarity.

5.2. CB, CE and CC configurations.

Common base configuration (CB): input and output characteristics, determination of transistor parameters (input and output) dynamic resistance, current amplification factor.

Common emitter configuration (CE): current relations in CE configuration, collector current in term of base current and leakage current ( $I_{CEO}$ ) relationship between the leakage current in CB and CE configuration, input and output characteristics, determination of dynamic input and output resistance and current amplification factor  $\beta$  from the characteristics.

Common collector configuration (CC): Expression for emitter current in terms of base current and leakage current in CC configuration.

5.3. Comparison of CB and CE configuration with regards to dynamic input and output resistance, current gain and leakage current performance of CE configuration for low frequency voltage amplification, Typical application of CB configuration in amplification.

5.4. Transistor as an amplifier in CE configuration.

DC load line, its equation and drawing it on collector characteristics.

Determination of small signal voltage and current gain of basic transistor amplifier using CE output characteristics and DC load line, Concept of power gain as a product of voltage gain and current gain.

6. Transistor Biasing And Stabilization Of Operating Point (09 Periods)

6.1. Different transistor biasing circuits for fixing the operating points, effect of temperature on operating point.

Need and method for stabilization of operating point.

Effect of fixing operating point in cut-off or saturation region on performance of amplifier

6.2. Calculation of operating point for different biasing circuits, use of Thevenin's theorem in analyzing potential divider biasing circuit.

6.3. Simple design problems on potential divider biasing circuits.

7. Single Stage Transistor Amplifier (09Periods)

7.1. Analysis of Single Stage CE, CB and CC amplifier.

7.2. Single stage CE amplifier circuits with proper biasing components.

8. Field Effect Transistor (Fet) (06 Periods)

8.1. Construction, operation, characteristics and Biasing of Junction FET.

8.2. Analysis of Single Stage CS,CG and CD amplifiers. (Only Brief Idea)

9. MOSFET (06 Periods)

9.1 Construction, operation, Characteristics and Biasing of MOSFET in both depletion and enhancement modes.

9.2 Analysis of Single Stage CS, CG and CD amplifiers. (Only Brief Idea)

10. CMOS (06 Periods)

10.1 Construction, operation and Characteristics of CMOS in both depletion and enhancement modes.

10.2 Use of CMOS as Inverter, Different application of CMOS, CMOS IC.

10.3 Comparison of JEET, MOSFET and Bipolar Transistor.

LIST OF PRACTICALS

1. Identification of types of packages, terminals and noting different ratings using data books for various types of semiconductor diodes (Germanium, point contact, silicon low power, high power and switching diode).

2. Familiarization with lab instruments (Multi-meter/CRO), etc.

3. Testing of various passive and active components.

4. Plotting of forward V-I characteristics for a point contact and P-N junction diode (Silicon & Germanium diode).

5. To Plot forward and reverse V-I characteristics for a zener diode.

6. Rectifier circuits using semiconductor diode, measurement of input and output voltage and plotting of input and output wave shapes.

i) Half wave rectifier



- ii) Full wave rectifier (centre tapped and bridge rectifier circuits)
7. To Plot wave shapes of a full wave rectifier with shunt capacitor, series inductor and filter circuit.
  8. To Plot the input and output characteristics and calculation of parameters of a transistor in common base configuration
  9. To Plot input and output characteristics and calculation of parameters of a transistor in common emitter configuration.
  10. Transistor Biasing circuits
    - i) Measurement of operating point ( $I_c$  &  $V_{ce}$ ) for a fixed bias circuit.
    - ii) Potential divider biasing circuits.  
(Measurement can be made by changing the transistor in the circuits by another of a same type number).
  11. Plot the FET characteristics and determination of its parameters from these characteristics.
  12. Measurement of voltage gain at 1 KHZ for different load resistance for a BJT amplifier circuit.
  13. Measurement of voltage gain for a JFET amplifier circuit.
  14. Measurement of voltage gain for a MOSFET amplifier circuit.

#### INSTRUCTIONAL STRATEGY

Electronic Components & Devices being a fundamental subject, it needs to be handled very carefully and in a manner such that students develop clear understanding of the related concepts and principles. The teacher may lay more emphasis on laboratory work and give home assignments to students to inculcate self study and problem solving abilities amongst them.

#### MEANS OF ASSESSMENT

Class Tests

Home Assignments

Attendance

Sessional Test

#### RECOMMENDED BOOKS

Bhargava, Kulshreshtha & Gupta – “Basic Electronics & Linear Circuits” – Tata Mc- graw-Hill.

Malvino, A. P.-“Electronics Principles” –Tata Mcgraw-Hill

Robert.L.Boylestad – “Electronic Devices & Circuits Theory” – Pearson Publication.

V.K.Mehta- “Principles of electronics” – S.Chand Publication.

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

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Period Allotted	Marks Allotted (%)
	6	7
	12	14
	6	7

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	12	14
	12	15
	9	11
	9	11
	6	7
	6	7
	6	7
Total	84	100

## 2.6 GENERAL WORKSHOP PRACTICE –II (For Electronics Engineering)

L T P  
- - 8

### RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are 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.

### LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

### DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: 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 various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

- Carpentry Shop
- Painting and Polishing Shop
- Electroplating Shop
- Computer Shop

## CARPENTRY SHOP

### 1.1 General Shop Talk

- 1.1.1 Name and use of raw materials used in carpentry shop : wood & alternative materials
- 1.1.2 Names, uses, care and maintenance of hand tools such as different types of Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools , measuring tools etc.
- 1.1.3 Specification of tools used in carpentry shop.
- 1.1.4 Different types of Timbers, their properties, uses & defects.
- 1.1.5 Seasoning of wood.

### 1.2. Practice

- 1.2.1 Practices for Basic Carpentry Work
- 1.2.2 Sawing practice using different types of saws
- 1.2.3 Assembling jack plane — Planning practice including sharpening of jack plane cutter
- 1.2.4 Chiselling practice using different types of chisels including sharpening of chisel
- 1.2.5 Making of different types of wooden pin and fixing methods. Marking measuring and inspection of jobs.

### 1.3 Job Practice

- Job 1 Marking, sawing, planning and chiselling and their practice
- Job II Half Lap Joint (cross, L or T – any one)
- Job III Mortise and Tenon joint (T-Joint)
- Job IV Dove tail Joint (Lap or Bridle Joint)

- 1.4. Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

## PAINTING AND POLISHING SHOP

- 2.1. Introduction of paints, varnishes, Reason for surface preparation, Advantages of Painting, other method of surface coating ie. Electroplating etc.

### 2.2. Job Practice

Job 1: To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.

Job II: To prepare metal surface for painting, apply primer and paint the same.

Job III: To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.

The sequence of polishing will be as follows:

Abrasive cutting by leather wheel

Polishing with hard cotton wheel and with polishing material

Buffing with cotton wheel or buff wheel.

### 3. ELECTROPLATING SHOP

3.1. Use of personal protective equipments and safety precautions while working.

3.2. Introduction and demonstration of machines and equipment used in electroplating shop

3.3 Practice Job

Job I : Electroplating practice i.e. Nickel plating

### 4. COMPUTER SHOP

Keyboard

Types of Keyboards

Interfacing (PS2, USB port, DIN connector)

Working

Mouse

Types of Mouse

Interfacing (serial, PS2, USB)

4.2.3 Working

Printers

Types (Dot matrix, Inkjet, Laserjet)

4.3.2. Interfacing (parallel port, USB port, Networking)

4.3.3. Working

4.3.4. Maintenance (cartridge change etc)

Installation of printers

4.3.6 Troubleshooting (Driver compatibility, Paper jam, printing problems due to uncleaned drum in laserjet printers, belt related problems in inkjet printer, jets choking problem in inkjet printer, color alignment problem).

4.3.7 Tracing network printer and sharing it.

Scanner

Types

Interfacing

4.4.3 Scanning a document

Monitor

Types and Interfacing

4.5.2 Fault finding and repairing

## CPU

4.6.1. Motherboard connection (dimensions, processor, chipset, BIOS, EFI (Extended Firmware Interfacing), UFI (Unified Firmware Interfacing)).

### 4.6.2 SMPS-AT

Working

Voltage levels

## MEANS OF ASSESSMENT

Workshop jobs

Report writing, presentation and viva voce

## RECOMMENDED BOOKS

Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.

Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.

Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.

Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi

Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi

Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi

Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

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

### 3.1 APPLIED MATHEMATICS –III

L T P  
5 - -  
RATIONALE

Contents of this course provide understanding of some elementary and advanced mathematics algorithms and their applications of solving engineering problems. Content of this course will enable students to use some advanced techniques like Beta-Gamma function, Fourier series, Laplace transform and probability distributions in solving complex engineering problems.

#### LEARNING OUTCOMES

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

- Understand matrix operations and uses of matrix in different problems.
- Apply elementary row and column operations in finding inverse of a matrix.
- Find Eigen values, Eigen vectors of a matrix and their different properties.
- Understand degree/order of differential equations and their solution techniques.

Use differential equations in engineering problems of different areas.  
 Find Fourier series expansion of a function  
 Apply Laplace transform and their applications in solving engineering problems.  
 Understand concept of probability distribution and their applications.

## DETAILED CONTENTS

### 1. Matrices (16 Periods)

#### 1.1 Algebra of Matrices, Inverse

Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skewhermitian, Orthogonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix.

Definition and Computation of inverse of a matrix.

#### 1.2 Elementary Row/Column Transformation

Meaning and use in computing inverse and rank of a matrix.

#### 1.3 Linear Dependence, Rank of a Matrix

Linear dependence/independence of vectors, Definition and computation of rank of matrix.

Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations.

#### 1.4 Eigen Pairs, Cayley-Hamilton Theorem

Definition and evaluation of eigen values and eigen vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, use in finding inverse and powers of a matrix.

### 2. Differential Calculus (15 Periods)

#### 2.1 Function of two variables, identification of surfaces in space, conicoids

#### 2.2 Partial Differentiation

Directional derivative, Gradient, Use of gradient  $\nabla f$ , Partial derivatives, Chainrule, Higherorder derivatives, Euler's theorem for homogeneous functions, Jacobians.

#### 2.3 Vector Calculus

Vector function, Introduction to double and triple integral, differentiation and integration of vector functions, gradient, divergence and curl, differential derivatives.

### 3. Differential Equation (15 Periods)

#### 3.1 Formation, Order, Degree, Types, Solution

Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree of a differential equation, Linear, nonlinear equation.

#### 3.2 First Order Equations

Variable separable, equations reducible to separable forms, Homogeneous equations, equations reducible to homogeneous forms, Linear and Bernoulli form exact equation and their solutions.



### 3.3 Higher Order Linear Equation:

Property of solution, Linear differential equation with constant coefficients

(PI for  $X = e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ ,  $X^n$ ,  $e^{ax}V$ ,  $XV$ )

### 3.4 Simple Applications

LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

## 4. Integral Calculus-II (12 Periods)

### 4.1 Beta and Gamma Functions

Definition, Use, Relation between the two, their use in evaluating integrals.

### 4.2 Fourier Series

Fourier series of  $f(x)$ ,  $-n < x < n$ , Odd and even function, Half range series.

### 4.3 Laplace Transform

Definition, Basic theorem and properties, Unit step and Periodic functions, inverse laplace transform, Solution of ordinary differential equations

## 5. Probability and Statistics (12 Periods)

### 5.1 Probability

Introduction, Addition and Multiplication theorem and simple problem.

### 5.2 Distribution

Discrete and continuous distribution, Binomial Distribution, Poisson distribution, Normal Distribution.

## INSTRUCTIONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples. The basic elements of Laplace transform, Differential equations and Applications of differential equations can be taught with engineering applications of relevant branch.

## MEANS OF ASSESSMENT

Assignments and Quiz/Class Tests

Mid-term and End-term Written Tests

Model/Prototype Making

## RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3. Applied Mathematics-III by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-II by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut.

5. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

#### SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	16	24
2.	15	20
3.	15	20
4	12	18
5	12	18
Total	70	100

## 3.2 ELECTRICAL ENGINEERING-II

L T P  
4 - 4

### RATIONALE

Electricity is said to be the life of industries. We cannot think of an industry without using electricity. The electrical appliances commonly used for industrial application are Transformers, D.C. and A.C. motors and generators. Therefore basic knowledge of these appliances should be known to the student to facilitate him in routine working.

### LEARNING OUTCOMES

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

- understand the concept of AC theory and phasor diagram
- understand one elementary idea of 3-phase supply
- demonstrate the operation of Transformers
- acquire the knowledge of DC machines and starters for DC machine.
- understand the working principle of alternators and synchronous motors.
- understand the working principle of single phase induction motor.

### DETAILED CONTENTS

#### A.C.Theory

(10 Periods)

- 1.1 Representation of sinusoidal quantities by phasors.
- 1.2 Physical explanation of the phase relationship between voltage and current when sinusoidal alternating voltage is applied across:-
  - (a) Pure resistance,
  - (b) Pure inductance and
  - (c) Pure capacitance.
- 1.3 Explanation of inductive reactance, capacitive reactance and their significance.
- 1.4 Relationship between voltage and current when alternating voltage is applied to
  - (a) Resistance and inductance in series,
  - (b) Resistance and capacitance in series.
- 1.5 Power in pure resistance, inductance and capacitance; power in combination of R-L-C circuits; power factor.
- 1.6 Active and reactive currents and their significance; practical importance of power factor.
- 1.7 Series and parallel resonance in R-L-C circuits, Q-factor of coils and capacitance.

#### 2. Three Phase Supply

(10 Periods)

- 2.1 Elementary idea about 3-phase supply.
- 2.2 Star and delta connection. Relationship between phase and line voltage and currents.
- 2.3 Power and power factor in three phase system and their measurement.
- 2.4 Comparison between three phase and single phase supply.

3. Transformers (10 Periods)

- 3.1 Principle of operation.
- 3.2 E.M.F equation, Voltage & Current relations.
- 3.3 Construction and applications of small transformers used in electronics and communication engg., construction of auto transformers, constant voltage transformer.
- 3.4 Phasor diagram of a transformer on load; Definition of regulation and efficiency; Elementary idea of losses in transformer, open circuit and short circuit test.

4. D.C. Machines (10 Periods)

D. C. Generator:

Working principle, constructional details, e.m.f equation, types of generators and their applications.

D. C. Motor:

Working principle, back e.m.f., types of D. C. motor and elementary idea of their characteristics, torque equation, methods of speed control (Description only).

4.3 Starters for D.C. Machines

5. Induction Motors (06 Periods)

5.1 Single Phase Induction Motor

Principle of operation and constructional details of single phase FHP induction motors (Split phase, capacitor start capacitor run, shaded pole, reluctance start, A.C. series, universal, hysteresis, servo and stepper motors their applications).

5.2 Starters for Induction motors

6. Synchronous Machines (10 Periods)

Alternators

Working principle, types of alternators, (brief description)

6.2 Synchronous Motors:

Working principle, construction details, vector diagram, effect of excitation on armature current and power factor, synchronous condenser.

Application of synchronous machines.

LIST OF EXPERIMENTS

1. To verify that in an A.C. circuit, the phasor sum ( not the algebraic sum ) of currents at any junction is zero.
2. To find the voltage-current relationship in a R-L series circuit and to measure power and power factor of the circuit.
3. To measure power and power factor in three phase system by two wattmeter method.
4. To determine the efficiency and regulation of a transformer by performing direct loading.
5. To measure the induced emf of separately excited D.C. generator as a function of field current.
6. To measure the terminal voltage of a D.C. shunt generator as a function of load current.
7. To measure the speed of a separately excited D.C. motor as a function of load torque at rated armature voltage.
8. To observe the difference in the starting current at switching on single phase capacitor start induction motor with :-
  - (a) The capacitor disconnected and
  - (b) The capacitor connected.
 Also to determine how to reverse the direction of rotation.
9. To determine V curves of a synchronous motor.

#### INSTRUCTIONAL STRATEGY

The teacher should lay stress on the concept of single phase and three phase supplies. The students must be aware of transformers and DC machines, induction motor and its starters must be learned in depth by students.

#### MEANS OF ASSESSMENT

Class test/quizzes  
 Home assignments  
 Attendance  
 Sessional Test  
 Practical Tasks

## RECOMMENDED BOOKS

A Text book of Electrical Technology by B.L. Thereja, A.K Theraja by S. Chand Publication.  
 Basic Electrical Engineering by V.K Mehta, Rohit Mehta, S. Chand Publication.  
 Electrical Engineering by J. B. Gupta; S.K Kataria& Sons Publication.  
 E-books/e-tools to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	17
2.	10	17
3.	10	17
4.	10	17
5.	06	15
6.	10	17
<b>Total</b>	<b>56</b>	<b>100</b>

## 3.3 ENVIRONMENTAL STUDIES

L T P  
3 - 2

## RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

## LEARNING OUTCOMES

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

Comprehend the importance of ecosystem and sustainable

Demonstrate interdisciplinary nature of environmental issues

Identify different types of environmental pollution and control measures.

Take corrective measures for the abatement of pollution.

Explain environmental legislation acts.

Define energy management, energy conservation and energy efficiency

Demonstrate positive attitude towards judicious use of energy and environmental protection

Practice energy efficient techniques in day-to-day life and industrial processes.

Adopt cleaner productive technologies

Identify the role of non-conventional energy resources in environmental protection.

Analyze the impact of human activities on the environment

## DETAILED CONTENTS

Introduction

(04 Periods)

Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.

2. Air Pollution

(04 Periods)

Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

3. Water Pollution

(08 Periods)

Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O<sub>2</sub>, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

4. Soil Pollution

(06 Periods)

Sources of soil pollution

Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste

Effect of Solid waste

Disposal of Solid Waste- Solid Waste Management

5. Noise pollution

(06 Periods)

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Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

6. Environmental Legislation (08 Periods)  
Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment (06 Periods)  
Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings.

#### LIST OF PRACTICALS

Determination of pH of drinking water  
Determination of TDS in drinking water  
Determination of TSS in drinking water  
Determination of hardness in drinking water  
Determination of oil & grease in drinking water  
Determination of alkalinity in drinking water  
Determination of acidity in drinking water  
Determination of organic/inorganic solid in drinking water  
Determination of pH of soil  
Determination of N&P (Nitrogen & Phosphorus) of soil  
To measure the noise level in classroom and industry.  
To segregate the various types of solid waste in a locality.  
To study the waste management plan of different solid waste  
To study the effect of melting of floating ice in water due to global warming

#### INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests,  
Mid-term and end-term written tests

#### RECOMMENDED BOOKS

Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.  
Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.  
Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi  
Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.  
Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.  
Environmental Studies by ErachBharucha; University Press (India) Private Ltd., Hyderabad.



Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons, New Delhi.

E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	10
2	04	10
3	08	20
4	06	14
5	06	14
6	08	20
7	06	12
Total	42	100

### 3.4 ELECTRONIC DEVICES AND CIRCUITS

L T P

6 - 6

#### RATIONALE

Having attained basic knowledge of electronic devices like diodes, transistors, and elementary circuits, in second semester, 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 in 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.

#### LEARNING OUTCOMES

After undergoing the subject, the students will be able to:  
 demonstrate the concept of single stage amplifiers and multistage amplifier.  
 describe the operation of large signal amplifiers.  
 demonstrate the concept of negative and positive feedback.  
 understand the operation of oscillators (Hartley, Colpitt, Wein Bridge etc)  
 describe the various types of tuned voltage amplifiers  
 design various wave-shaping circuits  
 describe the concept of multi-vibrators and operational amplifiers  
 understand the concept of regulated DC supplies.

#### DETAILED CONTENTS

#### 1. Single and Multistage Amplifiers (10 Periods)

Introduction to h-parameter in two port network  
 Transistor hybrid low frequency model in CE configuration and its characteristics  
 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

2. Large Signal Amplifier (10 Periods)

Difference between voltage and power amplifiers  
 Importance of impedance matching in amplifiers  
 Class A, Class B, Class AB, and Class C amplifiers,  
 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

3. Feedback Amplifiers (09 Periods)

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

4. Sinusoidal Oscillators (09 Periods)

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)

Tuned Voltage Amplifiers (09 Periods)

Series and parallel resonant circuits and bandwidth of resonant circuits.  
 Single and double tuned voltage amplifiers and their frequency response characteristics

Clipper and Clamper Circuit (08 Periods)

Introduction to Clipper  
 Series and shunt Clipper, positive and negative peak Clipper, Bias Clipper using diode  
 Clipper using Zener diode  
 Introduction to Clamper  
 Clamper Circuit analysis

7. Operational Amplifiers (10 Periods)

Characteristics of an ideal operational amplifier and its block diagram  
 IC-741 and its pin configuration, equivalent circuit of OPAMP.  
 Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current, offset voltage, Bias current

Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator, log amplifiers, anti-log amplifier, comparator, Schmitt triggers, sample and hold circuit.

Multivibrator Circuits and IC Timer

(09 Periods)

Working principle of transistor as switch

Concept of multi-vibrator: astable, monostable, and bistable and their applications

Basic idea of ICs, fabrication of IC

Block diagram of IC555 and its working and applications

Monostable, Bistable and Astablemultivibrator by using IC-555

Regulated Power Supplies

Basic regulated circuit by using Zener diode

Concept of DC power supply. Line and load regulation

Concept of fixed voltage, IC regulators (like 78XX, 79XX) and variable voltage regulator like (IC 723)

LIST OF PRACTICALS

Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier

To measure the gain of push-pull amplifier at 1KHz

To measure the voltage gain of emitter follower circuit and plot its frequency response

Plot the frequency response curve of Hartley and Colpitt's Oscillator

Plot the frequency response curve of phase shift and Wein bridge Oscillator

Use of IC 555 as monostable multivibrator and observe the output for different values of RC

Use of IC 555 as astablemultivibrator and observe the output at different duty cycles

To use IC 741 (op-amplifier) as

Inverter, ii) Adder, iii) Subtractor iv) Integrator

To realize positive and negative fixed voltage DC power supply using three terminal voltage regulator IC (7805, 7812, 7905)

Observation of output waveform of different type of Clipper and Clamper Circuit

Class Project: Fabricate any simple operational amplifier circuit (Inverter, Adder, Subtractor etc.) and test it.

