

STUDY AND EVALUATION SCHEME FOR
THREE YEARS DIPLOMA COURSE IN
1. ELECTRONICS ENGINEERING
2. ELECTRONICS ENGINEERING(Advance Microprocessor & Interface)
3. ELECTRONICS ENGINEERING(Microelectronics)
4. ELECTRONICS ENGINEERING(Modern Consumer Electronics Appliances)
(Effective From)
(Common With Instrumentation & Control Engineering)

I Year

Curriculum						S U B J E C T	Scheme of Examination								
Periods Per Week							Theory				Practical				Grand
Le c.	Tut ori al	Dr aw	Lab	Work Shop	Tot al		Examination	Sess. Marks	Total Marks	Examination	Sess. Marks	Total Marks	Tot al		
														Dur.	Marks
3	-	-	2	-	5	1.1 Professional Communication	2.5	50	20	70	3	20	10	30	100
3	2/2	-	-	-	4	1.2 Applied Mathematics-I	2.5	50	20	70	-	-	-	-	70
3	2/2	-	2	-	6	1.3 Applied Physics	2.5	50	20	70	3	40	20	60	130
3	-	-	-	-	3	1.4 Applied Chemistry	2.5	50	20	70	-	-	-	-	70
3	-	-	-	-	3	1.5 Engineering Mechanics and Material	2.5	50	20	70	-	-	-	-	70
3	-	-	2	-	5	1.6 Electrical Engineering-I	2.5	50	20	70	3	60	30	90	160
3	-	-	3	-	6	1.7 Electronic Components And Devices.	2.5	50	20	70	3	80	40	120	190
2	-	4	-	-	6	1.8 Technical Drawing.	3.0	50	20	70	-	-	-	-	70
-	-	-	-	-	6	1.9 Elementary Workshop Practice.	--	--	--	--	4	70	30	100	100
1	-	-	3	-	4	1.10 Computer Application For Engineering	--	--	--	--	3	60	30	90	90
21	3	6	12	6	48	<-----TOTAL----->	--	400	160	560	-	330	160	490	1050
												Games/NCC/Social and Cultural Activity + Discipline (20 + 30)		50	
												Aggregate		1100	

NOTE:- (1) Each period will be of 50 minutes duration.
(2) Each session will be of 32 weeks.
(3) Effective teaching will be at least 25 weeks.
(4) Remaining periods will be utilised for revision etc.

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(Effective From)

II Year

Curriculum						Scheme of Examination								
Periods Per Week						S U B J E C T	Theory				Practical			Grand Total
Le c.	Tut ori al	Dr aw	Lab	Work Shop	Tot al		Examination Dur.	Sess. Marks	Total Marks	Examination Dur.	Sess. Marks	Total Marks		
3	2/2	-	-	-	4	2.1 Applied Mathematics-II	2.5	50	20	70	--	--	--	70
3	-	-	2	-	5	2.2 Electrical Engineering-II	2.5	50	20	70	3	40	20	60
3	-	-	2	-	5	2.3 Industrial Electronics & Transducers.	2.5	50	20	70	3	40	20	60
2	2/2	-	2	-	5	2.4 Networks, Filters & Transmission Lines.	2.5	50	20	70	3	40	20	60
3	-	-	2	-	5	2.5 Electronic Devices And Circuits.	2.5	50	20	70	3	40	20	60
3	-	-	2	-	5	2.6 Principles of Communication Engineering.	2.5	50	20	70	3	40	20	60
3	-	-	3	-	6	2.7 Principles of Digital Electronics	2.5	50	20	70	3	40	20	60
-	-	-	-	6	6	2.8 Electronics Workshop.	--	--	--	4	100	40	140	140
3	1	-	3	-	7	2.9 Programming In C & C++	2.5	50	20	70	3	60	30	90
23	3	-	16	6	48	<-----TOTAL----->	--	400	160	560	--	400	190	590
													Games/NCC/Social and Cultural Activity + Discipline (20 + 30)	50
													Aggregate	1200

- NOTE:-
- (1) Each period will be of 50 minutes duration.
 - (2) Each session will be of 32 weeks.
 - (3) Effective teaching will be at least 25 weeks.
 - (4) Remaining periods will be utilised for revision etc.
 - (5) 4 weeks structured and supervised, branch specific, task oriented industrial/field exposure to be organised during summer vacation. Student will submit a report. There will be 60 marks for this exposure. These marks will be awarded by project examiner in the final year. (Examination marks : 40, Sess. marks : 20).
 - (6) Field visit and extension lectures are to be organised and managed well in advance at institute level as per need.