INSTRUCTIONAL STRATEGY

This subject being of fundamental importance for diploma holders in electronics engineering and related fields, emphasis on conceptual understanding may be given by taking the help of charts. Sufficient exercises may given to the students in single stage and multi-stage amplifier circuits in addition to simple exercises in fabricating and testing of various simple d.c circuits. The students may be encouraged to perform some additional practical exercises apart from the list provided.

MEANS OF ASSESSMENT

Class Test  
 Home Assignment  
 Attendance  
 Quiz  
 Sessional Test  
 Practical Tasks

#### RECOMMENDED BOOKS

Basic Electronics and Linear Circuits by NN Bhargava; Tata McGraw Hill, New Delhi

Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad

Malvino A. P- Electronics principles "Tata McGraw- Hill"

Electronics Devices and Circuits by Robert L. Boylestad and Louis Nasherslay- Pearson Publication

E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1.	10	12
2.	10	12
3.	09	11
4.	09	11
5.	09	11
6.	08	08
7.	09	11
8.	10	12
9.	10	12
Total	84	100

### 3.5 ELECTRONICS WORKSHOP

L T P  
 - 6

#### PART-A ELECTRICAL WORKSHOP

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### LEARNING OUTCOMES:-

After completing this course the learner will be able to:

Plan and Wire a small domestic building for a given load requirement.  
Specify the wiring plans of semi-industrial installations with three phase supply and a maximum of 5 KVA load.

#### Exercises to be Performed

- Identification and study of commonly used electrical materials such as wires, cables, switches, fuses, coiling, roses, battens, cleats and allied items.
2. Identification and study of various tools used in Electrical Workshop and safety measures.
  3. Making connection of single lamp and three pin plug socket to supply using batten wiring.
  4. Making Electrical connection for staircase wiring.
  5. Making of extension board with proper supply.

### PART-B ELECTRONICS WORKSHOP

#### LEARNING OUTCOMES: -

After completion of instruction in this subject the student will: -

Develop skill in selection and use of commonly used tools, equipment, components in a given situation.

Develop skill in wiring, soldering and desoldering works.

Develop skill in tracing circuits of simple (analogue and digital) electronic assembly.

#### Exercise to be Performed

Name and function of different tools and accessories including Tapes, Solders, Solder tips, Fluxes; De-soldering wick, Solder cleaning fluids, Sleeves, Tags.

Demonstrate the correct use of accessories mentioned in (1) above.

Given different type of power supply mention in (c), the student should be able to find out the operating range and regulate the power supplies Equipment Type.

Test waveform Generator :- Audio oscillator, Function, Generator, Signal Generator, Spectrum Analyzer.

Measurement Equipment ; Single beam CRO, Double beam/Dual trace CRO, electronic and Digital multimeters, Transistor tester/ Curve tracer, IC tester etc.

Power Supply - UPS, Inverter, different types of DC/AC power supplies

Various types of Single/Multicoiled, Insulated screened, Power type/ Audio/ Video/ General purpose wires and cables

Exercises to be performed

Study and testing of different types of Resistor, Capacitor, Inductor, Diode, Transistor (BJT, FET, MOS, CMOS) and ICs (All Popular families).

Study of different processes by performing in assembling- Soldering, desoldering, Cutting, Stripping and connecting.

Making of different types of mini electronic projects

#### PART-C PREPARATION OF PRINTED CIRCUIT BOARDS

##### LEARNING OUTCOMES:-

After completion of this Course, the learners will be able to prepare printed Circuit boards.

Exercise to be performed:-

Study of different types of PCB circuit in order to:

Acquire skill in silk screen printing techniques for the purpose of making the printed circuits boards.

Exposure to Non dry-method of PCB making using photoprocessing techniques.

Prepare, check, drill and store PCBs.

## 3.6 TRANSDUCER &amp; APPLICATION

L	T	P
4	-	4

## RATIONALE

The course is intended to develop the basic understanding as well as the competency to use, installed and test various transducers and sensors used for measuring non-electrical quantities like displacement, temperature, pressure, flow, level, pH, conductivity, density, velocity, viscosity and such others. The student is required to be familiar with the construction working principle and mounting procedure of different types of transducers including smart sensors. Transducers are used in almost every industry and also in everyday life.

## LEARNING OUTCOMES

After completion of the course, the students should be able to:

Identify different types of sensors and transducers and their applications in the field of instrumentation and control.

The students will be able to select appropriate transducers relating to a process and will also get the relevant technical know how about the conditioning of a signal from a transducer for the purpose of control.

Use of specific transducer and signal conditioning equipment in specifications.

Idea of different sensors and transducers for given application

Understand Variable resistance, variable inductance type and capacitive type transducer.

Understand the conductivity analyser and vibration & noise measurement.

Outline various application of PH analyser.

Differentiate between different types of smart sensors.

Identify various optical transducer

## DETAILED CONTENTS

## 1 INTRODUCTION:

## 1.1 Definition of transducer

## 1.2 Classification of Transducers:

Primary and secondary, mechanical devices as primary detectors.

Electrical transducer: Advantages, classification of electrical transducer, active and passive, analog and digital, Electrical phenomena used in transducers.

## 2 VARIABLE RESISTANCE TRANSDUCERS:

## 2.1 Principle of variable resistance transducers.

2.2 Potentiometers – Principle of working, construction, Linearity and sensitivity, Types, advantages and Disadvantage of potentiometers, its applications.

2.3 Strain Gauges – Theory of strain gauges, gauge factor, Types of strain gauges, Material for strain gauges. Temperature compensation in strain gauge, bad cell applications.

2.4 Thermistors – Construction, characteristics and Applications of thermistors.

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- 2.5 Hot wire anemometer
- 2.6 Carbon microphones
- 2.7 Application of different types of Variable Resistance Transducer in Industries.
- 3 VARIABLE INDUCTANCE TYPE TRANSDUCERS:
- 3.1 Principle of variable inductive transducers by variation of self inductance, mutual Inductance and eddy current. Different types of transducers, working on above principle.
- 3.2 L. V. D.T.: Construction, theory, linearly and sensitivity advantage, disadvantage and uses.
- 3.3 Electromagnetic pickup
- 3.4 Rotary Variable Differential Transformer (RVDT)
- 4 CAPACITIVE TRANSDUCERS:  
Principle of capacitive transducers, Concept of Capacitive transducers using change in distance between plates, area & dielectric constant. Differential arrangement for improving sensitivity, application of capacitive transducers, Level measurement with calibration using suitable formula, Condenser Microphone, Implementation of different types of Variable Capacitive Transducer in Industries.
- 5 OPTICAL TRANSDUCERS:  
Theory of photo emission, classification, of photo electric devices, vacuum photo tube, Gas photo tube, Photo multiplier tube, photo conductive cell, photo diode, photo transistor, Opto-coupler and their applications, Optical Fibre sensors.
- 6 PIEZO ELECTRIC TRANSDUCERS:  
Theory of piezoelectric effect, mode of operation and properties of piezoelectric crystal, equivalent circuit of piezoelectric transducers and applications of piezo electric transducer, Seismic Pick-up, Ultrasonic Transducer.
- 7 VISCOSITY MEASUREMENT:  
Definition of viscosity, measurement of viscosity by capillary type and rotational type cone and plate viscometer, two float viscometer, Rheometers and applications.
- 8 CHEMICAL SENSORS:  
Standards, working principle, types, materials, and design criterion: Chemical sensors-(pH sensor and conductivity sensor)- pH Sensor: Definition and need of pH measurement, buffer solution, reference and standard electrodes for pH measurement. Hydrogen calomel and Glass electrode PH-meter-direct reading type and indirect reading type, Uses of PH analyzer in Industries.  
Conductivity sensor: Definition of conductivity, conductance, Specific-conductance and equivalent conductance-Alternating current conduction, need of conductivity measurements.
- 9 VIBRATION AND NOISE MEASUREMENT  
Measurement of vibration – using seismic accelerometer, potentiometric type and LVDT

type, Piezo electric type accelerometer.

#### 10 SMART SENSORS & ITS APPLICATIONS

Introduction, Definition, Block Diagram of Smart Sensors, Difference between non smart Sensors & Smart Sensors, Smart Transducers, Introduction to Internet of Things (IoT) Sensors and actuators.

#### LIST OF PRACTICALS (TRANSDUCERS AND APPLICATION LAB)

To draw the input output characteristics of linear variable differential transducers and also study its details.

To fabricate a circuit using linear variable differential transducer for the measurement of non electrical quantity.

To draw I/O characteristics of the following phototransducers.

LDR

Photodiode

Photo Transistor

Optocoupler

Fabricate an application circuit using phototransducers as a switch and as a light intensity meter.

To fabricate an application circuit using given temperature transducer like thermistors and I. C. Sensors.

To fabricate an application circuit using capacitive transducers for measurement of level.

To draw I/O characteristic's of a strain gauge and study working of weighing Machine using strain gauge/ loadcell.

To measure conductivity of a given solution using conductivity meter and calibrate it.

To measure pH of given acidic and alkaline solutions using a pH meter and standardize it, using buffer solutions.

To measure density of given solution using simple hydrometer.

To measure vibration of motor or compressor system using a vibration meter and piezo-electric sensors.

To perform noise measurement using condenser microphone.

NOTE :- Experiments associated with study of equipment in the above should invariably be carried out and should not be restricted to the "Study: part only."

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

## RECOMMENDED BOOKS

- 1 Electrical and Electronics Measurement and Instrumentation by A.K. Shawney, Dhanpat Rai and Co., New Delhi
  - 2 Kalsi, H. S. Electronic Instrumentation Tata McGraw Hill, 3rd or later Edition
  - 3 Transducers by Peter Norton
  - 4 Industrial Instrumentation & control by S.K. Singh
- List of Software/Learning Websites
- <https://en.wikipedia.org/wiki/Transducer>
- <http://www.instrumentationtoday.com/>
- <https://internetofthingsagenda.techtarget.com/definition/smart-sensor>

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	2	5
2.	8	15
3.	6	10
4.	6	10
5.	6	10
6.	4	7.5
7.	4	7.5
8.	8	15
9.	6	10
10.	6	10
Total	56	100

### 3.7 Universal Human Values

L-T-P  
2-0-1

#### Course Objectives

This introductory course input is intended

To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings

To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way

To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

#### Course Methodology

The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.

It is free from any dogma or value prescriptions.

It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.

This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.

This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

The syllabus for the lectures is given below:

After every two lectures of one hour each, there is one hour practice session.

The assessment for this subject is as follows:

Sessions Marks (Internal): 20

Practical Marks (External): 30

Total Marks: 50

#### UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education

Self-Exploration—what is it? - its content and process; 'Natural Acceptance' and

Experiential Validation- as the mechanism for self-exploration

Continuous Happiness and Prosperity- A look at basic Human Aspirations

Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario  
Method to fulfill the above human aspirations: understanding and living in harmony at various levels

#### UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material the Body'

Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*

Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

Understanding the characteristics and activities of 'I' and harmony in 'I'

Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail

Programs to ensure *Sanyam* and *Swasthya*

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

#### UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

*Understanding Harmony in the family – the basic unit of human interaction*

Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;

Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship

Understanding the meaning of *Vishwas*; Difference between intention and competence

Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals

Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*),

Universal Order (*SarvabhaumVyawastha* )- from family to world family!

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

#### UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

Understanding the harmony in the Nature

Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature

Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space

Holistic perception of harmony at all levels of existence

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

#### UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values

Definitiveness of Ethical Human Conduct

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order  
Competence in professional ethics:

Ability to utilize the professional competence for augmenting universal human order  
Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,

Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems

Strategy for transition from the present state to Universal Human Order:

At the level of individual: as socially and ecologically responsible engineers, technologists and managers

At the level of society: as mutually enriching institutions and organizations

To inculcate Human Values among Students: The Role of self ,Parents and Teachers

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

Practical Session also Includes Different Yogic Exercises and Meditation Session

#### INSTRUCTIONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples.

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests,

Mid-term and end-term written tests

Practical assessment

Reference Material

The primary resource material for teaching this course consists of

a. The text book (Latest Edition)

Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.

The teacher's manual (Latest Edition)

Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.

PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.

Sussan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991

Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA

Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *limits to Growth*, Club of Rome's Report, Universe Books.

Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.

A Nagraj, 1998, *Jeevan Vidya ekParichay*, Divya Path Sansthan, Amarkantak.  
 E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.  
 A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

Relevant websites, movies and documentaries

Value Education websites, <http://uhv.ac.in>, <http://www.aktu.ac.in>

Story of Stuff, <http://www.storyofstuff.com>

Al Gore, *An Inconvenient Truth*, Paramount Classics, USA

Charlie Chaplin, *Modern Times*, United Artists, USA

IIT Delhi, *Modern Technology—the Untold Story*

Case study Hevade Bazar Movie

RC Shekhar, *Ethical Contradiction*, Trident New Delhi

*Gandhi A., Right Here Right Now*, Cyclewala Production

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	08	20
3	08	20
4	08	20
5	10	20
Total	42	100

## COMMUNICATION SKILLS – II

L T P  
4 - 2  
RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

### LEARNING OUTCOMES

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

Frame correct sentences with illustrations

Comprehend the language correctly

Interpret the language correctly

Use given material in new situations.

Correspond effectively using various types of writings like letters, memos etc.

Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organised set up and social context.

## DETAILED CONTENTS

1. Functional Grammar (16 periods)
  - 1.1 Prepositions
  - 1.2 Framing Questions
  - 1.3 Conjunctions
  - 1.4 Tenses
  
- 2 Reading (16 periods)
  - 2.1 Unseen Passage for Comprehension (Vocabulary enhancement - Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the passage should be covered under this topic.
  
- 3 Writing Skill (24 periods)
  - 3.1 Correspondence
    - a) Business Letters- Floating Quotations, Placing Orders, Complaint Letters.
    - b) Official Letters- Letters to Government and other Offices
  - 3.2 Memos, Circular, Office Orders
  - 3.3 Agenda & Minutes of Meeting
  - 3.4 Report Writing

## LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

## Speaking and Listening Skills

## Debate

Telephonic Conversation: general etiquette for making and receiving calls

Offering- Responding to offers.

Requesting – Responding to requests

Congratulating

Exploring sympathy and condolences

Asking Questions- Polite Responses

Apologizing, forgiving

Complaining

Warning

Asking and giving information

Getting and giving permission

Asking for and giving opinions

## INSTRUCTIONAL STRATEGY

Students should be encouraged to participate in role play and other student-centered activities in class rooms and actively participate in listening exercises

## MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-semester and end-semester written tests

Actual practical work, exercises and viva-voce

Presentation and viva-voce

## RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

[http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html) – 99k

<http://www.letstalk.com.in>

<http://www.englishlearning.com>

<http://learnenglish.britishcouncil.org/en/>

<http://swayam.gov.in>

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	16	28
2	16	28
3	24	44
Total	56	100

## 4.2 PRINCIPLES OF DIGITAL ELECTRONICS (Only for Instrumentation and control engineering)

L T P  
4 - 4

### 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 background in the broad field of digital systems design and microprocessors.

### LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- explain the importance of digitization.
- verify and interpret truth tables for all logic gates.
- realize all logic functions with NAND and NOR gates
- design and demonstrate adder and subtractor circuits
- verify and interpret truth tables of multiplexer, demultiplexer, encoder and decoder ICs
- design and realize different sequential circuit(Flip flops, counters and shift registers)
- verify performance of different A/D and D/A converters.
- explain the features and applications of different memories

### DETAILED CONTENTS

#### 1.Introduction (03 Periods)

Distinction between analog and digital signal.  
Applications and advantages of digital signals.

#### 2.Number System (03 Periods)

Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa.

Binary addition and subtraction including binary points. 1's and 2's complement method of addition/subtraction.

#### 3.Codes and Parity (04 Periods)

Concept of code, weighted and non-weighted codes, examples of 8421, BCD, excess-3 and Gray code.

Concept of parity, single and double parity and error detection

#### 4.Logic Gates and Families (06 Periods)

Concept of negative and positive logic

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

SSI, MSI, LSI, VLSI (Definition)

Propagation delay, Noise Margin, Fan in, Fan out, Power dissipation.

Comparison between TTL, CMOS, ECL, MOS on basis of diff parameter.

Introduction to Bipolar logic, MOS, ECL, TTL and CMOS logic families

Basic logic gate using NMOS, PMOS, CMOS

5.Logic Simplification (06 Periods)

Postulates of Boolean algebra, De Morgan's Theorems. Implementation of Boolean (logic) equation with gates

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

6.Arithmetic circuits (03 Periods)

Half adder and Full adder circuit, design and implementation.

Half subtractor and Full subtractor or Circuit, design and implementation.

7. Combinational Circuit (06 Periods)

Introduction to combinational circuit

Multiplexer, De-multiplexer, Encoder, Decoder block diagram and Circuit.

7 segment decoder

BCD Encoder Circuit

8. Introduction to Sequential circuit (06 Periods)

Introduction to Sequential

Copmparison between combinational and sequential circuit

Concept and types of latch with their working and applications

Operation using waveforms and truth tables of RS, T, D, Master/Slave JK flip flops.

Difference between a latch and a flip flop

9. Counters (06 Periods)

Introduction to Asynchronous and Synchronous counters

Binary counters

Divide by N ripple counters, Decade counter, Ring counter and twisted Ring counter.

10. Shift Register (05 Periods)

Introduction and basic concepts including shift left and shift right.

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

Universal shift register

11. A/D and D/A Converters (04 Periods)

Working principle of A/D and D/A converters

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

Simultaneous or flash type A/D converter

Successive Approximation A/D Converter

Single slope A/D converter

Dual Slope A/D converter

Brief idea of :

Binary Weighted D/A converter

R/2R ladder D/A converter

Applications of A/D and D/A converter.

## 12. Semiconductor Memories (04 periods)

Memory organization, classification of semiconductor memories (RAM, ROM, PROM, EPROM, EEPROM), static and dynamic RAM.

### LIST OF PRACTICALS

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. - Design of a half adder using XOR and NAND gates and verification of its operation  
- Construction of a full adder circuit using XOR and NAND gates and verify its operation
4. 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).
5. Verification of truth table for encoder and decoder ICs, Mux and DeMux
6. To design a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation.

To design a 4 bit ring counter and verify its operation.

Use of Asynchronous Counter ICs (7490 or 7493)

Note: Above experiments may preferably be done on Bread Boards.

### INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing), A/D, D/A Converters and other topics. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. Programming exercises other than the tested in circulation may be given to the students.

### MEANS OF ASSESSMENT

Class test/quizzes  
Home assignments  
Attendance  
Sessional Test  
Practical Tasks

### RECOMMENDED BOOKS

Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi

Digital Electronics by RP Jain, Tata McGraw Hill Education Pvt Ltd, New Delhi  
Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi  
Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India,  
New Delhi  
E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR,  
Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1.	03	07
2.	03	07
3.	04	07
4.	06	09
5.	06	11
6.	03	11
7.	06	11
8.	06	05
9	06	11
10.	05	11
11.	04	07
12	04	07
Total	56	100



## NETWORK FILTERS AND TRANSMISSION LINES

L T P  
4 - 4  
RATIONALE

The study of networks, filters and transmission lines leads to understanding of line communication, audio and video communication, and microwave communication. Particularly the study of networks takes off from principles of A.C. theory and introduces the student to parameters and characteristics of various networks, including filters. Also the study of transmission lines becomes important as its analogy is used in study of transmission of plane electromagnetic waves in bounded media.

## LEARNING OUTCOMES

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

describe the concept of symmetrical, asymmetrical, balanced, unbalanced, T, PI, ladder, lattice, L and Bridge T networks

demonstrate the operation of attenuators and filters.

understand the concept and applications of transmission lines.

measure standing wave ratio and characteristic impedance of the line

## DETAILED CONTENTS

Networks (16 Periods)

Two port (four terminals) network: Basic concepts of the following terms:

Symmetrical and asymmetrical networks: Balanced and unbalanced network; T-network,  $\pi$  network, Ladder network; Lattice network; L-network and Bridge T-network

Symmetrical Network:

Concept and significance of the terms characteristic impedance, propagation constant, attenuation constant, phase shift constant and insertion loss.

T-network and  $\pi$  Network (No Derivation)

Asymmetrical Network

Concept and significance of iterative impedance, image impedance,

The half section (L-section); symmetrical T and  $\pi$  sections into half sections (No Derivation)

2. Attenuators (10 Periods)

Units of attenuation (Decibels and Nepers): General characteristics of attenuators

Analysis and design of simple attenuator of following types; Symmetrical T and  $\pi$  type, L type.

Filters

(16 Periods)

Brief idea of the use of filter networks in different communication systems, concept of low pass, high pass, band pass and band stop filters.

Prototype Filter Section:

Impedance characteristics vs frequency characteristics of a low and high pass filter and their significance

Simple design problems of prototype low pass section.

M-Derived Filter Sections

Limitation of prototype filters, need of m-derived filters

Crystal Filters

Crystal and its equivalent circuits, special properties of piezoelectric filters and their use

Active Filters

Basic concept of active filters and their comparison with passive filters.

Transmission Lines (14 Periods)

Transmission Lines, their types and applications.

Distributed constants, T and  $\pi$  representation of transmission line section.

Concept of infinite line

Condition for minimum distortion and minimum attenuation of signal on-the-line and introduction to loading methods.

Concept of reflection and standing waves, definition of reflection coefficient, SWR & VSWR and their relation (no derivation).

Concept of transmission lines at high frequencies.

Introduction to stubs. (single, open and short stubs).

HVDC (High Voltage DC transmission) – Concept and Advantage, Disadvantage and areas of application.

## LIST OF PRACTICALS

- To measure the characteristic impedance of symmetrical T and  $\pi$  networks
- To measure the image impedance of a given asymmetrical T and  $\pi$  networks
- For a prototype low pass filter:

Determine the characteristic impedance experimentally  
Plot the attenuation characteristic

- To design and measure the attenuation of a symmetrical T/  $\pi$  type attenuator
- For a prototype high pass filter:

Determine the characteristic impedance experimentally  
To plot the attenuation characteristic

- a) To plot the Impedance characteristic of a prototype band-pass filter
- b) To plot the attenuation characteristic of a prototype band pass filter

- a) To plot the impedance characteristic of m- derived low pass filter
- b) To plot the attenuation characteristics of m-derived high pass filter

To observe the information of standing waves on a transmission line and measurement of SWR and characteristic impedance of the line

Draw the attenuation characteristics of a crystal filter

## INSTRUCTIONAL STRATEGY

Stress should be laid on problems in networks/ filter and transmission lines. Practical must be carried out after completion of topic to gain a good know how on the subject students should be given home assignments on various topics, stress on making own circuit models to calculate input/output impedance, characteristic impedance, losses etc. should be carried out by the students.

## MEANS OF ASSESSMENT

- Class test/quizzes
- Home assignments
- Attendance
- Sessional Test
- Practical Tasks

**RECOMMENDED BOOKS**

Network Filters and Transmission Lines by AK Chakarvorty; Dhanpat Rai and Co. Publication, New Delhi

Network Analysis by Soni and Gupta; Dhanpat Rai and Co. Publication, New Delhi

Network Filters and Transmission Line by Yash Pal; Ishan Publications, Ambala City

Electrical and Electronics Measuring instrumentation, A.K Sawhney; Dhanpat Rai and Co. Publication, New Delhi

E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS:

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	16	29
2	10	18
3	16	29
4	14	24
Total	56	100

## 4.4 ELECTRONIC INSTRUMENTS AND MEASUREMENT

L T P

4 - 4

## 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, he will acquire the requisite skills.

## LEARNING OUTCOMES

After undergoing the subject, students will be able to:

describe the specifications of measuring instruments.

demonstrate the working principle voltage, current and resistance measurement along with their applications.

understand the working of various parts of CRT.

measure frequency, voltage, time period and phase using CRO and DSO

demonstrate the working of RF signal generator, pulse generator and analysers

understand the working principle of DC/AC bridges and meters.

## DETAILED CONTENTS

## 1. Basics of Measurements (10 Periods)

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

## 2. Voltage, Current and Resistance Measurement (08 Periods)

Principles of measurement of DC voltage, DC current, AC voltage, AC current,

Principles of operation and construction of permanent magnet moving coil (PMMC) instruments and Moving iron type instruments,

## 3. Cathode Ray Oscilloscope (12 Periods)

Construction and working of Cathode Ray Tube(CRT)

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

Specifications of CRO and their explanation

Measurement of current, voltage, frequency, time period and phase using CRO

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

Working principle of spectrum analyser.

#### 4 Impedance Bridge Q Meters (08 periods)

Wheat stone bridge

AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge

Block diagram description of laboratory type RLC bridge, specifications of RLC bridge.

Block diagram and working principle of Q meter.

#### 5 Signal Generators and Analytical Instruments (08 Periods)

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

Distortion factor meter

Instrumentation amplifier: its characteristics, need and working

#### 6. Digital Instruments (10 Periods)

Comparison of analog and digital instruments

Working principle of ramp, dual slope and integration type digital voltmeter

Block diagram and working of a digital multi-meter

Specifications of digital multi-meter and their applications

Limitations of digital multi-meters.

Working principle of logic probe, logic pulser, logic analyzer and signature analyzer.

#### LIST OF PRACTICALS

- 1 Measurement of voltage, resistance, frequency using digital multimeter
- 2 Measurement of voltage, frequency, time period and phase using CRO
- 3 Measurement of voltage, frequency, time and phase using DSO
- 4 Measurement of Q of a coil
- 5 Measurement of resistance and inductance of coil using RLC Bridge
- 6 Measurement of impedance using Maxwell Induction Bridge
- 7 To find the value of unknown resistance using Wheat Stone Bridge
- 8 Measurement of distortion using Distortion Factor Meter

**INSTRUCTIONAL STRATEGY**

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

**MEANS OF ASSESSMENT**

Assignments and quiz/class tests  
 Mid-term and end-term written tests  
 Model/prototype making  
 Actual laboratory and practical work  
 Model/prototype making  
 Assembly and disassembly exercises  
 Viva-Voce

**RECOMMENDED BOOKS**

Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi

Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi

Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi

E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

**SUGGESTED DISTRIBUTION OF MARKS**

Topic No	Time Allotted (Periods)	Marks Allocation (%)
1.	10	18
2.	08	14
3.	12	22
4.	08	14
5.	08	14
6.	10	18
Total	56	100

## 4.5 PROCESS INSTRUMENTATION

L T P  
5 - 4  
RATIONALE

Precision measurement of process parameters such as pressure, level density, speed, temperature, flow, moisture etc. is very essential for successful running of a process industry. Various telemetric and manual control circuits are to be handled by technicians employed in these industries. Therefore to equip the diploma student in instrumentation and control engineering with the knowledge and skill of principles and circuitry for measurement of these parameters will be useful in world of work.

### LEARNING OUTCOMES

After completion of the course, the students should be able to:

Enabling the students to acquire knowledge about various Pressure measuring instrument Systems.

Understanding the concept and working of Level Measurement in instrumentation and control.

Students will be able to know about measurement technique of Speed and Temperature.

Enable the student to get familiarized with working of flow measurement systems.

Describe the basics of Moisture and Density Measurement Systems.

Understand the working and installation of Instrumentation system.

### DETAILED CONTENTS

#### 1. INTRODUCTION:

Introduction of a process and process variable, listing of different process variable and their definitions, Introduction and definition of the term process instrumentation as applicable to the field of engineering.

Importance of process instrumentation for process industry with example of any typical processes

Block diagram of a general instrumentation system, Elements of an instrument.

Symbol used in instrumentation system and process flow diagram

#### 2. PRESSURE INSTRUMENTATION:

2.1 Definition.

2.2 Units in SI & CGS system -Bar, Pascal, MPa, N/M<sup>2</sup>, PSI and conversion of one unit into other and conversion of one unit into another.

Pressure Elements- Diaphragm, Force Balance, Bellows, Bourden Tube, Pressure Gauges, Differential Pressure Gauges.

Types of pressure, atmospheric pressure, absolute pressure, gauge pressure, vacuum pressure, Importance of Pressure measurement, Pressure

Transmitters/Differential Pressure Transmitters (4-20 mA output). Advantages of 4-20 mA systems to be explained.



Differential pressure gauge, Uses of manometers for differential pressure measurement.

Measurement of pressure of corrosive fluids-diaphragm seal, liquid seal, Table listing corrosion resistance of Mild Steel, Stainless Steel, Monel and Hastalloyetc, to around four important corrosive fluids used in industry .

Measurement of static and dynamic pressure.

Pressure switch and regulators.

Electrical Methods :

(a) Resistive Methods - Strain Gauge, Potentiometer

(b) Capacitive Methods - Absolute capacitive & differential capacitive method.

Calibration of Pressure Gauge/Pressure Transducers/Pressure transmitters/Different Pressure Transmitters with Dead weight pressure gauge tester, Digital pressure indicator (Differential pressure and vaccum)

### 3 LEVEL INSTRUMENTATION:

3.1 Introduction, head, density and specific gravity their relationship, method of measurement

(a) Slight glass method.

(b) Bob tape method.

(c) Float method, Material for float, Float and shaft method.

(d) Magnetic float.

(e) Displacer method.

3.2 Indirect Method:

(a) By pressure gauge.

(b)Diaphragm box method.

(c) Air trap method.

(d) Air pressure balance method or bubbler method.

(e) Pneumatic force balance method.

(f) Level measurement in a pressuried vessel using differential gauges and differential Pressuregauges.

(g) Level measurement of corrosive liquid by use of seal.

(h) Level measurement by weighing.

(i) Level of dry material.

3.3Electrical Methods:

(a) Electrical Conductivity method.

(b) Capacitance method.

(c) Radioactive methods.

(d) Ultrasonic method.

(e) GWR (Guided Waves Radar)

### 4 MEASUREMENT OF SPEED:

Speed measurement, Tachometer (Contact type and non contact type - Details).

## 5 TEMPERATURE INSTRUMENTATION:

5.1 Definition of temperature, temperature scales, conversion of one temperature units into another, importance of temperature instrumentation.

5.2 Methods of measurement, industrial liquid thermometer, thermometric liquids and its property, limitation of glass thermometer.

5.3 Filled thermometers- Liquids filled, gas filled, vapour filled (construction and working principle of filled thermometers), comparison of various filled system thermometer .

5.4 (a) Possible sources of errors, ambient temperature effect, compensation of ambient temperature effect along capillary and bourdon.

(b) Mounting method and location and selection.

5.5 Bi-metallic thermometer, principle, construction, material combination of bi-metallic strip its use for control application.

5.6 Electrical methods for temperature measurement thermocouple, principle of production of thermal e.m.f, Seeback effect, Peltier effect, Thompson effect, thermo couple material and temperature range, gauge, protecting tube, standard characteristic curve for thermo couple, measurement of thermo couple e.m.f. by mill (temp Vs. e. m. f. ) voltmeter method and potentiometric method, use of compensating leads. Comparison between millimeter method and potentiometric method , calibration of M.C. voltmeter by potentiometer. Mounting of thermo couple.

5.7 Possible sources of errors and reference junction compensation.

Resistance Thermometer, principle, bulbs and wells, constructional detail.

Properties of resistance elements.

Measurement of resistance by resistance meter, bridge method and potentiometric method.

5.8 Semiconductor thermometer, Ranges and limitations.

5.9 Radiation pyrometer-Principle of working, working temperature range. Total radiation pyrometer-construction and working principle.

## 6 FLOW MEASUREMENTS:

6.1 Definition of flow-Bernoulli's theorem.

6.2 Differential pressure flow meters-Expression for flow rate in terms of differential pressure. Types of restriction, orifice, nozzle, ventury tube, construction and material used. Comparison between orifice, nozzle and ventury tube measurement of differential pressure in flow lines.

6.3 Variable area meter (Rotameter) construction, working principle and its advantage over other method.

6.4 Positive displacement meter, Rotating lobe meter, Rotating vane meter, or Nutating disc meter reciprocating piston meter.

6.5 Velocity Flow Meter:

- (a) Electromagnetic flow meter.
- (b) Ultrasonic flow meter.

6.6 Mass flow meter solid flow meter by weighting.

6.7 Flow through open channel:- Weirs and V-notch.

6.8 Methods of measurements of Fluid Flow by means of Orifice Plates and Nozzles, (for In-compressible fluids).

## 7 MOISTURE MEASUREMENT:

7.1 Definition: Direct drying and weighing method.

7.2 Electrical Methods: Conductance method, capacitance method.

7.3 Use of moisture in process industries.

7.4 Humidity measurement definition, absolute humidity, relative humidity, percentage humidity, Dew point, DRY & WET Bulb Hygrometer .

## 8 MEASUREMENT OF DENSITY

Definition relationship between density, pressure at the bottom of column of liquid and weight of a given volume, Relative density / Specific gravity

8.1 Liquid level method.

8.2 Displacement method.

8.3 Hydrometer method.

## 9 INSTALLATION :

Introduction, important symbols, method of installation of instrumentation system, Instrumentation flow diagram (few typical example).

## LIST OF PRACTICALS

### PROCESS INSTRUMENTATION LAB

To measure pressure by various methods

A. Pressure Gauge (Bourdon, Bellow and diaphragm type)

B. Digital Pressure Indicator

C. Vacuum pressure by any available vacuum gauge and compare.

To measure and record pressure of line by graphic recorder and electronic pressure recorder.

To measure level of a tank by

- A. Sight glass tube and flood method.
- B. Capacitive level detector
- C. resistive level detector.

To calibrate a pressure gauge using load weight tester and standard pressure calibration.

5. To study the construction and operation of level limit switch and make an application circuit using level limit switch.

6. To draw the I/o characteristic of elec. pressure transmitter.

7. To measure speed of motor by

- A. Mechanical tachometer
- B. Optical tachometer
- C. Inductive reluctance type tachometer

8. To measure temperature of a furnace by various methods.

- A. thermometer
- B. Thermocouple
- C. Pyrometer (Total radiation and optical pyrometer)
- D. RTD
- E. I.R. temperature sensor (Semiconductor type)

9. To record level/temperature using universal electronic meter.

10. To measure flow in a pipeline using

- A. Orifice meter
- B. Venturimeter
- C. Rotameter
- E. Electromagnetic flowmeter

11. To measure flow of air using anemometer.

12. To measure density of solution using electronic density meter and hydrometer

13. To measure moisture using Electronic moisture meter.

14. To study various instrumentation symbols used and draw all instrumentation flow diagram of a closed loop process control system.

NOTE: Out of 4 study type practical only 2 practicals should be performed and 10 practicals from other remaining 12 practicals should be performed

## MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making  
Actual laboratory and practical work, model/prototype making, assembly and disassembly  
exercises and viva-voce

## RECOMMENDED BOOKS

- 1 Industrial Instrumentation by Donald P Eckman
- 2 Industrial Instrumentation and Control by S K Singh

List of Software/Learning Websites

<https://en.wikipedia.org/wiki/pressure> transmitter

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	5	5
2.	11	20
3.	11	20
4.	5	5
5.	10	12
6.	10	12
7.	6	10
8.	6	10
9.	6	6
Total	70	100

## 4.6 ENERGY CONSERVATION

L T P  
3 - 2

### RATIONALE

The requirement of energy has increased manifold in last two decades due to rapid urbanization and growth in industrial/service sector. It has become a challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as an additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

### LEARNING OUTCOMES

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

- define principles and objectives of energy management and energy audit.
- understand Energy Conservation Act 2001 and its features.
- understand various forms & elements of energy.
- identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- identify areas of energy conservation and adopt conservation methods in various systems.
- evaluate the techno economic feasibility of the energy conservation technique adopted.

### DETAILED CONTENTS

Basics of Energy

Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.

Global fuel reserve

Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)

Impact of energy usage on climate

Energy Conservation and EC Act 2001

Introduction to energy management, energy conservation, energy efficiency and its need

Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.

Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating

## Electrical Supply System and Motors

Types of electrical supply system

Single line diagram

Losses in electrical power distribution system

Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)

3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers

### Electric Motors

Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors

#### 4. Energy Efficiency in Electrical Utilities

Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps

Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.

Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

## Lighting and DG Systems

Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting

DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation Energy Efficiency in Thermal Utilities

Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)

Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces

Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers

#### 6.4 Efficient Steam Utilization

Energy Conservation Building Code (ECBC)

ECBC and its salient features

Tips for energy savings in buildings: New Buildings, Existing Buildings

Waste Heat Recovery and Co-Generation

8.1 Concept, classification and benefits of waste heat recovery  
Concept and types of co-generation system

General Energy Saving Tips

Energy saving tips in:

- 9.1 Lighting
  - 9.2 Room Air Conditioner
  - 9.3 Refrigerator
  - 9.4 Water Heater
  - 9.5 Computer
  - 9.6 Fan, Heater, Blower and Washing Machine
  - 9.7 Colour Television
  - 9.8 Water Pump
  - 9.9 Cooking
- Transport

Energy Audit

- 10.1 Types and methodology
- 10.2 Energy audit instruments
- 10.3 Energy auditing reporting format

## PRACTICAL EXERCISES

To conduct load survey and power consumption calculations of small building.

To check efficacy of different lamps by measuring power consumption and lumens using lux meter.

To measure energy efficiency ratio (EER) of an air conditioner.

To measure effect of valve throttling and variable frequency drive (VFD ) on energy consumption by centrifugal pump.

To measure and calculate energy saving by arresting air leakages in compressor.

To measure the effect of blower speed on energy consumed by it.

## STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

Presentations of Case Studies

Debate competitions

Poster competitions



Industrial visits  
Visual Aids

### INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

### RECOMMENDED BOOKS

Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015

Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015

Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015

Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

### Important Links:

Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India.

[www.beeindia.gov.in](http://www.beeindia.gov.in)

Ministry of New and Renewable Energy (MNRE), Government of India. [www.mnre.gov.in](http://www.mnre.gov.in)

Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. [www.upneda.org.in](http://www.upneda.org.in)

**Central Pollution Control Board (CPCB)**, Ministry of Environment, Forest and Climate Change, Government of India. [www.cpcb.nic.in](http://www.cpcb.nic.in)

**Energy Efficiency Services Limited (EESL)**. [www.eeslindia.org](http://www.eeslindia.org)

Electrical India, Magazine on power and electrical products industry. [www.electricalindia.in](http://www.electricalindia.in)

## INDUSTRIAL TRAINING OF STUDENTS

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organised during the semester break starting after second year i.e. after 4<sup>th</sup> semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational

setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5<sup>th</sup> Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4<sup>th</sup> semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

Punctuality and regularity	15%
Initiative in learning new things	15%
Presentation and VIVA	15%
Industrial training report	55%

## 5.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P
5	-	-

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. It may be further added that an entrepreneurial mindset with managerial skills helps the student in the job market. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

## LEARNING OUTCOMES

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

Know about various schemes of assistance by entrepreneurial support agencies  
 Conduct market survey  
 Prepare project report  
 Explain the principles of management including its functions in an organisation.  
 Have insight into different types of organizations and their structures.  
 Inculcate leadership qualities to motivate self and others.  
 Manage human resources at the shop-floor  
 Maintain and be a part of healthy work culture in an organisation.  
 Use marketing skills for the benefit of the organization.  
 Maintain books of accounts and take financial decisions.  
 Undertake store management.  
 Use modern concepts like TQM, JIT and CRM.

## DETAILED CONTENTS

### SECTION – A ENTREPRENEURSHIP

#### 1. Introduction (04 Periods)

Concept /Meaning and its need  
 Qualities and functions of entrepreneur and barriers in entrepreneurship

Sole proprietorship and partnership forms and other forms of business organisations  
 Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organisation: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

#### 2. Market Survey and Opportunity Identification/Ideation (04 Periods)

Scanning of the business environment  
 Salient features of National and Haryana State industrial policies and resultant business opportunities  
 Types and conduct of market survey

Assessment of demand and supply in potential areas of growth  
 Identifying business opportunity  
 Considerations in product selection  
 Converting an idea into a business opportunity

3. Project report Preparation (06 Periods)

Preliminary project report  
 Detailed project report including technical, economic and market feasibility  
 Common errors in project report preparations  
 Exercises on preparation of project report  
 Sample project report

SECTION –B  
 MANAGEMENT

4. Introduction to Management (06 Periods)

Definitions and importance of management  
 Functions of management: Importance and process of planning, organising, staffing, directing and controlling  
 Principles of management (Henri Fayol, F.W. Taylor)  
 Concept and structure of an organisation  
 Types of industrial organisations and their advantages  
 Line organisation, staff organisation  
 Line and staff organisation  
 Functional Organisation

5. Leadership and Motivation (08 Periods)

Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders  
 Motivation: Definition and characteristics, Importance of self motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor)

6. Management Scope in Different Areas (14 Periods)

Human Resource Management: Introduction and objective, Introduction to Man power planning, recruitment and selection, Introduction to performance appraisal methods  
 Material and Store Management: Introduction functions, and objectives, ABC Analysis and EOQ  
 Marketing and sales: Introduction, importance, and its functions, Physical distribution,  
 Introduction to promotion mix, Sales promotion

Financial Management: Introductions, importance and its functions, knowledge of income tax, sales tax, excise duty, custom duty, VAT, GST

7. Work Culture (08 Periods)

Introduction and importance of Healthy Work Culture in organization

Components of Culture

Importance of attitude, values and behavior

Behavioural Science – Individual and group behavior.

Professional ethics – Concept and need of Professional Ethics and human values.

8. Basic of Accounting and Finance (10 Periods)

Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company

Objectives of Financial Management: Profit Maximization v/s Wealth Maximization

9. Miscellaneous Topics (10 Periods)

Total Quality Management (TQM): Statistical process control, Total employees Involvement, Just in time (JIT)

Intellectual Property Right (IPR) : Introduction, definition and its importance, Infringement related to patents, copy right, trade mark

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study 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 organisations on visit. Approach extracted reading and handouts may be provided.

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests

Mid-term and end-term written tests

Model/Prototype making.

#### RECOMMENDED BOOKS

A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)

Entrepreneurship Development and Management by J.S.Narang; Dhanpat Rai & Sons, Delhi.

Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi

Handbook of Small Scale Industry by PM Bhandari

Entrepreneurship Development and Management by MK Garg

6. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	06
2	04	06
3	06	08
4	06	08
5	08	12
6	14	20
7	08	12
8	10	14
9	10	14
Total	70	100

## 5.2 MICROPROCESSORS AND PERIPHERAL DEVICES

L T P

4 - 4

## RATIONALE

The study of microprocessors in terms of architecture, software and interfacing techniques leads to the understanding of working of CPU in a microcomputer. The development in microprocessors of 32 bit architecture brings the students face-to-face with mainframe enabling them to get employment in R&D, assembly, repair and maintenance of hardware of microprocessors and computers. Microprocessors find application in process control industry. They also form a part of the electronic switching system between source and destination in long distance telecommunications. Thus the microprocessor is an area of specialization. Students of electronics and related engineering branches often use microprocessors to introduce programmable control in their projects, in industrial training.

## LEARNING OUTCOMES

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

- understand the concept of microcomputer system
- describe Architecture and pin details of 8085
- write assembly language program using mnemonics
- interface various peripheral devices with microprocessor.
- use various data transfer techniques
- describe architecture and pin detail of 8086
- describe the idea of advance microprocessors like Pentium series and dual core.

## DETAILED CONTENTS

## 1. Evolution of Microprocessor (05 Periods)

Typical organization of a microcomputer system and functions of its various blocks.  
Microprocessor, its evolution, function and impact on modern society

## 2. Architecture of a Microprocessor (05 periods)

(With reference to 8085 microprocessor)

Concept of Bus, bus organization of 8085, Functional block diagram of 8085 and function of each block, Pin details of 8085 and related signals, Demultiplexing of address/data bus generation of read/write control signals, Steps to execute a stored programme



3. Instruction Timing and Cycles (05 periods)

Instruction cycle, machine cycle and T-states, Fetch and execute cycle, Timing Cycle Diagram

4. Programming (with respect to 8085 microprocessor) (09 periods)

Brief idea of machine and assembly languages, Machines and Mnemonic codes. Instruction format and Addressing mode. Identification of instructions as to which addressing mode they belong. Concept of Instruction set. Explanation of the instructions of the following groups of instruction set. Data transfer group, Arithmetic Group, Logic Group, Stack, I/O and Machine Control Group. Programming exercises in assembly language. (Examples can be taken from the list of experiments).

5. Memories and I/O interfacing (06 periods)

Concept of memory mapping, partitioning of total memory space. Address decoding, concept of peripheral mapped I/O and memory mapped I/O. Interfacing of memory mapped I/O devices.