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FINAL Year

Curriculum						S U B J E C T	Scheme of Examination								
Periods Per Week							Theory				Practical				Grand Total
Le	Tut	Dr	Lab	Work	Tot		Examination	Sess.	Total	Examination	Sess.	Total	Total		
c.	ori	aw		Shop	al	Dur.	Marks	Marks	Marks	Dur.	Marks	Marks	Marks		
2	2/2	-	-	-	3	3.1 Industrial Management and Entrepreneurship Development	2.5	50	20	70	--	--	--	70	
2	-	-	-	-	2	3.2 Environmental Education(*) And Disaster Management	2.5	50	--	--	--	--	--	--	
4	-	-	3	-	7	3.3 Communication Systems.	2.5	50	20	70	3	60	30	90	
3	-	-	3	-	6	3.4 Electronic Instruments And Measurement.	2.5	50	20	70	3	60	30	90	
3	2/2	-	3	-	7	3.5 Audio And Video System	2.5	50	20	70	3	60	30	90	
3	2/2	-	3	-	7	3.6 Television Engineering	2.5	50	20	70	3	60	30	90	
3	2/2	-	4	-	8	3.7 Microprocessor And Application.	2.5	50	20	70	3	60	30	90	
-	-	-	4	-	4	3.8 Project -i. Problem	--	--	--	--	3	90	40	130	
-	-	-	-	-	-	ii. Field Exposure	--	--	--	--	-	40	20	60	
20	4	-	20	-	44	<-----TOTAL----->	--	300	120	420	--	415	205	620	
3	1	-	-	-	4	3.9 ELECTIVE (Any One) Only For Electronics Engg.	2.5	50	20	70	-	--	--	70	
3	1	-	-	-	4	i. Modern Communication System	2.5	50	20	70	-	--	--	70	
3	1	-	-	-	4	ii. Bio Medical Electronics	2.5	50	20	70	-	--	--	70	
1	-	-	3	-	4	iii. Microwave & Radar Engg.	--	--	--	--	3	50	20	70	
3	1	-	-	-	4	iv. Electronics Equipment Testing	2.5	50	20	70	-	--	--	70	
3	1	-	-	-	4	Only For Electronics Engineerin Spl. Advance Microprocessor and Interface	2.5	50	20	70	-	--	--	70	
3	1	-	-	-	4	Only For Electronics Engg. Spl. In Microelectronics	2.5	50	20	70	-	--	--	70	
1	-	-	3	-	4	Only For Electronics Engg. Spl. Modern Consumer Electronics Appliances	--	--	--	--	3	50	20	70	
-	-	-	-	-	-	i. Modern Consumer Electro-nics Appliances	--	--	--	--	3	50	20	70	
-	-	-	-	-	-	<-----TOTAL----->	--	--	--	--	--	--	--	1130	
													Games/NCC/Social and Cultural Activity + Discipline (20 + 30)	50	
														1180	

NOTE:- (1) Each period will be of 50 minutes duration. 30% Carry Over of I Year 330
(2) Each session will be of 32 weeks. 70% Carry Over of II Year 840
(3) Effective teaching will be at least 25 weeks. 100% of Final Year 1180
(4) Remaining periods will be utilised for revision etc. ----
(5) Field visit and extension lectures are to be organised and managed well in advance at institute level as per need. 2350
(6) (*) It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

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MAIN FEATURES OF THE CURRICULUM

1. Title of the Course : Diploma In Electronics Engineering
2. Duration of the Course : Three Years
3. Type of the Course : Full Time Institutional
4. Pattern of the Course : Annual System
5. Intake : 30
6. Entry Qualification : High School 10+ with Science and Mathematics (Not Elementary
7. Admission Criteria : State Joint Entrance Examination