6. Interrupts (06 periods)

Concept of interrupt, Maskable and non-maskable, Edge triggered and level triggered interrupts, Software interrupt, Restart interrupts and its use, Various hardware interrupts of 8085, Servicing interrupts, extending interrupt system

7. Data Transfer Techniques (06 periods)

Concept of programmed I/O operations, sync data transfer, async data transfer (hand shaking), Interrupt driven data transfer, DMA, Serial output data, Serial input data

8. Peripheral devices (06 periods)

8255 PPI, 8253 PIT and 8257 DMA controller

9. Architecture of 8086 Microprocessor (06 periods)

Block diagram

Minimum and Maximum mode

Pin and Signals

Addressing Modes

10. Advance Microprocessors (02 periods)

- Introduction to Pentium series processors and core 2 duo, dual core (core i3, i5, i7)

### LIST OF PRACTICALS(minimum 8 practical)

Familiarization of different keys of 8085 microprocessor kit and its memory map  
 Steps to enter, modify data/program and to execute a programme on 8085 kit  
 Writing and execution of ALP for addition and sub station of two 8 bit numbers  
 Writing and execution of ALP for multiplication and division of two 8 bit numbers  
 Writing and execution of ALP for arranging 10 numbers in ascending/descending order  
 Writing and execution of ALP for 0 to 9 BCD counters (up/down counter according to choice stored in memory)  
 Interfacing exercise on 8255 like LED display control  
 Interfacing exercise on 8253 programmable interval timer  
 Interfacing exercise on 8279 programmable KB/display interface like to display the hex code of key pressed on display  
 Writing and execution of different ALP for 8086 (any four)  
 Generation of Square wave of desired freq using 8255.

### INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing). Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. Programming exercises other than the given in the list may be given to the students.

### MEANS OF ASSESSMENT

Assignments and quiz/class tests  
 Mid-term and end-term written tests  
 Actual laboratory and practical work, exercises  
 Viva-voce

### RECOMMENDED BOOKS

Microprocessor Architecture, Programming and Applications with 8080/8085 by Ramesh S Gaonker, Willey Eastern Ltd. New Delhi  
 Microprocessor and Applications by Badri Ram: Tata McGraw Hill Education Pvt Ltd , New Delhi  
 Microprocessor programming & applications.by sudhir Goyal, North Publication.  
 Microprocessor and interfacing by Douglas.V.Hall, McGraw Hill Higher Education, New Delhi.  
 E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	05	09
2.	05	09
3	05	09
4	09	14
5.	06	11
6.	06	11
7.	06	11
8.	06	11
9.	06	11
10.	02	04
Total	56	100

### 5.3 INDUSTRIAL CONTROL

L T P

6 - 4

#### RATIONALE

Electrical energy is the main source of energy for running nearly all type of industries. The machines are mainly driven by the electrical energy. Therefore the control of electrical power is of utmost importance in these machines. The objective of this paper is to familiarize the student with response of simple first order and second order systems, input, output relationships, components and devices used in control systems, thyristors and their application in heating, welding and motor control.

#### LEARNING OUTCOMES

After completion of the course, the students should be able to:

Demonstrate an understanding of fundamentals of Control System.

Ability to analyze the response of first and second order system with different basic input signals.

Uses of Laplace Transform in control system analysis.

Analyze the stability of control system using Routh-Hurwitz criterion.

Understand the construction and working of various power electronic devices and their selection based on application need.

Acquire knowledge of power converter like rectifier, Inverter, Cycloconverter etc.

Understand basic concept of electric drive and motor speed control using power electronic devices.

## DETAILED CONTENTS

### 1 INTRODUCTION:

Need of automatic control, classification of control systems:-

(a) Open loop and closed loop system, block diagram of feed back control system and its basic elements.

(b) Definition of other types of control system e.g.

(i) Linear and Nonlinear system.

(ii) Single input - Single output (SISO) system and Multi Input - Multi-output (MIMO) system.

(iii) Static and dynamic systems.

(iv) Continuous and discrete systems.

(v) Analog and digital system

(vi) Stable and Unstable systems.

### 2 SYSTEM EXCITATION AND RESPONSE OF SIMPLE SYSTEMS:

2.1 Step, ramp and pulse, exponential, sinusoidal type of inputs with examples.

2.2 Response of first order and second order systems with examples.

2.3 Response due to forcing function, response to step and ramp inputs.

2.4 Definitions of over shoot, under shoot, rise time and damping ratio, damping coefficient, settling time and peak time.

2.5 Stability Analysis using Routh-Hurwitz criterion

### 3 INPUT OUTPUT RELATIONSHIP OF CONTROL SYSTEMS:

3.1 Concept of laplace transform & reverse laplace of some useful functions

3.2 Theorems regarding initial and final values.

3.3 Derivation of transfer functions from basic relationship.

3.4 Transfer function of a system in cascade.

3.5 Transfer function of a system with feed back.

3.6 Block diagram representation of control system & simplification technique

### 4 COMPONENTS AND DEVICES USED IN CONTROL SYSTEMS:

Brief description, working of potentiometer, self balancing potentiometers, Servo motors, Eddy current clutches, Relays and contactors, Timing relays, Saturable core reactor and its use as magnetic amplifier.

### 5 THYRISTORS AND THEIR APPLICATIONS:

5.1 Name, symbol and typical application of members of Thyristor family.

5.2 SCR, TRIAC AND DIAC:

Basic structure, operation V-I characteristics and ratings, gate circuits, ratings

Triggering process and ckts, Turn off methods and circuits.

5.3 UJT:

Operation, V-I characteristics, use in relaxation oscillator, use of relaxation oscillations for triggering thyristors.

#### 5.4 HALF WAVE FULL WAVE RECTIFIERS:

Half wave, full wave rectifiers (Including Bridge) single phase and poly phase rectifiers using SCR's, explanation of 3 phase bridge controlled rectifier and its applications.

5.5 Principle of operation of basic inverter circuits, basic series and parallel commutated inverter circuits, Operation of choppers and applications

5.6 Cyclo converter

5.7 Uninterruptible power supply(UPS)

#### 6 HIGH FREQUENCY HEATING AND WELDING:

Induction heating, dielectric heating, resistance welding, electronic control of resistance welding and heating processes, Applications in industry .

#### 7 SOLID STATE MOTOR CONTROL:

7.1 Application of phase controlled rectifiers and A.C. phase control circuit in illumination control and temperature control.

7.2 D. C. motor speed control.

7.3 A. C. motor speed control.

7.4 Plugging, Dynamic & Regenerative Braking.

7.5 Introduction to Electric Drives

#### LIST OF PRACTICALS

1. To plot the time response of a first order electrical system.
2. To plot time response of second order electrical system and find out transfer function of a LCR circuit.
3. To draw the characteristic curves of S.C.R., Diac and Triac.
4. To study a power rectifier using SCR and draw input and output wave forms.
5. To study a single phase inverter.Circuit using S.C.R. and draw input and output wave forms.
6. To fabricate a S. C. R. chopper circuit, test it and determine duty cycle.
7. To study the effect of variation in firing angle on a C.R.O. and to plot the wave shapes.
8. To Fabricate a circuit for illumination control of Light Source using SCR .
9. To Fabricate a circuit for temperature control of a heating element using Thiresters.
10. To fabricate the traicDiac motor speed control circuit and draw input output (Speed) characteristics.

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

#### RECOMMENDED BOOKS

- 1 Linear Control Systems by B S Manke, Khanna Publishers
- 2 Power Electronics: Circuit Divecs and Application by M.H.Rashid, PHI publication
- 3 Power Electronics by P.S.Bimbhra Khanna publication
- 4 Elements of Electric Drives by J B Gupta by Katson Publication
- 5 Industrial Electronics and control By S.K.Bhattacharya& S Chattarji

List of Software/Learning Websites

<https://en.wikipedia.org/wiki/UPS>

<https://pdf.semanticscholar.org>

<https://en.wikipedia.org/wiki/welding>

<https://en.wikipedia.org/wiki/inductionwelding>

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	11	10
2.	14	20
3.	12	15
4.	11	10
5.	14	20
6.	10	10
7.	12	15
Total	84	100

## 5.4 SIGNAL TRANSMISSION RECORDING AND DISPLAY

L T P  
5 - -  
RATIONALE

The type of display device for the quantity to be measured depends on the actual working atmosphere in the industry. The processing of signal depends on the type of data sensing and handling equipment. The suitability for analogue, digital and recording system used by the industry. The objective of this paper is to equip the student with basic knowledge of display devices, display systems, data transmission and telemetry, recorders, instrumentation amplifiers and data acquisition systems which will be useful for the student for handling problems prevailing in the industry atmosphere.

## LEARNING OUTCOMES

After completion of the course, the students should be able to:

Enabling the students to acquire knowledge about various Display Devices and Systems.  
Understanding the concept and working of Recorders used in instrumentation and control.  
Students will be able to know about various modulation technique and Telemetry Systems.  
Enable the student to get familiarized with different Protocol use in signal transmission.  
Describe the basics of Analog and Digital Data Acquisition Systems  
Understand the working and characteristic of Instrumentation Amplifier.

## DETAILED CONTENTS

## 1 DISPLAY DEVICES:

Classification of display devices, working principles and typical use of various display devices-cathode ray tube (Gen. purpose CRTS, storage CRTS flat CRTS) Light Emitting Diodes, Seven segment display, Liquid Crystal displays, Touch screen display-Introduction, Types of touch screen display, Resistive and capacitive touch screen display concept and construction, Application of touch screen.

## 2 DISPLAY SYSTEMS:

Elements of controlling a display system, Use and implementation of Code converter, latches and shift registers, Counters in display systems. LED display, LCD display other displays.

## 3 RECORDER:

Necessity of recorder, Basic requirements of recording systems, classification of recorders-Analog (Graphic, Oscillographic and magnetic recorders) and Digital recorder.



3.1 Graphic Recorders: X-T and X-Y recorders.

3.2 Digital Recorders

Basic concept of Digital recorder, types of Digital recorder:

- (i) Electro magnetic recorder (Digital type recorder).
- (ii) Introduction and uses of Bar Code Reader & Recorder (Optical).
- (iii) Introduction and uses of Quick Response (QR) code reader and recorder (Optical).

4 DATA TRANSMISSION AND TELEMETRY:

4.1 Methods of Data Transmission - Electrical and Electronic.

4.2 Definition of Telemetry, General requirements of Telemetry system.

4.3 Types of Telemetry

- (i) Voltage Telemetry.
- (ii) Current Telemetry.
- (iii) Position Telemetry
- (iv) A. C. Telemetry-Concept of modulation and demodulation (A.M., F.M. and Phase Modulation).

(v) Pulse Telemetry System - Analog pulse telemetry (PAM, PFM, PDM, PPM) and Concept of Digital telemetry- PCM, Delta Modulation (Basic Principle Only)

4.4 Transmission Channels And Multiplexing

(Concept only) wire line channels, Radio channels, Microwave channels, Power line carrier channel (Concept only) and optical fibre channels, Time division multiplexing (TDM) and frequency division multiplexing (FDM), Concept of CDMA (Code Division Multiple Access). Introduction to Demultiplexing.

4.5 Introduction to Standard Protocol:

RS232, RS485, MODBUS, HART (Highway Addressable Remote Transmitters)

5 INSTRUMENTATION AMPLIFIER:

Introduction and Characteristics of instrumentation amplifiers in respect of input impedance, output impedance, drift, d.c. offset noise, gain, common mode rejection ratio, frequency response, slew rate etc.. Relating the suitability of these characteristics for amplifying signals from various Transducers. Applications

6 DATA ACQUISITION SYSTEMS (DAS):

6.1 General concept, Importance of DAS to instrumentation.

Types of DAS components of

- (i) Analog data acquisition system.
- (ii) Digital data acquisition system.

Use of Data Acquisition system. Use of recorder in digital data acquisition systems.

## 6.2 Modern trends in DAS - Introduction of microprocessor in DAS.

## MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making model/prototype making, assembly and disassembly exercises and viva-voce

## RECOMMENDED BOOKS

- 1 1. Electrical and Electronics Measurement and Instrumentation by A.K. Shawney, Dhanpat Rai and Co., New Delhi
  - 2 Telemetry Principles by D Patranabis , Tata McGraw-Hill Education.
  - 3 OP. Amp. & Linear Integrated circuit by R.A. Gayakward, Prentice Hall of India New Delhi
  - 4 Electronic Communication System by Georgy Kennedy , Tata McGraw-Hill
  - 5 Communication System by Simon Haykin, John Wiley & Sons
- List of Software/Learning Websites  
<https://en.wikipedia.org/wiki/TouchScreen>  
<https://pdf.semanticscholar.org>

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	15
2	10	10
3	14	30
4	14	30
5	10	5
6	10	10
Total	70	100

## 5.5 PROGRAMMING USING C

L T P

4 - 4

## RATIONALE

Computers play a vital role in present day life, more so, in the professional life of technician engineers. 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. The knowledge of C language will be reinforced by the practical exercises.

## LEARNING OUTCOMES

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

understand the concepts of C programming language  
 install C software on the system and debug the programme  
 identify a problem and formulate an algorithm for it.  
 identify various control structures and implement them.  
 identify various types of variables.  
 use pointer in an array and structure.  
 implement the language control structure  
 understand and execute member functions of C in the programme  
 implement array concept in C programme  
 execute pointers

## DETAILED CONTENTS

## 1. Algorithm and Programming Development (06 Periods)

Steps in development of a program  
 Flow charts, Algorithm development  
 Programme Debugging  
 Basis of C programming

## 2. Program Structure (09 Periods)

2.1 I/O statements, assign statements  
 2.2 Constants, variables and data types  
 2.3 Operators and Expressions  
 2.4 Standards and Formatted IOS  
 2.5 Data Type Casting

## 3. Control Structures (09 Periods)

## Introduction

Decision making with IF – statement

IF – Else and Nested IF

While and do-while, for loop

Break. Continue, goto and switch statements

## 4. Pointers (10 Periods)

4.1 Introduction to Pointers

4.2. Address operator and pointers

4.3 Declaring and Initializing pointers,

4.4 Single pointer,

## 5. Functions (11 Periods)

5.1 Introduction to functions

5.2 Global and Local Variables

5.3 Function Declaration

5.4 Standard functions

5.5 Parameters and Parameter Passing

5.6 Call - by value/reference

5.7 Recursion

## 6. Arrays (11 Periods)

6.1 Introduction to Arrays

6.2 Array Declaration, Length of array

6.3 Single and Multidimensional Array.

6.4 Arrays of characters

6.5 Passing an array to function

6.6 Pointers to an array

## LIST OF PRACTICALS

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 printf and scanf 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. Programs on one-dimensional array.
12. Programs on two-dimensional array.
13. (i) Programs for putting two strings together.  
(ii) Programs for comparing two strings.
14. Simple programs using structures.
15. Simple programs using pointers.
16. Simple programs using union.

#### INSTRUCTIONAL STRATEGY

The subject is totally practical based. Students should be given clear idea about the basic concepts of programming. In practical session student should be asked to draw flow chart write algorithm and then write program for the algorithm and run on computer. It is required that students should maintain records (files with printouts).

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests  
 Mid-term and end-term written tests  
 Actual laboratory and practical work  
 Exercises  
 Software installation  
 Operation  
 Development  
 Viva-Voce

#### RECOMMENDED BOOKS

Let us C by Yashwant Kanetkar  
 Programming in ANSI C by E Balaguruswami, Tata McGraw Hill Education Pvt Ltd, New Delhi  
 Programming in C by Reema Thareja; Oxford University Press, New Delhi  
 Programming in C by Gottfried, Schaum Series, , Tata McGraw Hill Education Pvt Ltd , New Delhi  
 Exploring C by Yashwant Kanetkar; BPB Publications, New Delhi  
 E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh

Websites for Reference:

<http://swayam.gov.in>

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	12
2	09	15
3	09	15
4	10	18

5	11	20
6	11	20
Total	56	100

## 5.6 MINOR PROJECT WORK

L T P

- - 6

## LEARNING OUTCOMES

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

Use effectively oral, written and visual communication

Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.

Identify, analyze and solve problems creatively through sustained critical investigation.

Develop co-worker and leadership abilities.

Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

Minor project work aims at exposing the students to various industries dealing with computers.

It is expected from them to get acquainted with computer environment. For this purpose, student during middle of the course are required to be sent for a period of two to four weeks at a stretch in different establishments. Depending upon the interest of students they are sent for exposure to:

Industrial practices in installation and maintenance of computers and computer networks

Fabrication of computers

Fault diagnosis and testing of computers

Industrial practices in respect of documentation and fabrication

A variety of computers and peripherals in assembly organizations

Software package development organizations

Maintenance of database

Write procedure or functions which can be attached as the library objects to the main projects

Write a procedure function to convert number of words.

Write a procedure function to convert all data function (create your own) Database connectivity, (SQL server, Oracle, Access), Library classes in C++ (same application).,

design web applications using PHP

Note: The teachers may guide /help students to identify their minor project work and check 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 detail project report of the observations/processes/activities by him/her. The students should be guided by the respective subject teachers. Each teacher may guide a group of 4 to 5 students.

The teachers along with field supervisors/engineers will conduct performance assessment of students. Criteria for assessment will be as follows:

Criteria	Weightage
Attendance and Punctuality	15%
Initiative in performing tasks/creating new things	30%
Relation with people	15%
Report Writing	40%

## 6.1 PROCESS CONTROL

L T P

6 - 4

### RATIONALE

To keep output at predesired value some adjustment in process parameters is required during the plant operation. The control actions to be performed are mainly ON- OFF, proportional, integral and derivative. These control actions can be performed by pneumatic, electric, electronics, hydraulic or mechanical controllers. The controlled variable is finally fed to the final control elements. The students, familiar with different type of controllers, their installation and maintenance will be more suitable to the process industries.

### LEARNING OUTCOMES

After completion of the course, the students should be able to:

- Understand the basic principles & importance of process control in industrial process plants
- Specify the required instrumentation and final elements to ensure that well-tuned control is achieved
- Understand block diagrams & the mathematical basis for the design of control systems;
  - To introduce the evaluation criteria and tuning techniques of controllers
  - Understand working of PLC, design PLC based application by proper selection and sizing criteria
- Understand evolution and architecture of DCS,HMI, hierarchical control in DCS,HMI

### DETAILED CONTENTS

#### 1 INTRODUCTION:

Basic of process control, Process characteristics, static and dynamic resistance and capacitance of a process, process time delay, dead time, Response of general closed loop process control system.

#### 2 AUTOMATION CONTROL ACTIONS:

Types of control actions Two position control- ON-OFF action, Proportional, Proportional plus Derivation action, Proportional plus Integral, Proportional plus Integral plus Derivative action, Control scheme- feed forward.

#### 3 FINAL CONTROL ELEMENT:



Introduction, Pneumatic Actuator, Hydraulic Actuator , Electric Actuator, Motor Actuator ,Control Valves . Types of Control Valves, Butterfly ,Globe,Gate, Ball valves, Solenoid valves, Installation and Maintenance of Control Valve , use of final control element.

- 4 PNEUMATIC AND HYDRAULIC CONTROLLER  
Flapper-Nozzle system as control element , Characteristic of flapper-nozzle system, Effect of non -linearity of various gain, , I/P Converter & P/I Converter, Direct acting and Reverse acting relay as amplifier in pneumatic system . ON-OFF, P, PI, PD and PID Pneumatic controller, Hydraulic fluids, Jet nozzles control component Comparison between Hydraulic and Pneumatic control system(Concept only)
- 5 ELECTRONIC CONTROLLER:  
Op-amp as building block of Electronics controller , ON-OFF, P, PI, PD, PID Electronic Controller.
- 6 DIRECT DIGITAL CONTROL SYSTEM:  
Introduction, DDC structure, DDC software basics , Advantage and Disadvantage of DDC
- 7 PROGRAMMABLE LOGIC CONTROLLER (PLC) ,SCADA,HMI  
Introduction ,Principal of operation, Architecture of PLC, Types of Programming ,Ladder Programming & Boolean Logic, Application, Merits and Demerits of PLC, SCADA/HMI & it's Functional Requirements System Architecture ,configuration , Working, Communication& protocols , Some popular PLC/SCADA/HMI .
- 8 DISTRIBUTED CONTROL SYSTEM (DCS):  
Real time computer control system – A Concept , Functional Requirements of DCS, System Architecture, configuration , Working , Communication & Protocols, some popular DCS.
- 9 PREVENTIVE MAINTENANCE:  
Objectives of preventive maintenance, elements of preventive maintenance, procedure of preventive maintenance schedules. Simple example of preventive programmes and maintenance schedules .
- 10 VIRTUAL INSTRUMENTATION:  
Concept of Data flow techniques , Basic of Data Acquisition and use of Analysis tools

## LIST OF PRACTICALS

- 1 1.To draw characteristic of
  - A. Quick opening control valve
  - B. Equal percentage control valve
  - C. Linear control valve
- 2 To draw the characteristic of valve
  - A. Without Positioner
  - B. With valve Positioner and compare it
- 3 To study the working of D/P transmitter and plot th I/O characteristic at different range of I/P span
- 4 To study the working of ON/OFF level controller and draw I/O characteristics.
- 5 To Draw characteristics of I/P and P/I converter.
- 6 To verify the logical Expression / Logic Gates using Ladder Logic on PLC Panel.
- 7 To write and perform simple program using Ladder Logic on PLC panel
- 8 To Perform Data Read and Write operation using HMI & PLC panel.
- 9 To study a distributed control system panel and do various experiment task on it.
- 10 To design a simple control diagram of SCADA software and link it to a given PLC and do various experiment or it.
- 11 Design a control loop of a typical process using LABVIEW and do various task using virtual instrumentation software
- 12 To fabricate and install a process instrumentation system.

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making  
Actual laboratory and practical work, model/prototype making, assembly and disassembly  
exercises and viva-voce

#### RECOMMENDED BOOKS

- 1 D.P Eckman, “Automatic Process control” 7<sup>th</sup> Edition, John Wiley New York 1990
- 2 Curtis D. Johnson Peocess Control Instrumentation Technology, 8<sup>th</sup> Edition, Pearson 2006
- 3 Coughanowr, D.R., “Proces Systems Analysis and Control”, McGraw-Hill International Edition,2004
- 4 Bela G Liptak “Process Contro and Optamization”., InstrumenrEngineers , Handbook volume2, CRC press and ISA, 2005
- 5 S. K. Singh “Industrial Instrumentation and Control “
- 6 Surekha Bhanot “Process Control Prinviples& Applications”

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	7	10
2	10	10
3	9	10
4	9	15
5	9	10
6	9	10
7	12	15
8	9	10
9	7	5
10	3	5
Total	84	100

## 6.2 MICROCONTROLLERS &amp; EMBEDDED SYSTEM

L T P

6 - 6

## RATIONALE

The study of microcontrollers in terms of architecture, software and interfacing techniques leads to the understanding of working of microcontrollers and applications of microcontroller in electronic industries. Microcontroller is the heart of the programmable devices. Embedded systems and Micro-controllers have also assumed a great significance in the electronic and consumer goods industry and are a very vital field. Students of electronics and related engineering branches often use microcontroller to introduce programmable control in their projects, automation and fault finding in industry. The subject aims expose students to the embedded systems besides giving them adequate knowledge of micro controllers.

## LEARNING OUTCOMES

After completion of the subject, the learner should be able to:  
 understand the working of microcontrollers  
 understand the Instruction set and programming related to microcontrollers  
 describe embedded system  
 explain embedded operating systems  
 program PIC microcontroller and AVR microcontroller  
 interface sensors with microcontroller

## DETAILED CONTENTS

- |     |   |              |
|-----|---|--------------|
| 1.  | Microcontroller series (MCS)                    | (14 Periods) |
| 1.1 | Architecture of 8051Microcontroller             |              |
| 1.2 | Pin details                                     |              |
| 1.3 | I/O Port structure                              |              |
| 1.4 | Memory Organization                             |              |
| 1.5 | Special Function Registers (SFRs)               |              |
| 1.6 | External Memory                                 |              |
| 2.  | Instruction Set for Microcontroller Programming | (16 Periods) |
| 2.1 | Instruction Set of 8051                         |              |
| 2.2 | Addressing Modes,                               |              |
| 2.3 | Types of Instructions                           |              |
| 2.4 | Timer operation                                 |              |
| 2.5 | Serial Port operation                           |              |
| 2.6 | Interrupts                                      |              |
| 3.  | Introduction to Embedded System                 | (08 Periods) |

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

4. Embedded operating systems (10 Periods)

Real-time operating system, factors affecting embedded systems, applications of embedded systems, embedded systems characteristics and features,

5. Introduction of PIC microcontroller, block diagram, function of each block. Introduction of AVR microcontroller, block diagram, function of each block. (10 Periods)

6. Programming concepts of microcontrollers. Basic introduction of Software used in microcontrollers. How to transfer C or ASM code in microcontrollers. (10 Periods)

7. Input/output interface (08 Periods)  
- Sensors, 7-segment display, LCD, LED and relay

8. Internet of Things (08 Periods)  
- Introduction to Internet of things  
- Application, architecture, protocols  
- Functional blocks of IoT, Characteristics of IoT  
- Brief idea of Arduino IDE

### LIST OF PRACTICALS

Familiarization with Micro-controller Kit and its different sections

Programming to interface switches and LEDs

Programming and interface of Seven Segment and LCD.

Programming for A/D converter, result on LCD.

Programming for D/A converter, result on LCD.

Programming for serial data transmission from PC to Kit or Vice versa.

Programming and interfacing of RELAY and Buzzer

Design PIC based Security System

Design AVR based Temperature indicator cum controller.

Practical using Arduino-interfacing sensors

Interfacing Light Emitting Diode(LED)- Blinking LED

Interfacing Button and LED – LED blinking when button is pressed

Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp

Interfacing Relay module to demonstrate Bluetooth/wifi based home automation application. (using Bluetooth/wifi and relay).

## INSTRUCTIONAL STRATEGY

Instruction should be given to students by showing them actual microcontrollers in the class room so that they can develop the concept. Exercise on programming should be done by taking simple examples like interfacing of switch, LED and relay.

## MEANS OF ASSESSMENT

Assignments and quiz/class tests  
 Mid-term and end-term written tests  
 Actual laboratory and practical work  
 Model making  
 Viva-Voce

## RECOMMENDED BOOKS:-

Fundamentals of Microprocessor and Microcontroller by B. Ram , Dhanpat Rai Publications.  
 Microcontroller and Embedded Systems using Assembly And C by Muhammad Ali Mazidi, RolinMckinlay, Janice GilispieMazidi: Pearson  
 PIC Microcontroller and Embedded Systems : Using assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Danny Causey; Pearson  
 Microcontroller and Embedded Systems using Assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Janice GilispieMazidi, Pearson  
 Embedded Systems - Architecture, Programming, Design, by Kamal, R. Tata McGraw Hill, New Delhi  
 YashavantKanetkar, ShrirangKorde, “21 Internet Of Things (IOT) Experiments”  
 NeerparajRai , “Arduino Projects For Engineers”  
 E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	14	16
2	16	18
3	08	10

4	10	12
5	10	12
6.	10	12
7.	08	10
8.	08	10
Total	84	100

## 6.3 BIO-MEDICAL INSTRUMENTATION

L T P

4 - 4

## RATIONALE

Instrumentation has brought a new revolution in the field of medical science. An insight into human body could become possible on account of introduction of various bio instrumentation and cure of various impossible diseases could become possible.

This course will cover various systems of the human physiology, signals of biological origin obtained from these systems, biosensors, transducers, bioelectrodes used to acquire such signals, and amplifiers for measuring biopotentials. Electrical safety of medical devices; measurements of the blood pressure, blood flow, respiratory system, clinical laboratory equipment, medical imaging, and bioethics will also be discussed. The main objective of this course is to introduce student to basic biomedical engineering technology. As a result student can understand, design and evaluate systems and devices that can measure, test and/or acquire biological information from the human body.

## LEARNING OUTCOMES

After completion of the course, the students should be able to:

Develop the understanding of the various Transducers and Biomedical sensors.

Students will understand basic principle of Transducers and various biomedical sensors.

The course contents will enable the students to understand and design biomedical instrumentation systems.

The contents will allow the students to understand the importance of the sensors and transducers for medical applications.

## DETAILED CONTENTS

## 1 INTRODUCTION:

Basic measurement system, Measurement, Measurand, Accuracy, Precision, Errors in Measurements, Signal and Noise, Calibration, Transduction principles, Classification and Characteristics of Transducers, Transducer parts and electrical design characteristics.

## 2 HUMAN PHYSIOLOGY:

Elementary ideas of cell structure  
Heart and circulatory system  
Central nervous System  
Muscle action  
Respiratory System  
Body temperature

## 3 BIOPOTENTIAL ELECTRODES:

Electrode theory: the electrode / Electrolyte interface, Polarizable and nonpolarizable electrodes, Liquid junction potential, Electrode potential, Application of Biopotential



electrodes.

ECG electrodes: Surface electrodes, Silver- silver chloride electrodes, stainless steel electrodes, Electrode impedance and Electrode equivalent circuit.

EMG electrodes: Surface electrodes, Needle and Wire electrodes.

EEG electrodes: Micro and suction electrodes- Glass microelectrodes, Metal microelectrodes, Suction electrodes, Microelectrode equivalent circuit.

#### 4 **BIOSENSORS:**

Definition of biosensor, Application and origin of biosensor, Transduction mechanism of biosensor, Blood gas and pH sensors, Bio-Analytical Sensor, Enzymatic biosensors, Optical Biosensors, PO<sub>2</sub> and PCO<sub>2</sub> sensor, Manufacturing techniques of Biosensors.

#### 5 **BIO-MEDICAL RECORDERS:**

Principle of Physiological pre amplifier and specialized amplifiers.

Generalised Block diagram of a Bio-medical recorder.

ECG machine: Block diagram of ECG machine ECG machine,

EEG machine & EEG leads

EMG machine

#### 6 **MEDICAL DISPLAY SYSTEM:**

Cardioscope

Cardioscope as sub system

Multi channel display system.

CT SCAN, MRI

#### 7 **PATIENT MONITORING SYSTEM:**

Concept, block diagram are working.

Microprocessor application in patient monitoring.

#### 8 **ULTRASOUND INSTRUMENTATION:**

Basic principles of ultra-sonics

Doppler principle

Fetal Monitor

Pulse-echo technique

Pulse-echo instrument and imaging

Imaging system, scanners.

#### 9 **DEFIBRILLATOR AND PACE MAKERS:**

Block Diagram and principle of

DC defibrillator

Synchronised defibrillator Pacemakers.

- 10 PHYSIOTHERAPYS:  
Short wave dia-thermy machine  
Control of output power  
Application techniques

11 LOW VOLTAGE THERAPY INSTRUMENTS:

- Diagnosticstimulators  
Therapy stimulators  
Constant current/constant voltage stimulators.

MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making  
Actual laboratory and practical work, model/prototype making, assembly and disassembly  
exercises and viva-voce

## LIST OF PRACTICALS

- 1 To operate and familiarization with
  - A) B P Apparatus/Sphygmomanometer
  - B) Electronic B P meter
- 2 To operate and familiarization with Ventilator.
- 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 Measurement of Heart rate using stethoscope.
- 6 Measurement of Heart Sound using Phonocardiography machine.
- 7 To record electrical parameters of the Heart using ECG machine and determine the heart rate, time and amplitude of QRS Complex
- 8 To measure The EMG signals and interface with PC
- 9 To measure Human Body temperature using clinical Thermometer and Digital thermometer.
- 10 To measure pH of a given biological solution (Blood/urine) using pH meter.
- 11 To detect Blood Group using Antigens.
- 12 Operation and use of Electro-Physiotherapy.

- 13 To measure Air Flow using spirometer.
- 14 Study & Installation of medical equipments in laboratories of Hospitals precautions to be taken.

#### RECOMMENDED BOOKS

- 1 R.S. Khandpur, Biomedical Instrumentation Technology and Application, McGraw-Hill Professional, 2004
- 2 Leslie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer. "Biomedical Instrumentation and Measurement," 2<sup>nd</sup> Edition, PHI 2003
- 3 Fundamental of Biomedical instrumentation by Dr. O.N. Pandey

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	5	5
2.	5	10
3.	5	10
4.	5	10
5.	5	10
6.	5	10
7.	5	10
8.	5	10
9.	5	8
10.	5	10
11.	6	7
Total	56	100

## 6.4.1 SPECIALISED INSTRUMENTS

L T P

4 - -

## RATIONALE

The objective of this subject is to prepare students of I & C Engineering to know about various types of instruments used for testing, measurement and analysis of solid, liquid and gaseous samples and objects. These instruments are used in different types of industries, process plants and research laboratories. As the students will have to test, operate, maintain and calibrate various testing and analytical instruments, this subject has been designed to develop basic concept and skills of these testing and analytical instruments.

## LEARNING OUTCOMES

After completion of the course, the students should be able to:

Understand X-rays, its production and use for non-destructive testing by different methods.

Understand Ultrasonic, its production and use for non-destructive testing and measurement by different methods.

Understand Radioactivity and various types of nuclear radiations, Counters for detecting and measurement of nuclear radiations, Testing and Measurement using radioactivity.

Understand Gas-Liquid Chromatography, Gas analysis using various Detectors.

Understand Electrophoresis and Polarography.

Understand electromagnetic spectrum, Emission Spectra and Absorption Spectra, Photometer, Colorimeter and Spectrophotometer for Visible, Ultra-violet and Infra-red radiations. Flame Photometer.

Understand functions of Analyser, Principle and working of Infra-red and Zirconium oxide based analyser, Sampling techniques.

## DETAILED CONTENTS

## 1 X-RAYS:

1.1 Generation of X-rays and its characteristics, Application and use of X-ray in non-destructive testing with the help of following methods.

(a) Roentgenographic method (Radiographic method)

(b) Xerographic method.

© Roentgenoscopic method (Fluoroscopic method).

1.2 Precautions and Protection from X-rays

## 2 ULTRA SONIC:

2.1 Ultrasonic-properties and uses, ultrasonic transducers, Generation of Ultrasonic waves, its application in non-destructive testing by following method.

(a) Direct sounding or Transmission or shadow method.

(b) Oscillation reflection method.

(c) Ultrasonic pulse method.

2.2 Application of Ultrasonic for thickness measurement (Resonance method).

- 3 NUCLEAR INSTRUMENTS:  
Types of nuclear radiation, measurement of radio activity, Ionisation chamber, Proportional counter, Geiger-Muller counter and Scintillation counter. Application of Gamma Rays in non- destructive testing by radioactive methods. Application of radio activity in density and thickness measurement.
- 4 CHROMATOGRAPHY:  
Principle of Chromatography, Gas liquid chromatography, Applications in measuring air pollutants, Gas analysis- Using thermal conductivity, Flame ionisation detector and Electron Capture Detector.  
Introduction to HPLC
- 5 ELECTROPHORESIS:  
The principle of working of Electrophoresis, Electrophoresis techniques, Paper electrophoresis, uses.  
Polarography-Principle & working, uses.
- 6 SPECTROPHOTOMETRY:  
6.1 Electromagnetic Spectrum, Beer Lambert Law, Components of an absorption instrument, Principle of colorimeter and filter photometer, Single beam and dual beam filter photometer, Direct reading type and double beam spectrophotometer for visible, infrared and ultraviolet regions, advantages of double beam spectrophotometer and Applications.  
6.2 Principle of flame photometry, Flame photometers-Components, working and its applications.
- 7 GAS ANALYSER AND SAMPLING TECHNIQUE:  
7.1 Basic function of analyser, types of analysers- Infrared and Zirconium oxide based analyser, Working principle and construction of gas analyser, Precautions to be taken in maintaining accuracy, Need of sampling, types of samples and technique of sampling.

#### INSTRUCTIONAL STRATEGY

The teachers should give emphasis on understanding of concept and working principles. Also the teacher can use charts, PowerPoint presentation as well as videos/animations to explain construction and working of various instruments. Industrial visits will fulfill required necessary exposure to the instruments.

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

## RECOMMENDED BOOKS

- 1 Hand book of Analytical Instruments, R. S. Khandpur, Tata McGraw Hill, New Delhi
- 2 Analytical Instrumentation, Bela G. Liptak, Chilton Book Company
- 3 Principles of Industrial Instrumentation, D. Patranabis, Tata McGraw Hill, New Delhi
- 4 Process Instrumentation & Control, A.P.Kulkarni, NiraliPrakashan, Pune
- 5 Process Instrumentation & Control, A.P.Kulkarni, NiraliPrakashan, Pune
- 6 Non-destructive test and Evaluation, J. Prasad & C.G. Krishnadas Nair, Tata McGraw Hill, New Delhi
- 7 A Course in Electrical and Electronic Measurements and Instrumentation, Sawhney A. K., Dhanpat Rai & Co.
- 8 Industrial Electronics & Control, S.K. Bhattacharya & S. Chatarjee, Tata McGraw Hill, New Delhi

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	8	15
2.	8	15
3.	10	15
4.	8	15
5.	6	10
6.	10	15
7.	8	15
Total	56	100

## 6.4.2 ROBOTICS

L T P

4 - -

## RATIONALE

In recent times, automation in various industries has increased manifolds. For automation, robots are used in different ways in the industry. The objective of this subject is to prepare students of I & C Engineering to familiarize with robots which will help them in the field of automation. Also this will make students future ready as the robots are going to be used in all walks of life.

## LEARNING OUTCOMES

After completion of the course, the students should be able to:

Understand fundamental of Robots, its advantages and disadvantages, degrees of freedom.

Understand components of Robot, types of Robots.

Compare various robotic controller and differentiate them.

Understand End effectors and Grippers.

Explain vision system and sensors used in robots.

Understand Robotic programming and Language.

Appreciate uses and applications of Robots in industry and other fields.

## DETAILED CONTENTS

## 1 FUNDAMENTALS OF ROBOT

Definition of Robot, Difference between a robot and an automated machine, Advantages and Disadvantages of Robots .Classification -Cartesian, Polar, Cylindrical, Jointed arm, SCARA robot. Basic motions of Robot or degrees of freedom. Factors for Selection of a robot.

## 2 ROBOTIC SYSTEMS

Introduction , Basic components of robotics system ,Mechanical Design of a Robot, Types of Mechanical Joints, Robots Qualities, Robot Specifications, Robot's kinematic Control, types of controller used in robotic system, Non Servo Control , Servo Control –point-to-point and continuous path control, examples.

## 3 ROBOT END EFFECTORS

Definition of End Effectors, Types of End-effectors, Tools, Types of Tools, Characteristics and elements of End-arm tooling, Description of Mechanical grippers –Two & three finger gripper, Vacuum grippers, Magnetic grippers, Adhesive grippers.

## 4 ROBOTIC SENSORS

Definition of Robotic Sensor, Characteristics of a Sensing device, Types of Sensors- External and Internal sensors, Touch or Tactile Sensors - Binary & Analog sensors , Strain Gauge, Position and displacement sensors- Optical encoder-LVDT, Proximity Sensors – Contact & Non-contact proximity sensors, Optical proximity sensor, Ultrasonic sensors,



Fibre optic scanning sensors, Scanning laser sensors, Range sensors, Definition of Robotic Vision ,Functions of Robot vision systems, Components of machine vision system ,Advantages of Machine vision, Industrial Applications.

#### 5 ROBOT PROGRAMMING AND LANGUAGES

Definition of Robot program. Online and Offline Programming, Programming approaches – Robot oriented programming , Object oriented or Task level programming . Methods to program the Robot work cycle. Robot Programming Languages, Requirement of a Robot programming Language,Types of Robot languages. Example of a robot program.

#### 6 ROBOT APPLICATIONS

Applications of Robots, Applications in manufacturing, Examples-Spray Painting, Welding, Material Handling and transfer, Machine loading and unloading applications, Sorting of parts, Inspection of parts, Automatic guided vehicle system. Precautions for Robot, Future of Robots.

### INSTRUCTIONAL STRATEGY

The teachers should give emphasis on understanding of concept and working principles. Also the teacher can use charts, PowerPoint presentation as well as videos/animations to explain construction and working of various robotic concepts. The teacher may ask students to collect information and data about various types of robots used in the industry. Students can also make projects based on robotics. Quiz/Assignment/Seminar can be held in the classes to enhance knowledge of students. Industrial visits will fulfill required necessary exposure to the instruments.

### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making Model/prototype making, assembly and disassembly exercises and viva-voce

### RECOMMENDED BOOKS

- 1 Industrial Automation and Robotics, A. K. Gupta and S. K. Arora, University Science Press
- 2 Robotics and Industrial Automation, R. K. Rajput, S. Chand, New Delhi
- 3 Automation and Robotics, Khushdeep Goyal, Deepak Bhandari, S. K. Kataria & sons
- 4 Robotics and Controls, R. K. Mittal & I. J. Nagarath, Tata McGraw Hill

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	15
2	10	20
3	8	15
4	12	20
5	10	15
6	8	15
Total	56	100

## 6.4.3 NEURAL NETWORK

L T P

4 - -

Rationale:

This course introduces the basic models, learning algorithms, and some applications of neural networks. After this course, we should be able to know how to use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, and so on.

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

Understand Basic neuron models, application classification and Basic approach of the working of ANN

Identify Supervised Learning Single-layer Networks

Understand Unsupervised Learning

Differentiate different networks

Learn Basic application like Pattern recognition, function approximation, information visualization, etc

## TOPIC WISE DISTRIBUTION OF PERIODS

## DETAIL CONTENTS

1: Fundamentals of Neural Networks: Introduction, Biological Neurons and Memory, Structure & Function of a single Neuron, Artificial Neural Networks (ANN). Typical Application of ANN Classification, Clustering, Pattern Recognition, Function Approximation.

Basic approach of the working of ANN – Training, Learning and Generalization.

2: Supervised Learning: Single-layer Networks, Linear Separability, handling linearly non-separable sets. Training algorithm. Error correction & gradient decent rules.

Multi-layer network- Architecture, Back Propagation Algorithm (BPA) – Various parameters and their selection, Applications, Feedforward Network, Radial- Basis Function (RBF) network & its learning strategies.

3: Unsupervised Learning: Winner-takes all Networks, Hamming Networks. Adaptive Resonance Theory, Kohonen's Self organizing Maps.

4: Neurodynamical models: Stability of Equilibrium states, Hopfield Network, Brain-state-in-a-Box network, Bidirectional associative memories.

5: Applications: Pattern recognition, function approximation, information visualization.

## Recommended Books:

1. Satish Kumar – Neural Network: A classroom approach
2. Jacek M.Zurada- Artificial Neural Networks
3. Simon Haykin- Artificial Neural Network

## ` SUGGESTED DISTRIBUTION OF MARKS

Topic No.	No. of Periods	Marks (%)
1	10	20
2	13	20

3	13	20
4	10	20
5	10	20
Total	56	100

## 6.5 PROJECT WORK

L T P

- - 8

### RATIONALE

Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

### LEARNING OUTCOMES

After undergoing the project work, the students will be able to:

Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project.

Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study

Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.

Develop firsthand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.

Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc. Assemble/fabricate and test an electronics gadget.

### General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish

close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

Some of the project activities are given below:

- Projects related to designing small electronic equipment / instruments.
- Projects related to increasing productivity in electronic manufacturing areas.
- Projects related to quality assurance.
- Projects connected with repair and maintenance of plant and equipment.
- Projects related to design of PCBs.
- Projects related to suggesting substitutes of electronics components being used.
- Projects related to design of small oscillators and amplifier circuits.
- Projects related to design, fabrication, testing and application of simple digital circuits and components.

- Projects related to microprocessor/microcontroller based circuits/ instruments.

Some of the projects based on above areas are listed below for the benefit of students:

1. Microprocessor/Microcontroller based rolling display/bell and calendar
2. Microprocessor based stepper motor control.
3. Speed control of DC Machines by Microprocessor/Microcontrollers
4. Temperature monitoring using Microprocessor/Microcontroller based systems.
5. Microprocessor/Microcontroller based liquid level indicator and control
6. Fabrication and assembling of digital clock.
7. Fabrication of ON line/OFF line UPS of different ratings and inverters
8. Design, fabrication and testing of different types of experimental boards
9. Repair of oscilloscope, function generator
10. Microprocessor/Microcontroller based solar tracking system
11. GSM based car or home security system
12. Bank token display using microcontroller
13. Microprocessor/Microcontroller Based A/D converter
14. Microprocessor/Microcontroller Based D/A converter
15. Simulation of half wave and full wave rectifiers using Simulation Software
16. Simulation of class A, Class B, Class AB and Class C amplifiers
17. Simulation of different wave forms like sine, square, triangular waves etc.