III.			LIST OF EXPERTS
1.	Dr. A.S. Darbari	Manager, Darbari Industries	Dhuman Ganj, Allahabad.
2.	Prof. R.N. Biswas	Prof & Head Electrical Engg. Deptt.	I.I.T., Kanpur
3.	Prof. K.K. Bhutani	Prof & Head, Computer Centre	Muir College Campus Allahabad University Allahabad.
4.	Prof. K. K. Tripathi	Prof. & Head, Electronics Engineering Deptt.	H.B.T.I., Kanpur
5.	Prof. V. K. Jain	Prof. & Head, Computer Science & Engg. Deptt.	H.B.T.I., Kanpur
6.	Shri R. C. Yadav	Sr. Engineer, Computer Centre	M.C.C., Allahabad University, Allahabad.
7.	Shri R. S. Verma	Engineer, Computer Division	Uptron India Ltd., Lucknow.
8.	Shri Prasant Kumar Arya	H.C.L. Ltd., Lucknow	
9.	Shri Arunara Ray	AMALCO (H.C.L. Ltd.,) Lucknow	
10.	Shri Bal Gopal	Asstt. Prof. Electronics Engineering Deptt.	H.B.T.I., Kanpur
11.	Shri Girish Chandra	Lecturer, J.K Institute of Applied Physics	Allahabad University Allahabad.
12.	Shri C. K. Dwivedi	Lecturer, J.K Institute of Applied Physics	Allahabad University Allahabad.
13.	Shri Om Prakash	Head, Instrumentation & Control Engineering	I.E.R.T., Allahabad
14.	Shri P. K. Srivastava	Head, Electronics Engineering Deptt.	I.E.R.T., Allahabad
15.	Prof. P. K. Singh	Head, Computer Science	I.E.R.T., Allahabad
16.	Shri G. S. Rai	Head, Electronics Engg.	Govt. Polytechnic, Pilibhit
17.	Shri S. C. Gupta	Asstt. Director	Directore of Technical Education, Kanpur.
18.	Shri S. C. Tewari	Lecturer, Electronics	Govt. Polytechnic, Fatehpur

19. Shri Akhilesh Verma Lecturer, Electronics Govt. Polytechnic,
Narendra Nagar,
Tehri Garhwal

The curriculum as developed, was reviewed by the following committee (constituted as per Govt. Letter No. 1471/92-Pra. Shi.-3-1992 Lucknow Dated-8/12 May 1992).

1.	Prof. R.N. Biswas	Prof & Head Electrical Engg. Deptt.	I.I.T., Kanpur
2.	Shri A. Shafi	Officer Incharge	Electronics Test & Development Centre, Uptron Estate, Panki, Kanpur.
3.	Shri B. K. Misra (Representative G.M.)	Manager (R&D)	Indian Telephone Industries, Mankapur Gonda
4.	Shri S. C. Kaushal	D.E. Telecomm.	Microwave Station, Sarvodaya Nagar, Kanpur
5.	Shri S. S. Roy (Representative C.I.I.)	Dy. Manager (R&D)	Indian Telephone Industries, Raibareli
6.	Shri S. C. Gupta	Asstt. Director	Directorate of Technical Education, U.P. Kanpur
7.	Smt. Sushma Gaur	Asstt. Professor	Board of Technical Education, U.P., Lko.
8.	Shri P. C. Dikshit	Director	Institute of Research Development & Training U.P., Kanpur
*			

The members of the committee recommended its being adopted after a few ammendments which have been incorporated in the curriculum.

LIST OF EXPERTS

The names of experts whose upshots made possible coming up of this curriculum are listed below :

- | | |
|---|---|
| 1. Shri R.G.Gupta
Director (Reted.)
Pollice Wireless
Mahanagar, Lucknow | 5. Shri J.S.Rai
H.O.D. Electronics
Govt.Polytechnic
Kanpur |
| 2. Dr. K.K.Tripathi
Prof. & Head
Deptt. of Electronic Engg.
H.B.T.I., Kanpur | 6. Shri S.K.Singh
H.O.D. Electronics
F.G.Polytechnic
Raibareli |
| 3. Shri Vishal Saxena
Senior Engineer
P.C.Maintenace cell
I.I.T., Kanpur | 7. Shri S.C.Gupta
H.O.D. Electronics
Govt. Polytechnic
Unnao |
| 4. Dr.R.Tiwari
Centre Manager
Computer Center
I.I.T., Kanpur | 8. Smt.Dayawanti Pandey
H.O.D.Computer Engg.
Govt.Girls, Poly.
Lucknow |

LIST OF EXPERTS

On dated 30-11-04 & 27-01-05 the following experts whose contribution and support in the revision of this curriculum is a matter of obligation to I.R.D.T.

- | | |
|--|--|
| 1. Prof. Anjan Ghosh | Deptt. of Electronics Engg.
I. I. T., Kanpur |
| 2. Prof. Utpal Das | Deptt. of Electronics Engg.
I. I. T., Kanpur |
| 3. Mr. Dharmendra Singh
Asst. Professor | Deptt. of Electronics Engg.
I. I. T., Roorkee |
| 4. Mrs. Rachna Asthana
Asst. Professor | Deptt. of Electronics Engg.
H.B.T.I., Kanpur |
| 5. Mr. G. P. Bagharia
Asst. Professor | Deptt. of Electronics Engg.
H.B.T.I., Kanpur |
| 6. Mrs. Rajani Bisht
Asst. Professor | Deptt. of Electronics Engg.
H.B.T.I., Kanpur |
| 7. Mr. Manish Sahu
D.G.M., Microwave | B.S.N.L., Kanpur |
| 8. Mrs. T. Gupta
Faculty | I.E.T., Kanpur |

- | | | |
|-----|---|--|
| 9. | Mr. S. N. Mathur
Station Engineer | Doordarshan, Kanpur |
| 10 | Mr. S. K. Verma
Principal | Govt. Poly., Kanpur |
| 11. | Mr. S. P. C. Lal
Head, Electronics Engg. | Govt. Girls Poly., Varanasi |
| 12. | Mr. Sabir Ali
Head, Electronics Engg. | Govt. Poly., Mainpuri |
| 13. | Mr. N. B. Sadh
A.S.E. | A.I.R., Prasar Bharti, Kanpur |
| 14. | Ms. Anjana Rani
Dy. Manager | Uptron India Ltd., Lucknow |
| 15. | Mr. A. G. P. Kujur | A. M. Computers, I.T.I., Manakapur
Gonda. |
| 16. | Mr. G. S. Rai
Dy. Director | D. T. E., Kanpur |
| 17. | Mr. S. C. Gupta
Dy. Director | D. T. E., Kanpur |
| 18. | Dr. S. S. Pattanik
Head, E & CE | N.I.T.T.I., Chandigarh |
| 19. | Smt R. P. Alam
Asstt. Professor | I. R. D. T., Kanpur |

FIRST YEAR DIPLOMA COURSE IN "ELECTRONICS ENGINEERING"

1.1 PROFESSIONAL COMMUNICATION

[Common to All Engineering/Non Engineering Courses]

L T P
3 - 2

Rationale:

Communication forms an important activity of diploma holder. It is essential that he/she should be in a position to communicate in writing and orally with superiors, equals and subordinates. This subject aims at providing working knowledge of languages like Hindi and English so as to train the students in the art of communication. It is suggested that maximum attention should be given in developing Communication abilities in the students while imparting instructions by giving maximum emphasis on practice.

Sr.No.	Units	Coverage time		
		L	T	P
1.	Introduction to communication methods meaning, channels & media written and verbal.	5	-	-
2.	Development of comprehension of English & Hindi through study of text material & language exercises.	20	-	-
3.	Development of expression through			
	A. Letters (English & Hindi)	10	-	-
	B. Report writing (English) Note making and minutes writing	10	-	-
4.	Composition	10	-	-
5.	Grammar	20	-	-
		75	-	50

1. PART I : COMMUNICATION IN ENGLISH
 - 1.1 Concept of communication, importance of effective communication, types of communication, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, Listening, reading, writing and speaking, Barriers in communication, Modern tools of communication- Fax, e-mail, Telephone, telegram, etc.
 - 1.2 Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.

1.3 Development of expression through:

1.3.1 Letters :

Kinds of letters:-

Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters. Application for a job.