GPS based vehicle tracking system

Calculate BER(Bit Error Rate) of various modulation techniques

Electronic Weighing Machines

Setting up home security system using biometrics and video recording

Making an overhead tank water level controller using a pump and control system

PLC based water level controller/sequential motor starter/bottling plant/traffic light control.

Some Suggested Projects for I&C Engg

Motion Based Automatic Door Opener

Ultrasonic Distance Measurement  
 Liquid Level Controller System  
 Liquid Flow Measurement & Control  
 Boiler Pressure Controller System  
 PLC based Temperature/Level/Pressure/Flow Control System  
 DC Motor Speed Control  
 Home Automation  
 Robotic Arm Movement Control  
 Room Temperature Controller  
 Fire and Hazardous Gas Detection Alarming System  
 Automatic Light Intensity Controller  
 Any other innovative project related to the prescribed syllabus

## NOTE:

The list is only the guideline for selecting a project; however a student is at liberty to select any other related project of his choice independently under guidance of his teacher.

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance Criteria	Max.** Marks	Rating Scale				
			Excellent	Very Good	Good	Fair	Poor
1.	Selection of project assignment	10%	10	8	6	4	2
2.	Planning and execution of considerations	10%	10	8	6	4	2
3.	Quality of performance	20%	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5.	Sense of responsibility	10%	10	8	6	4	2
6.	Self expression/ communication skills	5%	5	4	3	2	1
7.	Interpersonal skills/human relations	5%	5	4	3	2	1
8.	Report writing skills	10%	10	8	6	4	2
9.	Viva voce	10%	10	8	6	4	2
Total marks		100	100	80	60	40	20

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get “Overall Good grade” failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared “not eligible to receive diploma”. It is also important to note that the students must get more than six “goods” or above “good” grade in different performance criteria items in order to get “Overall Good” grade.

	Range of maximum marks	Overall grade
i)	More than 80	Excellent
ii)	79 > 65	Very good
iii)	64 > 50	Good
iv)	49 > 40	Fair
v)	Less than 40	Poor

### Important Notes

This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.

The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.

The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.

It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations in such an exhibition.



## 10. RESOURCE REQUIREMENT

### 10.1 PHYSICAL RESOURCES

#### (A) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

#### (B) Equipment requirement:

Following Laboratories/Shops are required for Diploma Programme in Instrumentation & Control Engineering:  
Communication Skills Lab  
Applied Physics Lab  
Applied Chemistry Lab

Engineering Drawing  
Electrical Engineering Lab  
Basics of IT Lab/Computer Lab  
Carpentry Shop  
Painting and Polishing Shop  
Fitting and Plumbing Shop  
Sheet Metal Shop  
Welding Shop  
Electronic Lab  
Digital Electronic and Microprocessor  
Instrumentation and Control Lab  
Computer Lab  
Electrical Engineering Lab  
Process Instrumentation Lab  
Transducers & Application Lab  
Process Control Lab  
Industrial Control Lab  
Bio-Medical Instruments Lab

## EQUIPMENT REQUIRED FOR ELECTRONICS ENGINEERING

Sr. No.	Description	Qty	Total Price (Rs)
<b>COMMUNICATION SKILLS LABORATORY</b>			
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500
<b>APPLIED PHYSICS LABORATORY</b>			
1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12	2,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12	2,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12	2,000
4.	Mirrors (convex, concave)	5 Each	1,500
5.	Pendulum Setup	02	4,000
6.	Gravesand's Apparatus	02	3,000
7.	Inclined Plane Setup	02	2,000
8.	Flywheel Setup	02	4,000
9.	Prism	05	1,500
10.	Spectrometer	02	25,000
Sr. No.	Description	Qty	Total Price (Rs)
11.	DC Ammeters Moving coil weston-type ammeter with ebonite stand	10	3,500
12.	DC Miliammeters	2	1,000
13.	DC Microammeters	2	700
14.	DC voltmeters	10	700
15.	DC Millivoltmeters	10	2,000
16.	Sensitivity Galvanometer	2	800
17.	Student Galvanometers	10	4,000

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18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	2	1,000
19.	D type DC Voltmeter Range : 0 to 1 Volt	2	1,000
20.	D type Galvanometers Sensitivity : 20 microamperes per scale division,	8	8,000
21.	Resistance boxes (dial type) assorted	8	8,000
22.	Rheostats	10	4,000
23.	Miscellaneous items (Spring, Pan, Glycerine, Optic fibre, Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall type)	2	20,000
25.	Stoke's Apparatus	2	10,000
26.	Gumther's Apparatus	2	16,000
27.	Resonance Tube Apparatus with accessories and Tuning fork set	2	14,000
28.	Sodium Lamp setup with Biprism	2	10,000
29.	Ohmic resistance coil	10	5,00
30.	Slide wire bridge	2	8,000
31.	PN Junction diode Apparatus	2	10,000
32.	Laser (as per requirement)	1	1,00,000
33.	Numerical aperture setup	1	25,000
34.	Miscellaneous	LS	3,000
Sr. No.	Description	Qty	Total Price (Rs)
<b>APPLIED CHEMISTRY LABORATORY</b>			
	Digital Balance	1	80,000
	Burette 50ml	30	3,000
	Pipette 25ml	60	4,000
	Beakers 100ml	60	4,000
	Burette stand	30	30,000
	Glazed tile	30	1,000
	Conical flask 50ml (Titration flask)	60	4,000
	Standard (Measuring) flask (to prepare standard solution) 250ml/100ml	30	6,000
	Able's Flash Point apparatus	2	10,000
	(1/10)°C thermometer	06	6,000
	Candles	20	100
	Crucible with lid	06	2,000
	Muffle furnace	1	18,000
	Decicators	06	8,000
	Pair of tongue (small and big)	24 (small) 2 (big)	2,000

	Chemicals EDTA-1 kg Eriochrome Black-T(solochrome black T)-200g Buffer solution (NH <sub>3</sub> - 2.5 ltr, NH <sub>4</sub> Cl – 1 kg) Zinc sulphate- 500g H <sub>2</sub> SO <sub>4</sub> - 2.5 ltr Phenolphthalein indicator (as per requirement) Methyl orange indicator (as per requirement) Charcoal (as per requirement) Kerosene- 1 ltr	LS	20,000
	Miscellaneous	LS	2,000
Sr. No.	Description	Qty	Total Price (Rs)
<b>ENGINEERING DRAWING</b>			
1.	Drawing Boards (700 x 500mm)	60	25,000
2.	Draughtsman Tables	60	1,80,000
3.	Draughtsman Stools	60	40,000
4.	Computer Aided Drawing (CAD) Software	30 User	5,00,000
5.	Model of different wooder joints	1	1,000
6.	Model of different screw threads	1	1,000
7.	Model of various locking devices	1	1,000
8.	Model of various joints	1	1,000
9.	Cut section Model of various couplings	1	3,000
10.	Miscellaneous	LS	5,000
<b>ELECTRICAL ENGINEERING LABORTORY</b>			
1.	Voltmeter	5	7,500
2.	Ammeter	5	10,000
3.	CRO	1	15,000
4.	Wattmeter	5	10,000
5.	Multimeter	1	4,000
6.	Resistive load	1	4,000
7.	Regulated supply	1	8,000
8.	Signal generator	1	5,000
9.	Rheostat	2	2,500
10.	Lead acid battery	1	4,000
11.	Cables, Coils, Lamp (as per requirements)	LS	1,500
12.	Resistance, Inductor, Capacitor (as per requirements)	LS	1,500
13.	Miscellaneous	LS	1,500

Sr. No.	Description	Qty	Total Price (Rs)
<b>BASICS OF IT LABORATORY/COMPUTER LABORATORY</b>			
1.	Computer System with latest configuration	30	8,00,000
2.	Printer (MFP)	1	25,000
3.	Printer (Laser)	1	35,000
4.	Plotter	1	75,000
5.	Digitiser	1	50,000
6.	Antivirus Software	LS	10,000
7.	Internet Facility on Computers	LS	2,00,000
8.	LCD Projector	1	35,000
9.	UPS	60	1,20,000
10.	Software (latest windows, latest MS Office)	1	1,00,000
11.	Scanner	1	10,000
12.	Miscellaneous	LS	5,000
<b>CARPENTRY SHOP</b>			
1	Work benches fitted with carpenter vices	5	20,000
2.	Circular saw grinder	1	6,000
3.	Wood cutting band saw-vertical	1	10,000
4.	Bench grinder	1	5,000
5.	Drilling machine	1	8,000
6.	Wood turning lathe	1	40,000
7.	Wood Planner	1	20,000
8.	Tool accessories measuring and marking Instruments	25	25,000
9.	Band saw blade brazing unit	1	10,000
10.	Miscellaneous	LS	1,500

Sr. No.	Description	Qty	Total Price (Rs)
<b>PAINTING AND POLISHING SHOP</b>			
1.	Spray gun with hose pipe	1	1,000
2.	Paint brushes	20	2,000
3.	Paint/Varnish	LS	2,000
4.	Air Compressor with 2 hp motor	1 set	10,000
5.	Miscellaneous	LS	2,000
<b>FITTING AND PLUMBING SHOP</b>			
1.	Work benches with vices (4 vices on each bench)	5	30,000
2.	Marking tables with scribes	4	24,000
3.	Surface plates	5	20,000

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4.	Accessories like calipers, V blocks, height, gauges steel rules and scribers	25	50,000
5.	Tool kits – taps, dies, drills	25	40,000
6.	Tool kits – chisels, hammers, files, hacksaw	25	25,000
7.	Drilling machine	2	12,000
8.	Pipe vice	4	1,000
9.	Chain wrenches	5	1,250
10.	Ring spanner set	5	600
11.	Pipe die set 2”	2 set	1,000
12.	Pipe bending device	1	5,000
13.	Various plumbing fittings	LS	2,000
14.	Miscellaneous	LS	1,500
<b>SHEET METAL SHOP</b>			
1.	Hammers	8	3,000
2.	Mallets (Hard & Soft)	5	2,000
3.	Sheet and wire Ganges	LS	8,00
4.	Shearing Machine	1	20,000

Sr. No.	Description	Qty	Total Price (Rs)
5.	Bar folding Machine	1	20,000
6.	Burring machine	1	10,000
7.	Various sheet (black plain, galvanized iron, corrugated, Aluminium)	1 Each	1,000
8.	Hand Shears/Snippers	4	2,000
9.	Nuts, Bolts, Rivets, Screw	LS	5,00
10.	Miscellaneous	LS	1,000
<b>WELDING SHOP</b>			
1.	Electrical welding transformer set with accessories	3	30,000
2.	Gas Cutting Unit	1	3,000
3.	Work benches with vices	3	5,000
4.	Welding generator set	1	10,000
5.	Oxy acetylene welding set with accessories	1	7,000
6.	Acetylene generating set	1	6,000
7.	Electric welder tool kit	10	10,000
8.	Projection welding machine	1	15,000
9.	Brazing equipment with accessories	1	10,000
10.	Soldering irons	3	1,000
11.	Pedestal grinder	1	10,000
12.	Metal spraying gun	1	10,000
13.	Spot welder	1	25,000
14.	TIG welding set	1	1,00,000
15.	MIG welding set	1	1,00,000

16.	Welding Partition Screen	5	2,500
17.	Miscellaneous	LS	3,000
Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs) Per Unit
ELECTRONICS LABORATORY			
1.	DC regulated low voltage variable power supply	10,	25,000
2.	DC regulated multiple output power supply	4	12,000
3.	Audio oscillator	4	16,000
4.	Wide band RC Oscillator	4	10,000
5.	RF Signal Generator	2	8,000
6.	Pulse Generator	2	10,000
7.	Function Generator	4	20,000
8.	Single trace CRO with accessories	4	60,000
9.	Dual trace CRO with accessories	4	1,00,000
10.	Electronic Multimeter DC and AC with different ranges	8	30,000
11.	Electronics digital Multimeter three and a half digit	8	25,000
12.	Digital LCR- Q meter	2	20,000
13.	Transistor tester type 911	1	5,000
14.	Audio output power meter	2	6,000
15.	Mains Voltage stabilizer(3 KVA)	1	10,000
16.	AC Millivoltmeters	4	16,000
17.	DC Millivoltmeters	2	6,000
18.	Voltmeter	5	3,000
19.	DC Ammeter	5	3,000
20.	Battery of different voltage and Ampere hour	2	3,000
21.	Single Phase variac	3	6,000
22.	Rheostat of different wattage and resistance	5	3,000
23.	Servo stabilizer power supply	1	8,000
24.	IC Bread Boards	20	10,000
25.	Distortion factor meter	1	10,000
26.	Decade resistance, capacitance and inductance (four each)	12	12,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs) Per Unit
27.	Transducers: Pressure type, thermocouple, LVDT, opto Pick-up, electromagnetic pick-up, ultrasonic pick-up and	LS	30,000



	potentiometer etc		
28.	Thyristor control experimental kits Instrumentation/Transducer experimental kit. Basic electronic experiment kit	LS	2,50,000
29.	Digital Panel meters	6	3,000
30.	Digital thermometer	1	4,000
31.	Stroboscope cum motor drive disc	1	10,000
32.	Digital load indicator with load Cells	1	10,000
33.	Digital Lux meter	1	8,000
34.	CROs 20 MHz (Scientific Make)	6 Nos.	22,000
35.	Function Generators Audio Frequency	6 Nos.	7,500
36.	Regulated Power Supply	6 Nos.	3,600
37.	Multimeter (Digital)	10 Nos.	2,000
38.	Rectifier Kits	6 Nos.	2,200
39.	Filter Circuit Kit	6 Nos.	2,200
40.	Bread Boards	12 Nos.	2,800
41.	Transistor Kits CB CE	6 Nos. 6 Nos.	2,400 2,400
42.	FETs	6 Nos.	2,400
43.	Operational Amplifier Kits	6 Nos.	3,000
44.	Raw Materials	LS	20,000
45.	Kit for clamping Circuits	05	
46.	Kit for clipping Circuits	05	
47.	Kit for Monostable MV	05	
48.	Kit for Astable MV (555)	05	
Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs) Per Unit
49.	Kit for i) Hackling Oscillator ii) Cal pelt Oscillator iii) Weir Bridge Oscillator iv) RC Phase shift Oscillator v) Crystal Oscillator	5 each	
50.	Kit to plot V-I characteristics of i) P-N Junction Diode ii) Zenor Diode iii) BJT iv) FET	05	
51.	Kit for CB, CE, CC Configurations	05	
<b>ELECTRONIC DESIGN AND SIMULATION TECHNIQUES</b>			
1.	Computers	20	
2.	Softwares:- DIP Trace /ORCAD/LAB VIEW/WIN SPICE etc.		

ELECTRONICS WORKSHOP			
1.	Hand Tools Set	5	5,000
2.	Soldering Set`	5,	5,000
3.	Hand Drill	1	3,000
4.	PCB Etching Machine	2	2,500
5.	Silk Screen Printing	2 set	50,000
6.	Drafting Equipment	1 set	15,000
7.	PCB Drilling Machine	1	10,000
8.	Sheet metal folding and binding machine	1	20,000
9.	Sheet metal cutting machine	1	5,000
10.	Centre Lathe	1	15,000
11.	Grinder	1	6,000
12.	Circular saw	1	6,000
13.	DC regulated low voltage variable power supply	2	12,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs) Per Unit
14.	Audio Oscillator	2	6,000
15.	RF Signal generator	2	8,000
16.	Digital LCR-Q meter	2	10,000
17.	Digital multi-meter	4	12,000
18.	Dual trace/DSO	4	25,000
19.	AC Milivoltmeter	2	3,500
20.	IC Bread boards	6	3,000
21.	Soldering stations temperature controlled	0	10,500
22.	Solder suckers with accessories	10	500
23	Digital IC Tester	02	5000
DIGITAL ELECTRONICS AND MICROPROCESSORS LABORATORY			
1.	DC regulated low voltage variable power supply	6	15,000
2.	DC regulated multiple output power supply	3	9,000
3.	Digital IC power supply	8	10,000
4.	Electronic Digital Multimeter	6	9,000
5.	CRO Dual trace, 25 MHz	4	1,00,000
6.	Digital frequency meter/universal Counter timer	2	20,000
7.	Pulse Generator	2	10,000
8.	Logic probes (TTL and CMOS)	10	2,500
9.	Digital logic trainer (TTL)	4	20,000
10.	Logic Trainer Boards	10	10,000
11.	Microprocessor trainer Kits 8085	10	50,000
12.	Microprocessor Trainer Kits 8086	2	60,000
13.	Computer Trainer	1	30,000

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14.	Interfacing Cards	5	2,50,000
15.	Micro-controller Kit 8051 based	10	1,00,000
16.	Digital IC Tester	1 No.	50,000
17	Universal Programmer	2No.	7,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs) Per Unit
18	Digital Multimeter	10 No.	60,000
19.	EPROM Programme	2	10,000
20.	EPROM Eraser	2	1,500
21	Additional cards	LS	50,000
22	Ink jet Printers	2	6,000
23.	Laser Printers	2	12000
24	Scanners	2	5000
25	Copier	1	3000
26	Scanner cum Copier cum Printer, Fax	1	4500
<b>MEASUREMENT LABORATORY</b>			
1.	Light Measurement (Photocells) Kit	4 Nos.	15,000
2.	LVDT Kit	4 Nos.	8,000
3.	Pressure Measurement Kit	4 Nos.	9,500
4.	Strain Measurement Kit	4 Nos.	14,000
5.	Water Level Measurement Kit	4Nos.	11,500
6.	RPM Measurement Kit	4Nos.	5,000
7.	Temperature Measurement Kit	4Nos.	5,000
8.	Maxwell's Bridge Kit	4Nos.	7,500
9.	Wein's Bridge Kit	4 Nos.	4,500
10.	Anderson Bridge Kit	4 Nos.	5,000
11.	Flux Meter (Digital) Kit	4 Nos.	5,000
12.	Q. Meter (Digital) Kit	4 Nos.	5,000
13	pH meter kit	4 Nos.	
14	Wheat stone bridge kit	4 Nos.	
<b>ELECTRICAL MACHINE LABORATORY</b>			
1.	Ammeter, Voltmeter, Wattmeter and Energy Meters (3- phase and 1- phase)	8 each	40,000
2.	3-Phase Resistive load	4 Nos.	16,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs) Per Unit
3.	LCR/Q Bridge	1	5,000
4.	Tong tester	4	12,000
5.	Transformer (single phase)	2	16,000
6.	Watt meter, Volt meter, Ammeter,	2 each	10,000
7.	DC Shunt Motor, 2 hp with loading arrangement	1	20,000
8.	Induction Motor (Single phase)	2	10,000
9.	Induction Motor (Three phase)	2	10,000
10.	Slipping Induction Motor 3 HP with loading facility	1	25,000
11.	Alternator and Load for Alternators	1	25,000
12.	DC generator with prime-mover motor	2	25,000
13.	DC Regulated Power Supply	2	6,000
14.	Starters (DOL and Star Delta)	2 each	8,000
15.	Rheostats	4	12,000
16.	Tacho meters (digital)	2	15,000
17.	Maggar (Insulation Tester)	2	5,000
18.	Earth Tester	2	10,000
19.	Digital Multi-meter	10	32,000
20.	Rectifier, Inverter Set	1	10,000

#### PROCESS INSTRUMENTATION LAB

1	Burden type, diaphragm type, bellows type pressure gauge of different sizes & ranges upto 10 Kg. cm <sup>2</sup> (Also calibrated in psi) Complete setup for comparing regarding by different method mentioned above with air pressure regulator & filter for varying pressure along with small vacuum pump	1 Each	
2	1. Vacuum gauge	1	500
	2. Monometer (Mercury Filled)	1	500
	3. Vacuum Pump	1	2000
3	Bourden sensor 0-10 kg cm circular chart recorder for recording speed ½ hr., 1 hr, 12 hr, 24 hr with precision air pressure regulator & filter input 10 kg cm <sup>2</sup> & output 0-10 kg cm <sup>2</sup>	1	50000
4	Dead weight pressure gauge tester along with standard dead weight accuracy +0.1% range upto 20 kg cm <sup>2</sup> (0-10 kg cm <sup>2</sup> )	1	50000
5	Level measurement setup having sight glass tube float & bubbler method with pressure regulator bubble counting unit and digital pressure indicator	1	5000

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6	Level limiting switches (different type)	1 No.	2000
7	Contract type and non-contact type speed measurement setup	01 (Setup)	20000
	Motor ¼ HP with speed regulator		
	Magnetic Pick Up		
	Photo electric method		
	Digital hand held tachometer with various coupling		
	Stroboscope		
8	Temperature measurement setup along with heat source (variable temp.) and various sensors e.g RTD, Thermocouple ( various types and various shapes) Total radiation pyrometer temperature range 0-400 °C Furnace muffle (0-1000°C) with temperature controller indicator.	1 No.	30000
9	Hot temperature bath	1 No.	10000
	Iron / Constantan C/A1, Pt, Kh	1 No.	5000
10	Potentimeter	1 No.	1000
	Thermocouple Test set	1 No.	2000
	Temperature Indi	1 No.	1500
11	Electromagnetic flowMeter	1 No.	25000
	Pump Set	1 No.	
	Tank	1 No.	
12	Temperature recorder	1 No.	8000
	Sensor	1 No.	