1.3.2 Report writing and Note making and minutes writing.

1.4 Grammer : Transformation of sentences, Preposition, Articles, Idioms and Phrases, One word substitution, Abbreviations.

1.5 Composition on narrative, descriptive, imaginative, argumentative, discussion and factual topics.

2. PART II : COMMUNICATION IN HINDI

2.1 Development of comprehension and knowledge of Hindi usage through rapid reading and language exercises based on prescribed text material developed by IRDT.

2.2 Development of expression through ;

Letter writing in Hindi:

Kinds of letters:-

Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters, Application for a job.

(1) Paper should be in two parts, part I - English and part II Hindi.

COMMUNICATION AND PRESENTATION PRACTICES

1.A. Phonetic transcription

B. Stress and intonation :

(At least 10 word for writting and 10 word for pronounciation)

2. ASSIGNMENT : (Written Communication)

Two assignment of approximately 400 word each decided by the teachers.

SUGGESTED ASSIGNMENTS :

1. a picture/photograph
2. an opening sentence or phrase
3. a newspaper/magzine clipping or report
4. factual writting which should be informative or argumentative.

3. Oral Conversation:

1. Short speeches/declamation : Bid farewell, Felicitate somebody, Celebrate a public event, Offer condolences
2. Debate on current problems/topics
3. Mock Interview : Preparation, Unfolding of personality and Expressing ideas effectively
4. Group discussion on current topics/problems
5. Role Play/ general conversation : Making polite enquiries at Railway Station, Post Office, Banks and other Public places, Replying to such enquiries, enquiring about various goods sold in the market and discussing their prices. Complaining about service at Hotel, restaurant, Offering apologies in reply to such complaints, complain to a company about a defective product you have brought, reply to such complaints.
6. Presentation skill, Use of OHP and LCD.

4. Aural :

Listening to conversation/talk/reading of short passage and then writing down the relevant or main points in the specified number of words and answering the given questions

The assignments/project work are to be evaluated by the internal/ external examiner. The distribution of 30 marks e.g.

10 marks for assignment (Given by subject teacher as sessional marks)

10 marks for conversation and viva-voce

10 marks for phonetic transcription

STRUCTURE OF COMMUNICATION TECHNIQUE PAPER

Distribution of Marks

Theory Paper : 50 Marks

Sessional : 20 Marks

Practices : 30 Marks

- Q1. Question based on the topics prescribed text material will be set to test the candidates ability to understand the content, explain words and phrases, making sentence of given words and ability to summarise will be included. All questions will have to be answered.

A. from English Text Book 10 Marks

B. from Hindi Text Book 5 Marks

- Q2. Candidates will be required to write one letter (English) and one letter in (Hindi) from a choice of two -

A. English Letters 5 Marks

B. Hindi Letters 5 Marks

- Q3. Report Writing on given outlines 5 Marks

Q4. There will be a number of short answer questions to test the candidates knowledge of functional grammar, structure and usage of the language. All the items in this question will be compulsory. The grammar questions has four parts -

(Total Part: A For 5 Marks, B For 3 Marks, C For 3 Marks and D For 4 Marks)

A. This part of the question has to do with the transformation of sentences. English uses several patterns of sentence formation and the same meaning can be expressed by several patterns e.g. Active to Passive voice and vice versa, Direct to Indirect and vice versa, Reframing sentences by changing part of speech e.g Noun to Adjective, Interchanging degree of comparison.

Interchanging Moods - Affirmative to Negative, Assertive to Interrogative or to exclamatory

B. The second part usually requires blanks in a sentence to be filled in with a suitable preposition and articles.

C. The third part is usually an exercise on tenses.

D. The fourth part concerns with one word substitution and abbreviation, uses of idioms and Phrases.

Q5. COMPOSITION : (About 300 Words) (5 marks)

Candidates will be required to select one composition topic from a choice of five. The choice will normally include narrative descriptive, argumentative, discussion and factual topics. The main criteria by which the composition will be marked are as follows

A. the quality of the language employed, the range and appropriateness of vocabulary and sentence structure the correctness of grammatical construction, punctuation and spelling.

B. The degrees to which candidate have been successfully in organising both the composition as a whole and the individual paragraphs.

1.2 APPLIED MATHEMATICS I

[Common to All Engineering Courses]

L T P
3 2/2 -

Rationale:

The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects.

S.N.	Units	Coverage Time		
		L	T	P
1.	Algebra-I	18	6	-
2.	Trigonometry	7	2	-
3.	Coordinate Geometry	15	5	-
4.	Differential Calculus-I	15	5	-
5.	Integral Calculus-I	20	7	-
		75	25	-

DETAILED CONTENTS:

1. ALGEBRA-I :
 - 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
 - 1.4 Vector algebra : Dot and Cross product, Scaler and vector triple product. Application to work done, Moment of a force, Plane geometry.
2. TRIGONOMETRY :
 - 2.1 Relation between sides and angles of a triangle : Statement of various formulae showing relation ship between sides and angle of a triangle.
 - 2.2 Complex number.

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

3. CO-ORDINATE GEOMETRY :

3.1 Standard form of curves and their simple properties -

Parabola $x^2=4ay$, $y^2=4ax$,

Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Tangent and normals

3.2 Straight lines, planes and spheres in space -

Distance between two points in space, direction ratios, Finding equation of a straight line, and shortest distance between two lines

Under different conditions equation of a plane $lx+my+nz=c$, relation between lines and planes, sphere $x^2 + y^2 + z^2 + 2gx + 2fy + 2wz=d$

4. DIFFERENTIAL CALCULUS - I :

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, - Function of a function, Logarithmic differentiation, Differentiation of implicit functions, Higher order derivatives, Leibnitz theorem.

4.3 Special functions (Exponential, Logarithmic, Hyperbolic, Inverse circular and function), Definition, Graphs, range and Domain and Derivations of each of these functions.

4.4 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, sketching of some simple curves (without assumptions, question, not to be asked in the examination), Rate, Measure, velocity, Acceleration, Errors and approximation.

5. INTEGRAL CALCULUS - I :

5.1 Methods of Indefinite Integration :- Integration by substitution, Partial fraction and by parts, Integration of special function of 4.3.

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

- 5.3 Application : Finding areas bounded by simple curves, Length of simple curves, Volume of solids of revolution, centre of mean of plane areas.
- 5.4 Simpsons and Trapezoidal Rule : their application in simple cases, Concept of error for simple function.

1.3 APPLIED PHYSICS

[Common to All Engineering Courses]

L T P
3 2/2 2

Rationale:

Engineering physics is a foundation Course. Its purpose is to develop proper understanding of physical phenomenon and scientific temper in the students. While teaching the subject, teachers should make maximum use of demonstrations to make the subject interesting to the students.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Measurement	4	1	-
2.	Vector	3	1	-
3.	Force and Motion	4	1	-
4.	Dynamics of rigid body (Rotational Motion)	4	1	-
5.	Fluid Mechanics and Friction	4	1	-
6.	Work, Power and Energy	4	2	-
7.	Elasticity	2	1	-
8.	Simple Harmonic Motion	4	1	-
9.	Heat Transfer & Radiation	4	2	-
10.	Application of Sound Waves, Acoustics and Ultrasonics	6	2	-
11.	A. Optics	4	1	-
	B. Fiber Optics	4	1	-
12.	D.C. Circuits	4	1	-
13.	Dielectrics	4	2	-
14.	Magnetic Fields and Materials	4	2	-
15.	Semi Conductor Physics	5	1	-
16.	Nuclear Physics	4	2	-
17.	Laser & its Application	4	1	-
18.	Non-conventional energy sources	3	1	-
		75	25	50

DETAILED CONTENTS:

1. Measurement

a) Units and Dimensions

Fundamental and derived units :

S.I. Units & Dimensions of physical quantities, Dimensional formula and dimensional equation. Principle of homogeneity of dimensions and applications of homogeneity principle to:

i) Checking the correctness of physical equations,

- ii) Deriving relations among various physical quantities,
 - iii) Conversion of numerical values of physical quantities from one system of units into another. Limitations of dimensional analysis.
- b. Errors in measurements, accuracy and precision, random and systematic errors, estimation of probable errors in the results of measurement (Combination of errors in addition, subtraction, multiplication and powers). Significant figures, and order of accuracy in respect to instruments, Standard deviation, Variance.
- 2. Vector :