13

## PROCESS INSTRUMENTATION LAB

Sl. No.	Name of Experiment	Apparatus Qty.		Price
1.	Measurement of pressure by Various Method A. Bourdon Tube B. U-tube & inclined tube mano meter (water & Hg filled) C. Wall type mono meter D. Vaccum Measurement	Burden type, dis pheagam type, bellow type pressure Each guage of different sizes & tanges upto 10 Kg. cm2 (Also calibrated in psi) Complete setup for comparing regarding by different method mentioned above with air pressure regulator & filter for varying pressure along small vaccum pump	1	

2.	Measurement of Vacuum by Vacuum gauge & manometer.	1. Vacuum gauge 2. Monometer(Mercury Filled) 3. Vacuum Pump		500
3.	To record the pressure by pressure recorder (Complete Set)	Bourden sensor 0-10 kg cm circular chart recorder for recording speed 1/2 hr., 1 hr 12 hr, 24 hr with precision air pressure regulator & filter input 10 kg cm <sup>2</sup> & output 0-10 Kg cm <sup>2</sup>	1	50000
4.	To calibrate pressure gauge by dead weight tester.	Dead weight pressure gauge tester along with standard dead weight accuracy +0.1% range upto 20 kg cm <sup>2</sup> (0-10 kg cm <sup>2</sup> )	1	50000
5.	Measurement of liquid level by float method and air bubbler method (Complete Set)	Level measurement setup having sight glass tube float & bubbler method with pressure regulator bubble counting unit and digital pressure indicator	1	5000
6.	To study the construction & operation level limiting switches	1. Level limiting switches (different type).	1 No.	2000
7.	Measurement speed of motor by hand tachometer	Contract type and non-contact type speed measurement setup A. Motor 1/4 HP with speed regulator B. Magnetic Pick Up C. Photo electric method D. Digital hand held tachometer with various coupling E. Stroboscope	1 (setup)	20000

8.	Measurement of Temperature dial thermometer, Bimetallic thermometer & resistance thermometer, Thermocouple thermometer & pyrometer	Temperature measurement setup alongwith heat source(variable temp.) and various sensors e.g RTD, Thermocouple(various types and various shapes) Total radiation pyrometer temperature range 0-400oC Furnace muffle (0-1000oC) with temperature controller indicator.	1	30000
9.	Measurement of temperature by different thermocouple such as	1. Hot temperature bath	1 No.	10000
		2. Iron/Constantan C/Al, Pt,Kh Thermocouple	1 No.	5000
10.	Calibration of temperature indicator by Potentiometer/Thermocouple Test Set.	1. Potentiometer	1 No.	1000
		2. Thermocouple Test set	1 No.	2000
		3. Temperature Indi	1 No.	1500
11.	Study the construction & operation of electro-magnetic flow meter.	1. Electromagnetic flow Meter	1 No.	
		2. Pump Set	1 No.	25000
		3. Tank	1 No.	

12.	Study of temperature recorder & temperature recording by temperature recorder.	1. Temperature recorder 2. Sensor	1 No. 1 No.	8000
13.	Measurement of flow by Orifice meter, Venturi meter, Rota Meter Pilot tube & Magnetic Flowmeter	Experimental Setup For Measurement of Flow with pump & water circulating system having all methods with flow variation	1	50000
<p>1. Sump Tank :Material :Stainless Steel, 2mm Thick/PP 55mm Thick</p> <p style="text-align: center;">Capacity :30 liter Dimension : 1ft(L) X 1ft(W) X 1ft(H)</p> <p>2. Piping : 1" class B GI with 1" SS valve :10 Nos.</p> <p>3. Centrifugal Pump " 1/2" HP, 230 V AC supply</p> <p>4. Rotameter : Range 0-2000 LPH Glass tube type/Acrylic body, Bob material : SS 304, Connection :1" Mounting " Intel-Bottom, Outlet - Top</p> <p>5. Orifice : 1" Line size, connectric type, MOC : Polypropylens (PP)/SS</p> <p>6. Ventury : 1" Line Size.</p> <p>7. Manometer : U tube manometer, H:400 mm Panel Mounting type</p> <p>8. Flowmeter : Size 1" type : Wheel flowmeter, Range 0-2000 LPH Output :4-20 mA/DPT</p> <p>9. Flow Indicator : 3.5 digit dispaly, 230 V AC operated Cut Out : 92mm X 92mm X 144mm Range : 0-2000 LPH, Input :4-20 Ma</p> <p>10. Electrical Control Pannel :MS Powder coated panel with switches,</p>				



	Indicator, Text Points, Controller on front facial, UK 2.5, thermal connector mounted on/DIN rail channel, Use of 1 sq. mm Multistrand wire proper insulated Lugs, Ferruling and neat wire dressing and clamping wires and power cables are seated through 1"X1" PCV cable tray, Dimension 1ft (L) X 1Ft (W) X 1ft (H).			
14.	To determine relative humidity by Hydrometer	Experimental setup having humidity chamber with fogger digital hand head battery operated device, 20-90% humidity measurement, memory for higher < lowest humidity with digital display	1	1000
15.	To study the constructional details and to measure percentage moistures of given sample by commercial moisture meter.	Experimental Setup for moisture measurement	1	20000
16.	To study the construction and operation of level limiting switches moistures of given sample by commercial moisture meter.	Experimental Setup for study of level limiting switches	1	5000

### **TRANSDUCERS & APPLICATION LAB**

Sl. No	Name of Experiment	Apparatus	Qty.	Price
1	To draw the output &	The Setup of LVDT having	1	15000

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	input characteristics of linear variable differential transducers.	Following Details A. LVDT of accuracy + 0.5% resolution of 0.1 mm, 3.5 digital display, TEST points provided to observe wave from on CRO, micrometer provided for mech. displacement with suitable variable powers supply variable tray		
2.	Fabrication of Ckts using L.V.D.T..	1. L. V. D. T. & Associated	1	5000
3.	To draw a light intensity V/S, O/P characteristics of LDR, Photo diode, Photo Transister Soler Dellconductive	Complete setup of photo transducers having following specification A. Photo Dicde Circuit B. Photo Transistor Circuit C. LDR Circuit D. Solar Cell Circuit For Characteristics Measurement E. Variable light intensity source with precision regulator F. Lux meter to measure intensity of light source G. Suitable power supply & Output digital device	1	10000
4.	To fabricate an applica circuit using photo transducer.	1. Photo Transducer 2. Circuits Components	1	5000
5.	To draw the characteristics of given temperature transducer, thermistor	Complete setup of temp. sensing device with suitable circuit to draw I/O characteristics having	1	10000

	and also fabricate an application circuit using thermistor.	following details. A. Temperature source like Small furnace with temp. controller & indicator B. Output measuring device (Digital) C. All temp. sensor e.g. RTD, Thermister, Thermo couple, solid state sensor etc.		
6.A.	Study & Construction details of a capacitive transducer.	Setup of capacitive Transducer having following details	1	10000
B.	To measure noice using	A. Metallic Guage Capacitor with angular displacement		
C.	consensee microphone To measure level using capacitive probe	B. Circuit for above C. Variable Freq. source with output device D. Condenser microphone & related circuit for noice measurement with sound sources and output measuring device E. Circuit for measuring level of liquid using capacitive probe.		
7.	To study the construct- ion of strain gauge and Rosset's and use it for measurement at stress or pressure.	Experimental Setup having Straingauge mounted on cantilever beam with weight pan & Standard weight with specification A. Display 3.5 digit 7 segment LED display B. Range 0-2 Kg C. Accuracy +0.5% D. Resolvtion 0.01, least count 1 gm Test point to plot weight vs strain guage output.	1	30000

8.	<i>To study the construction of a recorder.</i>	<i>A. Mechanical Recorder</i> <i>i. Circular chart recorder with input sensor and variable speed system with recording system</i> <i>ii. Strip chart recorder (Multi Point) with 3/4 sensor &amp; stylus(colour) having variable chart speed control</i> <i>iii. Electronics multi point recorder with LED display sensors &amp; computer interface</i>	1	30000
9.	<i>To study the Strain gauge, Load Cell and Strain gauge indicator</i>	<i>Setup of load cell &amp; its measuring system along with suitable power supply</i> <i>A. Range 0-100 kg or more</i> <i>B. Standard weights for calibration</i> <i>C. A Model of Dharma Kanta using load cell and its</i>	1	10000

		<i>measuring system (if dharmakanta model is not available than standard weight system along with digital display can be purchased)</i>		
10.	<i>To study the construction conductivity meter and its application.</i>	<i>Conductivity Meter Having Following specification A. Range 0.01 Mu siemens/cm to 199.0Mu siemens/cm in 5 different ranges B. Accuracy +02% C. Standard solution for calibration D. 3.5 digit 7 segment LED display with over range indication E. Two conductivity cells, cell stand &amp; Standard conductivity solutions.</i>	1	10000

11.	<i>To study the working principle and construction of PH meter.</i>	<i>pH meter having following specification A. pH range 0-14 with resolution 0.01 pH B. Accuracy +0.40 pH or +0.20 + 2 mv from measurement C. Temperature compensation 0-100 oC D. Glass electrode, Standard electrode &amp; combined electrode (02 sets) E. Display 3.5 digits 7 segment F. Buffer solution of 4,7 &amp; 9 pH</i>	1	10000
12.	<i>To measure density using hydrometer</i>	<i>Setup having different types of hydrometer with suitable display (digital) for different density solutions/liquid</i>	1	1000
13.	<i>To measure vibration using Piezoelectric</i>	<i>Setup having different types of piezo electric pickup with</i>	1	52000

	<i>type accumulator</i>	<i>source of vibration &amp; output display</i>		
14.	<i>To measure noise using condenser microphone</i>	<i>1. Condenser Microphone</i>	<i>1</i>	<i>1000</i>
15.	<i>Transducer&amp;Instrument Kit (Pre-Port)</i>		<i>1</i>	<i>41000</i>
16.	<i>Dead Weight Tester (0-10 Kg./cm.)</i>		<i>1</i>	<i>43000</i>
17.	<i>LI Maker Transducer and Instrumentation Trainer</i>		<i>1</i>	<i>5000</i>

**PROCESS CONTROL LAB**

<i>Sl.No.</i>	<i>Name of Experiment</i>	<i>Apparatus</i>	<i>Qty.</i>	<i>Price</i>
1.	<i>To calibrate the control valve.</i>	<i>Control valve training module to draw equal %ne characteristics Liner characteristics &amp; Quick opening characteristics of linear valve,non-linear valve and quick opening valve</i>	<i>1</i>	<i>200000</i>

		<p><i>having following specification</i></p> <p><i>Stainless steel sump tank</i></p> <p><i>30 liter</i></p> <p><i>2. Centrifugal pump 1/4 hp 1Q</i></p> <p><i>3. Pneumatic control valve</i></p> <p><i>two way globe type linear quick opening equal % valve (at least own should be air to close or air to open)</i></p> <p><i>4. Experimental setup for solenoid valve &amp; electric motor control valve</i></p> <p><i>5. Rotameter to measure flow through valve range 0-2000 LPH glass tube type acrylic body 1/2" mounting</i></p> <p><i>6. Air compressor 1/2 HP (Optional)</i></p>		
<i>2.</i>	<i>To draw the characteristics of</i>	<i>1. Valve positioner mounted</i>	<i>1 Set</i>	<i>4000</i>



	<i>valve positioner and actuator.</i>	<i>on a control valve (Automatic diaphragm type) for</i> <i>1/2 pipe line smallest size cost iron/brass</i>  <i>2. Pressure gauge 0 to 20 PSI</i>  <i>3. Filter Regulator</i>  <i>4. Misc. Pressure pipe bends etc.</i>	   1   1	   800  600  2000
3.	<i>To study the working of DP cell and Plot the input and output characteristics.</i>	<i>Differential Pressure Transmitter calibration setup which gives an idea regulating the calibration procedure of transmitter having following specification</i>  <i>1. Input Range : 0-400 cm of water column</i>  <i>2. Output Range : 4-20 mA</i>	1	150000

		<p>3. Power Supply : 24V DC</p> <p>4. U-tube manometer/digital pressure indicator for input measurement</p> <p>5. Precision pressure regulator for regulating given input pressure range</p> <p>6. Digital output indicator pressure range</p> <p>7. Digital output indicator input 4-20 mA, mains operated</p> <p>8. Air compressor 1/2 HP for pressure input</p>		
4.	<p>To study the working of on/off level controller and plot the line response chart and calculate time constant. (Complete Set)</p>	<p>PLC based ON-OFF water level control system having following specification</p> <p>1. PLC : Allen Bradly or equivalent, Actual Plant I/O Digital inputs-3 digital output-2</p> <p>2. Level Tank : Material : Transparent acrylic</p> <p>3. Sumptank : Material :</p>	1	100000

		<p><i>Stainless Steel capacity</i></p> <p><i>30 Liter</i></p> <p><i>4. Fractional HP Pump :</i></p> <p><i>230 V AC 1 Ohm vertical</i></p> <p><i>SS Body</i></p> <p><i>5. Level Switch-Float</i></p> <p><i>operated switching action</i></p> <p><i>reversible</i></p> <p><i>6. Solenoid valve-230 V, 1Q,</i></p> <p><i>1/2" size vertical mounting</i></p>		
5.	<p><i>To draw the characteristics curve of proportional temperature controller.</i></p> <p><i>(Complete Setup)</i></p>	<p><i>Proportional Temperature controller setup having following specification</i></p> <p><i>1. Temp. Sensor - Type RTD</i></p> <p><i>PT-100</i></p> <p><i>2. Process Tank 2-3 liter material SS304 with heater</i></p> <p><i>3. Thyristor for heater control input 4-2mA panel mounted output 0-230 V AC, 6A max.</i></p> <p><i>4. Pump 1/4" HP</i></p>	1	100000

		<p>5. PID controller-NC based PID controller</p> <p>6. Electrical Control Panel</p> <p>7. Rotameter 0-1000 LPH, Acrylic Body</p>		
6.	<p>To calibrate the given PI pneumatic controller by varying proportional percentage &amp; integral time.</p>	<p>1. Pneumatic PID controller</p> <p>2. Air filter cum pressure</p> <p>3. Circulator Chart Pressure factor.</p> <p>4. Diaphragm Control Valve 1/2" size.</p> <p>5. Pressure gauge -3</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>15000</p> <p>600</p> <p>3000</p> <p>3000</p> <p>600</p>
7.	<p>PLC based multi process control trainer</p> <p>Technical Specification</p> <p>1. Slump Tank : Material :Stainless Steel, 2mm Thick</p> <p>Capacity : 30 liter</p>		1	350000

<p><i>Dimension : 1.5 ft(L) X 1 ft (W) X 1 ft(H)</i></p> <p><i>2. Centrifugal Pump : 1/2"/1/4 HP, 230 V AC supply surface</i></p> <p><i>mounting</i></p> <p><i>3. Level Tank : Material : Acrylic 5 mm Thick</i></p> <p><i>Dimension : 150 mm(o) X 500 mm(H)</i></p> <p><i>4. Temperature Cabinet : 1" thick insulation wall with circulation fan and thermostat</i></p> <p><i>Heater : 1 KW</i></p> <p><i>Dimension : 1.25 ft(L)X1.25ft(W)X2ft (H)</i></p> <p><i>5. Pressure Vessel : Shape cylindrical, Material SS304</i></p> <p><i>Diameter : 150 mm Length 300 mm</i></p> <p><i>Capacity : 15 KG/cm<sup>2</sup> with 1/2 BSP connection for pressure gauge, inlet &amp; drain facility</i></p> <p><i>6. Piping : 1/2"/1" Class B GI with 1" SS ball valve 17 No.</i></p> <p><i>7. Flowmeter : 2 No. Size : 1/2"/1" Turbine type/wfm type</i></p> <p><i>Range : 0-1000/0-2000 LPH, Supply : 24 V DC</i></p> <p><i>100 mA, Output : 3-20 mA, Type : 3 wire type</i></p> <p><i>Mounting : Horizontal connection : 1"</i></p> <p><i>8. Level Transmitter : Input : 0-400/0-500 mm</i></p> <p><i>Output : 4-20 mA, Supply 24 V DC</i></p> <p><i>100 mA, Type 2 wire capacitance</i></p>		
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	<p><i>type, Mounting : Top 2" screwed connection</i></p> <p><i>9. Pressure Transmitter : Input 0-25 Kg/Cm2 /0-4 Kg/Cm2</i></p> <p><i>Output : 4-20 mA, Supply 24: V DC 50 mA, Type 2 wire piezoresistive type, Medium : water pressure, Mounting : Top 1/2" BSP connection</i></p> <p><i>10. Temperature Transmitter :</i></p> <p><i>Input : RTD, Output : 4-20 mA type, Range 0-200 oC</i></p>		
<i>8.</i>	<p><i>PC based multi process control system trainer</i></p> <p><i>1. Thyresterized Phase Angle Control Card:</i></p> <p><i>Input : 0-40 mA, Output : 0-230 V AC variable, 10 Max.</i></p>	<i>1</i>	<i>350000</i>

9.	<p><i>Distributed control system trainer</i></p> <p><i>1. Computer (Optional) : PC with colour monitor</i></p> <p><i>15" PC Pentium Dual Core with 2 Serial communication</i></p> <p><i>Ports, 80 GB HDD, 512 MB RAM, Floppy Drive</i></p> <p><i>Features</i></p> <ul style="list-style-type: none"> <li><i>- Compact Ergonomic Design</i></li> <li><i>- User Friendly, Self Explanatory System</i></li> <li><i>- Leak Proff Safety Measures, Sturdy Piping</i></li> <li><i>- Enhanced Electrical safety Consideration</i></li> <li><i>- Training Manuals, Mimic Charts for operation Ease.</i></li> <li><i>- System Frame with caster wheel arrangement for ease in movement</i></li> <li><i>- MS power coated cubical plant with standard Instrument Mounting</i></li> <li><i>- Inbuilt Safety Measures to avoid improper usage</i></li> <li><i>- Computer Interface (Optional)</i></li> </ul> <p><i>Range of Experiments</i></p> <ul style="list-style-type: none"> <li><i>- Study of PLC</i></li> <li><i>- Study of PLC based control of Multiprocess</i></li> </ul> <p><i>System</i></p> <ul style="list-style-type: none"> <li><i>- Study of data logging system</i></li> <li><i>- Study of facebook, cascade, ration adn on-off</i></li> </ul>	1	<p><i>10,00000</i></p> <p><i>+</i></p>
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	<p><i>sprit range, control schemes.</i></p> <ul style="list-style-type: none"> <li>- <i>Calibration of various sensors, transmitter like pressure, level, flow, control valve, rotameter, E/P et.</i></li> <li>- <i>ON-OFF Control : Level, Pressure adn Temperature</i></li> <li>- <i>Study of SCADA application/Software computerized control of PC-PLC based Multi Process Control System</i></li> </ul> <p><i>System Dimension</i></p> <p><i>5.5 Ft(L) X 2.5 FT.(W) X 5.5 Ft. (H)</i></p> <p><i>Service Requirement</i></p> <ul style="list-style-type: none"> <li>- <i>Single Phase Electrical Supply of 230 V 50 Hz.</i></li> <li>- <i>Water Supply adn Drainage arragement</i></li> <li>- <i>Clean, Dry, Compressed Air Supply at 2.1 KG/Cm2</i></li> </ul>		
10.	<i>Flow control system trainer</i>	<i>1</i>	<i>100000</i>
11.	<i>Level control system trainer</i>	<i>1</i>	<i>150000</i>
12.	<i>Pressure control system trainer</i>	<i>1</i>	<i>100000</i>



13.	<i>Control valve characteristic trainer</i>	<i>1</i>	<i>50000</i>
14.	<i>Electro pneumatic converter trainer</i>	<i>1</i>	<i>100000</i>
15.	<i>Pressure transducer/transmitter module.</i>	<i>1</i>	<i>50000</i>
16.	<i>PC-PLC based pneumatic trainer</i>	<i>1</i>	<i>150000</i>

17.	<p><i>Feed back,Cascade, Ratio control Trainer among. with SCADA &amp; PC interface.</i></p> <p><i>Technical Specification</i></p> <p><i>1. Slump Tank : Material :Stainless Steel, 2mm Thick</i> <i>Capacity : 30 liter</i> <i>Dimension : 1.5 ft(L) X 1 ft (W) X 1 ft(H)</i></p> <p><i>2. Level Tank : Material : Acrylic 5 mm Thick</i> <i>Dimension : 150 mm(o) X 500 mm(H)</i></p> <p><i>3. Temperature Cabinet : 1" thick insulation wall with circulation fan and thermostat</i> <i>Heater : 1 KW</i> <i>Dimension : 1.25 ft(L)X1.25ft(W)X2ft (H)</i></p> <p><i>4. Centrifugal Pump : 1/4 HP, 230 V AC supply surface mounting</i></p> <p><i>5. Pressure Vessel : Shape cylindrical, Material SS304</i> <i>Diameter : 150 mm Length 300 mm</i> <i>Capacity : 15 KG/cm2 with 1/2 BSP connection for pressure gauge, inlet &amp; drain facility</i></p> <p><i>6. Piping : 1" Class B GI with 1" SS ball valve 17 No.</i></p> <p><i>7. Flowmeter : 2 No. Size : 1" Turbine type/wfm type</i> <i>Range : 0-2000 LPH, Supply : 24 V DC</i> <i>100 mA, Output : 3-20 mA, Type : 3 wire type</i></p>	1	200000
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<p><i>Mounting : Horizontal connection : 1/2"</i></p> <p><i>8. Level Transmitter : Input : 0-400/0-500 mm</i></p> <p><i>Output : 4-20 mA, Supply 24 V DC</i></p> <p><i>100 mA, Type 2 wire capacitance</i></p> <p><i>type, Mounting : Top 2" screwed</i></p> <p><i>connection</i></p> <p><i>9. Pressure Transmitter : Input 0-25 Kg/Cm<sup>2</sup> /0-4 Kg/Cm<sup>2</sup></i></p> <p><i>Output : 4-20 mA, Supply 24: V DC</i></p> <p><i>50 mA, Type 2 wire piezoresistive</i></p> <p><i>type, Medium : water pressure,</i></p> <p><i>Mounting : Top 1/2" BSP connection</i></p> <p><i>10. Temperature Transmitter : Input : RTD, Output : 4-20 mA</i></p> <p><i>11. Thyresterized Phase Angle Control Card:</i></p> <p><i>Input : 0-40 mA, Output : 0-230 V AC variable</i></p> <p><i>12.Pneumatic Control Valve : 2 No. size : 1",</i></p> <p><i>Characteristics : Equal Percentage, Type : Two way Globe</i></p> <p><i>type with valve, Two Way Globe type with valve Positioner</i></p> <p><i>Cv : 9 US GPM, with diaphragm actuator, Flange</i></p> <p><i>connection : PCD 80 mm, ID : 26 mm, OD : 110 mm,</i></p> <p><i>Positioner Action : 0.2 to 1.0 Kg/Cm<sup>2</sup> (with bypass)</i></p> <p><i>(Director Action/ Reverse Action) Pneumatic Input Signal:</i></p> <p><i>0.2 to 1.0 KG/Cm<sup>2</sup> (with Bypass)</i></p> <p><i>13. Rotameter : 2 No. Range 0-2000 LPH Glass</i></p> <p><i>tube type/Acrylic body, Connection :1"</i></p>		
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<p><i>Mounting : Intel-Bottom, Outlet – Top</i></p> <p><i>14. E/P Convertor : Input : 4-20 mA, Output : 3-15 psi</i></p> <p><i>Connection 1.4", Supply 1.4 Kg/Cm2</i></p> <p><i>15. Air Pressure Regulator : 0-10 Kg/Cm2 with pressuregauge, Connection 1.4 NPT/BSP</i></p> <p><i>16. Level Switch : Float operated, Float Material SS304</i></p> <p><i>Switch Voltage : 240 V AC/200 V AC, Switching</i></p> <p><i>Current : 2A Switch Action : Reversable, Weight : 315 GMS</i></p> <p><i>17. Current Meters : 3 No Range 0-20 mA, Supply 230 V AC</i></p> <p><i>Output : 44mm X 92 mm X 110 mm</i></p> <p><i>18. Isolator : 2 No single isolator : Input : 4-20 mA,</i></p> <p><i>Output : 4-20 mA, Supply : 230 V AC</i></p> <p><i>19. Supply : 24 V DC 1.5 A, Size : 48mmX126mmX68mm</i></p> <p><i>20. Electronic PID Controller : 2 No. Single Input</i></p> <p><i>PID and Dual Input PID with serial PC Interface</i></p> <p><i>(ASCII Protocol) RS 232 cotout size 92X92X144 mm</i></p> <p><i>Input 4-20 mA, Output : 4-20 mA, Digital: Dual For</i></p> <p><i>PV and SP, Bar graph display for output and devisation</i></p> <p><i>HI-low alarm annunciation</i></p> <p><i>21. Electrical Control Pannel :MS Powder coated panel with switches,</i></p> <p><i>Indicator, Text Points, Controller on front facial, UK 2.5,</i></p> <p><i>thermal connector mounted on/DIN rail channel, Use of 1</i></p> <p><i>sq. mm</i></p> <p><i>Multistrand wire proper insulated Lugs, Ferruling and neat</i></p>		
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<p>wire</p> <p>dressing and clamping wires and power cables are seated through</p> <p>1"X1" PCV cable tray, Dimension 1ft (L) X 1Ft (W) X 1ft (H).</p> <p>22. SCADA Application Software (Optional) : SCADA S/w  PID control setting (P, PI, PD &amp; PID mode), Auto/  Manual tuning of PID, Data Storage, Off line  analysis, Online data acquisition, Simulation and  Printing of data in Graphical and tabular from  Interactive Graphical User Interface (GUI) includes.</p> <p>23. Air Compressor (Optional): Tank capacity : 30 liters  Discharge : 2 CFM Motor : Half HP 230 V AC operated,  Working Pressure " 3-4 Kg/Cm2</p> <p>24. Computer (Optional) : PC with color monitor  15" PC Pentium Dual Core with 2 Serial communication  Ports, 80 GB HDD, 512 MB RAM, Floppy Drive</p>		
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18.	<i>Flopper-Nozzle assembly trainer</i>	1	50000
19.	<i>PID Control trainer.</i>	1	100000
20.	<i>Multi Process Control Trainer</i>	1	50000
21.	<i>Temperature Control System Trainer.</i>	1	50000
22.	<i>PLC/Computer Based hydraulic Trainer.</i>	1	200000

**NOTE:-**

*Process control equipment's may be purchased in the form of complete set and may be installed and commissioned in the supervision of firm supplying the equipment.*

**INDUSTRIAL CONTROL LAB**

<i>Sl.N o.</i>	<i>Name of Experiment</i>	<i>Apparatus</i>	<i>Qty.</i>	<i>Price</i>
1.	<i>To draw the time response of Ist order electrical system</i>	<i>Resistive setup of Ist order system along with a power supply &amp; display system &amp; measurement points for CRO Display</i>	1	15000

2.	<p>To draw time response of IInd order LCR circuit and find out its transfer function</p>	<p>LCR system having different value of variable L,C,R with series &amp; Parallel Combination for IInd order control system</p> <ul style="list-style-type: none"> <li>- Display for O/P</li> <li>- Suitable power supply with variable freq.</li> <li>- Measurement points for CRO</li> </ul>	1	15000
3.	<p>To draw characteristics curves for SCR, Diac &amp; Triac</p>	<p>Setup for drawing I/p characteristics of SCR Traic &amp; Diac having input variable DC/AC supply &amp; suitable O/p display</p>	1	15000
4.	<p>To study a power rectifier using SCR and draw input/output wave form</p>	<p>Setup for characteristics of power rectifier using SCR with staitable phase control circuit in full wave and half wave</p>	1	15000

		<i>rectification &amp; measuring points for CRO display (Single phase &amp; Three Phase rectifier)</i>		
5.	<i>To study single phase inverter circuit using SCR &amp; draw input &amp; O/p wave forms</i>	<i>Setup for single phase inverter using transistor circuit &amp; SCR &amp; MOSFET circuit and draw characteristic (i) Variable Supply (ii) variable load</i>	1	
6.	<i>To fabricate &amp; SCR chopper circuit, Test it and determine duty cycle.</i>	<i>Setup for chopper circuit using SCR &amp; Vary its duty cycle &amp; draw wave form</i>	1	
7.	<i>To study the effect of variation in firing angle on a C.R.O. &amp; to plot the wave form</i>	<i>Setup for SCRR &amp; TRIAC firing circuit and draw I/o wave form (i) Resistive circuit (ii) Single RC circuit (iii) Double RC circuit</i>	1	



		<i>(iv) with snubber circuit</i>		
8.	<i>To study the data transmission with the help of two synchro's</i>	<i>Obsolete Item (Not need to Purchase)</i>		
9.	<i>To fabricate the traic diac motor speed control circuit &amp; draw i/p, o/p (speed) characteristics</i>	<i>Setup for motor speed control circuit for DC &amp; AC motor with phase control using DOAC-TRIAC along with suitable motor &amp; tacho meter</i>	1	

**LIST OF EQUIPMENTS/INSTRUMENTS REQUIRED IN LABORATORY**

**( Bio- Medical Instruments)**

<b>S.NO</b>	<b>EQUIPMENTS/INSTRUMENTS</b>	<b>SPECIFICATIONS</b>	<b>PRICE(APP ROX.)</b>
	<i>Conventional Blood Pressure</i>	<i>Range:0-300mmHg, accurate,</i>	<i>3000/-</i>

	<i>Monitor Sphygmomanometer Deluxe With Stethoscope</i>	<i>visual angle easily adjustable within 0 to 90 degrees, highly precision, soft fine cuff</i>	
	<i>Electronic Sphygmomanometer</i>	<i>LCD Display, measurement range: 0 to 299 mmHg, resolution 1mm Hg, operating temperature 10 degree centi-40 degree centi, long battery life, with electric shock protection</i>	<i>3000/-</i>
	<i>Ventilator</i>	<i>Electrical/Pneumatic input/output, manual control, battery power supply, alarm system,</i>	<i>4.75lakh</i>
	<i>Glucometer with strip</i>	<p><i>Strip Specification:</i></p> <p><i>Weight:0.2lbs(75g)</i></p> <p><i>Measurement range and units-</i></p> <p><i>a).10-900 mg/dL(U.S)</i></p> <p><i>b).1-50 mmol/L( Outside U.S)</i></p> <p><i>Sample Volume Required:1.2uL</i></p> <p><i>Time to Glucose Results:6 sec</i></p> <p><i>Strip port Connection to USB</i></p> <p><i>Battery information:</i></p> <p><i>a).type:3 V Li Button Battery</i></p> <p><i>b).life: in 600 tests before battery requires replacement</i></p> <p><i>LCD black/white display, Large numeric display(30mm),Auto shut off of meter when not in use</i></p>	<i>2000/-</i>

	<i>Standard Pulse Oximeter</i>	<i>24 hr memory, with USB adapter, full analysis software</i>	<i>5000/-</i>
	<i>Stethoscope</i>	<i>Tunable diaphragm, dual head solid stainless chest piece</i>	<i>2000/-</i>
	<i>Phonocardiography Machine</i>	<i>220-230 v driven, frequency :10 Hz to 2KHz(+1db)</i> <i>Size/weight:42*30*12cms/3kgs</i>	<i>35000/-</i>
	<i>12 Channel ECG Machine</i>	<i>Three operating modes(Automatic, Manual and Rhythm),</i> <i>Printer storage memory,</i> <i>Frequency response:0.05 to 150 Hz</i> <i>CMRR should be 90 db</i> <i>Recording speed:25mm/sec and 50 mm/sec</i> <i>8clip electrodes,12 chest electrode with silicon rubber bulb,12 packets of recording paper,1 bottle of jelly and 12 no's reusable button type electrode</i> <i>Power supply: 220V, portable, high resolution ,system configuration accessories, spares and consumables</i> <i>Should have digital filter for AC and EMG, defibrillation protection</i>	<i>65000/-</i>
	<i>EMG Machine</i>	<i>2/4/8 channels mode, user</i>	<i>2.5 lakh</i>

		<i>friendly interface, 8 amplifier channel, specific function keys support the optimal handling, integrated stimulator, integrated operation panel, battery backup</i>	
	<i>Clinical Thermometer</i>	<i>Temperature range: 35-42 degree home/clinical purpose</i>	<i>500/-</i>
	<i>Digital Thermometer</i>	<i>Digit display, Accuracy:0.2-0.5 degree celcius,auto off feature</i>	<i>1500/-</i>
	<i>PH Meter For Blood/Urine PH. Measurement</i>	<i>Measuring range: 0-14 ph accuracy:+0.01ph to+1 parameter: pH, temperature range: 0-1000c auto with temp.probe/manual with keys, LCD display, power supply: ac/dc adapter</i>	<i>12000/-</i>
	<i>Blood Group Test Kit with Reagent</i>	<i>Blood testing equipment, blood grouping antibodies, temp 2-10 degree centigrade, sensitivity above 99%</i>	<i>1000/-</i>
	<i>Electro-Physiotherapy machine</i>	<i>Power source:230v AC 50Hz, medium frequency: 4Hz and 2Hz, Pulse amplitude:0-100mA/channel, timer-0-99 minutes ,  Technical specification:  Ultrasonic nominal freq:1 MHz  Ultrasonic output:15 Acoustic Max  Operations:2.2wats/cm<sup>2</sup>  Treatment time:0-6min</i>	<i>10,000/-</i>

		<i>Timer:0-99min , gel bottle</i>	
	<i>Spirometer</i>	<i>Volume range: at least 8l volume displacement, accuracy: +3% ,resolution: up to 25ml, temperature measurement, battery backup</i>	<i>40,000/-</i>

<b>Sr. No.</b>	<b>Particulars</b>	<b>Unit</b>	<b>Aprox. Total Cost</b>
<b>ENVIRONMENT ENGINEERING LABORATORY</b>			
	<i>pH Meter</i>	<i>01</i>	<i>500</i>
	<i>Turbidity Meter</i>	<i>01</i>	<i>5000</i>
	<i>Oven with Temperature Controller and Forced Air Circulation Type</i>	<i>01</i>	<i>20000</i>
	<i>B.O.D. Incubator</i>	<i>01</i>	<i>25000</i>
	<i>Water Analysis Kit</i>	<i>01</i>	<i>5000</i>
	<i>High Volume Sampler</i>	<i>01</i>	<i>40000</i>
	<i>Electrical Balance for weighing upto 1/10 of milligram (capacity)</i>	<i>01</i>	<i>1000</i>
<b>ENERGY CONSERVATION LABORATORY</b>			
<i>1</i>	<i>Clamp meter</i>	<i>02</i>	<i>5000</i>
<i>2</i>	<i>Multimeter</i>	<i>02</i>	<i>2000</i>

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3	<i>Power Analyser</i>	<i>01</i>	<i>20000</i>
4	<i>Different types of lamps (LS)</i> <i>60 W lamp, 230 V, 100 V</i> <i>200 W lamp</i> <i>500 W lamp</i> <i>100 W lamp, 110 V, 150 V</i>	<i>10</i>	<i>500</i>
5	<i>Lux meter</i>	<i>02</i>	<i>5000</i>
6	<i>Centrifugal pump, 1 kW</i>	<i>1</i>	<i>15,000</i>
7	<i>Standard window A.C.</i>	<i>01</i>	<i>20000</i>
8	<i>Anemometer</i>	<i>02</i>	<i>5000</i>
9	<i>Thermometer</i>	<i>03</i>	<i>2000</i>
10	<i>Flow meter</i>	<i>02</i>	<i>10000</i>
11	<i>Pumping set with at least two pumps of different capacity.</i>	<i>1 set</i>	<i>10000</i>
12	<i>Pressure gauge fitted on discharge lines</i>	<i>1 set</i>	<i>2000</i>
13	<i>Variable Frequency Drive</i>	<i>02</i>	<i>50000</i>
14	<i>A small compressor with a small network of pipe line fitted with suitable pipeline, pressure gauge, safety valve and loading / unloading pressure switch.</i>	<i>1</i>	<i>3000</i>
15	<i>Stop watch</i>	<i>2</i>	<i>1000</i>
16	<i>Small blower (1.5 kW motor) with inlet and outlet ducts of approximately one meter length on both sides</i>	<i>1</i>	<i>10000</i>
17	<i>Black Box (for checking lamp efficacy including stand and luxmeter)</i>	<i>1</i>	<i>25000</i>

**NOTE:**

*In addition to the above, laboratories in respect of physics, chemistry, Computer Centre etc will be required for effective implementation of the course. Provision for photocopiers, PC facilities along with LCD Projection System etc. has also to be made.*

**(C) Furniture Requirement**

*Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.*

**10.2 Human Resources Development:**

*Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.*

## **11. EVALUATION STRATEGY**

### **11.1 INTRODUCTION**

*Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation.*

*The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)*

#### *Formative Evaluation*

*It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.*

#### **Summative Evaluation**

*It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.*



*In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.*

## **11.2 STUDENTS' EVALUATION AREAS**

*The student evaluation is carried out for the following areas:*

*Theory*

*Practical Work (Laboratory, Workshop, Field Exercises)*

*Project Work*

*Professional Industrial Training*

### **A. Theory**

*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 sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.*

*Section-I*

*It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.*

### **Section-II**

*It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II*

### *Section-III*

*It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section*

*Table II : Suggested Weightage to be given to different ability levels*

<b><i>Abilities</i></b>	<b><i>Weightage to be assigned</i></b>
<i>Knowledge</i>	<i>10-30 percent</i>
<i>Comprehension</i>	<i>40-60 percent</i>
<i>Application</i>	<i>20-30 percent</i>
<i>Higher than application i.e. Analysis, Synthesis and Evaluation</i>	<i>Upto 10 percent</i>

**B. Practical Work**

*Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.*

**C. Project Work**

*The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.*

**D. Professional Industrial Training**

*Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, 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. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.*

## **12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION**

*This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.*

*The document so prepared is now ready for its implementation. It is the faculty of polytechnics who 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 a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.*

### **(A) Broad Suggestions:**

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 and made available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.*

3. *HOD of every Programme Department along with HODs and incharges of other departments are required to prepare academic plan at department level referring to institutional academic plan.*
  
4. *All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.*

**(B) Course Level Suggestions**

*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.*

*Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all above activities properly and ensure execution of the plan effectively.*

*Following is the gist of suggestions for subject teachers to carry out T-L process effectively:*

1. *Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available and courses to be taught.*
  
2. *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. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.*
  
3. *Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.*
  
4. *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.*
  
5. *Concept and content based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.*
  
6. *There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.*
  
7. *Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feed back to every student*

8. *The student centred activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.*
  
9. *Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time.*
  
10. *Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.*
  
11. *Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.*
  
12. *Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.*
  
13. *A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.*

### **13. LIST OF PARTICIPANTS**

***The following experts participated in the workshop for Developing the Curricula Structure and Contents of Diploma Programme in Electronics Engineering for UP State on 5-6 April, 2018 at NITTTR, Chandigarh:***

1. *Sh. Pankaj Yadav, Assistant Director, Directorate of Technical Education, Kanpur*
2. *Sh. Lal Ji Patel, Text Book Officer/CDC Officer, IRDT, Kanpur*
3. *Mohd. Qamruzzaman, Lecturer English, Government Polytechnic, Kanpur*
4. *Sh. Anjani Kumar Sharma, HOD, Chemical Engg. Government Polytechnic, Chandari*
5. *Dr. Balram, Lecturer Maths, Government Polytechnic, Lucknow*
6. *Sh. Sanjay Kumar Singh, Lecturer, Electrnics, Government Polytechnic, Aurai, Bhadohi, UP.*
7. *Sh. Nirdosh Kumar, Lecturer, Electrical Engg. Government Polytechnic, Naraini, Banda*
8. *Sh. Vinod Sonthwal, Lecturer, Civil Engg. NITTTR, Chandigarh*
9. *Sh. Vikas Choudhary, Lecturer, Civil Engg. Government Polytechnic, Changipur, Bijnor*
10. *Sh. Ashish Kumar, Head, Mechanical Engg. Government Polytechnic, Narwana Khurd, Meerut*
11. *Sh. Gopal Chandra Nayak, Assistant Professor, Regional Institute of English, Sector 32-C, Chandigarh.*
12. *Sh. Amit Doegar, Assistant Professor, Computer Science and Engg. NITTTR, Chandigarh*
13. *Dr. Kanika Sharma, Assistant Professor, ECE, NITTTR, Chandigarh*
14. *Mrs. Shano Solanki, Assistant Professor, Computer Science and Engg. NITTTR, Chandigarh*
15. *Dr. Lini Mathew, Associate Professor, Electrical Engg. NITTTR, Chandigarh*
16. *Dr. KC Lachhwani, Assistant Professor, Applied Science, NITTTR, Chandigarh*
17. *Mrs. Rama Chhabra, Associate Professor, CDC, NITTTR, Chandigarh*
18. *Dr. AB Gupta, HOD, CDC, NITTTR, Chandigarh*



19. *Sh. Roshan Lal, Sr. Lecturer, Kalpana Chawla Govt. Polytechnic for Women, Ambala City*
20. *Dr. P. Sudhakar Rao, Assistant Professor, Mechanical Engg. NITTTR, Chandigarh*
21. *Sh. Kamal Kumar, Lecturer, Computer, Government Girls Polytechnic, Lucknow*
22. *Sh. Pravesh Verma, Deputy Secretary, Board of Technical Education, Lucknow*
23. *Dr. Dinesh Yadav, Lecturer, Physics, Government Polytechnic, Bareilly*
24. *Dr. Yogendra Singh, Lecturer, Chemistry, Government Polytechnic, Ghaziabad*
25. *Professor Seema Kapoor, Dr. SSBUI CET, Panjab University, Chandigarh*
26. *Sh. Navdeep Singh, Sr. Lecturer, Computer Sc. Engg. Government Polytechnic, Khuni Majra, Mohali*
27. *Sh. Gurmail Singh, Sr. Lecturer, ECE, Government Polytechnic, Khuni Majra, Mohali*
28. *Dr. Shimi S.L., Assistant Professor, Electrical Engg. NITTTR, Chandigarh*

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2. *Sh. Narendra Kumar, Workshop Superintendent, Government Polytechnic, Kanpur*
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6. *Sh. Alok Srivastava, HOD, Civil Engg. Government Polytechnic, Shahjahanpur*
7. *Dr. Vinod Kashyap, Lecturer, English, Government Polytechnic, Lucknow*
8. *Sh. Rakesh Kumar, Lecturer, Electronics, Government Polytechnic, Barabanki*
9. *Sh. Subhash Chandra Misra, Retired Sr. DDG, BSNL, DOT, GOI*
10. *Sh. Brijesh Mishra, Softpro India*
11. *Sh. Ajay Choudhary, , Softpro India*
12. *Sh. FR Khan, JEEC, UP*
13. *Sh. K. Ram, Joint Director, (CZ)*
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16. *Sh. RK Singh, HOD, Electronics, Government Polytechnic, Pratapgarh*
17. *Ms. Rashmi Sonkar, HOD, IT, Government Girls Polytechnic, Faizabad*
18. *Sh. Ankit Gupta, Lecturer, Mechanical Engg. Government Polytechnic, Lucknow*
19. *Ms. Meenu Dwivedi, Lecturer, Mechanical Engg. Government Polytechnic, Lucknow*
20. *Sh. Sanjay Kumar Srivastava, Tata Motors Ltd., Lucknow*
21. *Sh. Kamal Kumar, Lecturer, Computer, Government Girls Polytechnic, Lucknow*
22. *Sh. Manoj Kumar, Director, IRDT, Technical Education, Kanpur*
23. *Sh. RC Rajput, Director, Technical Education, Kanpur*
24. *Sh. Sanjeeva Kumar Singh, Secretary, Board of Technical Education, Lucknow*
25. *Sh. Pravesh Verma, Electrical Engg. Board of Technical Education, Lucknow*
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27. *Sh., Ashrapal, Principal, Government Polytechnic, Tundla, Firozabad*
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30. Sh. OP Chaudhari, Lecturer, Government Polytechnic, Lucknow

***The following experts participated in the workshop for Developing Curriculum Contents of 2<sup>nd</sup> year and 3<sup>rd</sup> year subjects of diploma course in Instrumentation & Control Engineering for UP State on 28 Feb,2019 15 March, 2019 at IRDT, Kanpur:***

1. Sh. Devendra Kumar, HOD, Electronics Engg. Government Polytechnic, Mainpuri

2. Sh. P.K.Gupta , HOD, I&C, Government Polytechnic, Rampur

3. Sh. D.K.Maurya , HOD, I&C , Government Polytechnic, Kanpur

4. Sh. Yogesh Singh , IRDT, Kanpur

5. Sh. Sushil Kumar , Dy. Manager , I.T.I. Limited Mankapur

6. Sh. Sudhir Kumar , Jr. Manager , HAL, Kanpur

7. Sh. Nitin Kumar Sharma , Lecturer , I&C , Government Polytechnic, Kanpur

8. Km. Shilpi Gupta, Lecturer , I&C Government Girls Polytechnic ,Lucknow

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***The following experts participated in the workshop for Finalizing Curriculum Contents of 2<sup>nd</sup> year and 3<sup>rd</sup> year subjects of diploma course in Instrumentation & Control Engineering for UP State on 30 June, 2019 at Government Polytechnic Lucknow organized by IRDT, Kanpur:***

*Sh. D.K. Rudra, Principal, Government Girls Polytechnic Lucknow*

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