Scalar and vector quantities; Addition, Subtraction, Resolution of vector- Cartesian components of vector, Scalar and vector product of two vector.
- 3. Force and Motion

Parabolic motion, projectiles thrown horizontally and at an angle. Problems on time of flight, horizontal range, and maximum horizontal range. Central forces. Circular motion, angular velocity, angular acceleration and centripetal acceleration. Relationship between linear and angular velocity and acceleration. Centripetal and centrifugal forces. Practical applications of centripetal forces. Principle of centrifuge. Gravitational force, Motion of satellites, Kepler's laws, Escape velocity, Geostationary satellite, Concept of Black holes, Jet propulsion theory, Motion of Multi-stage Rocket, SLV, PSLV and GSLV Rockets.
- 4. Dynamics of Rigid Body (Rotational Motion)

Rigid body, Rotational motion, Moment of inertia, Theorems (Perpendicular and Parallel axis) of moment of inertia (Statement). Expression of M.I. of regular bodies, Radius of gyration, angular momentum, Conservation of angular momentum, Torque, Rotational kinetic energy. Rolling down the slant planes.
- 5. Fluid Mechanics & Friction

Surface tension, Capillaries, Equation of continuity ($A_1V_1=A_2V_2$), Bernoulli's theorem, stream line and Turbulent flow, Reynold's number.

Introduction, Physical significance of friction, Advantage and disadvantage of friction and its role in every day life. Static and dynamic frictional forces. Coefficients of static and dynamic friction and their measurements. viscosity, coeff. of viscosity, & its determination by stoke's method.
- 6. Work, Power and Energy

Work done by force on bodies moving on horizontal and inclined planes in the presence of frictional forces, Concept of power and its units. Calculation of power (simple cases). Concept of kinetic and potential energy, various forms of energy, Conservation of energy. Force constant of spring, potential energy of a stretched spring.

7. Elasticity

Elasticity, stress and strain. Hooke's law, elastic limit. Yielding point and breaking point. Modulus of elasticity Young's modulus, bulk modulus and modulus of rigidity, Poisson ratio, Resilience.

8. Simple Harmonic Motion

Periodic Motion, characteristics of simple harmonic motion; equation of S.H.M. and determination of velocity and acceleration. Graphical representation. Spring-mass system. Simple pendulum. Derivation of their periodic time. Energy conservation in S.H.M. Definition of free, forced, undamped and damped vibrations, Resonance and its sharpness, Q-factor.

9. Heat Transfer and Radiation

Modes of heat transfer, coefficient of thermal conductivity and its determination by (i) Searle's method for good conductors, and (ii) Lee's method for poor conductors. Conduction of heat through compound media, Conduction and convection, Radial flow of heat, Blackbody radiation, Stefan's law, Wien's displacement and Rayleigh-Jeans laws, Planck's Law.

10. Application of Sound Waves

Acoustics

Standing waves, Closed and Open organ pipes, Resonance, End-correction. Definition of pitch, loudness, quality and intensity of sound waves. Echo and reverberation and reverberation time. Sabine's formula. Control of reverberation time (problems on reverberation time). Acoustics of building defects and remedy.

Ultra-Sonic :

Generation, Magnetostriction, Piezoelectric effect, Application in new technology

11.A Optics

Quantum nature of light, Coherence (Spatial and temporal), Duality of wave and particle, Concept of Interference, Biprism, Fraunhofer single and N-slit diffraction, Grating, Resolving and dispersive power, Elementary concept of

polarisation.

B. Fibre Optics :

Critical angle, Total internal reflection, Principle of fibre optics, Optical fibre, Pulse dispersion in step-index fibres, Graded index fibre, Single mode fibre, Optical sensor.

12. D.C. Circuits

Principle of Wheat Stone bridge and application of this principle in measurement of resistance (Meter bridge and Post Office Box); potentiometer, Kirchoff's Law and their simple application. Principle of Carey-Foster's bridge. Electric potential, potential energy, Energy of a charged capacitor. Fleming left hand rule, torque on a current loop, Moving coil, Galvano meter. Charging/discharging of capacitors, Ballistic galvanometer, its charge sensitivity and Current sensitivity.

13. Dielectrics :

Electric dipole; effect of electric field on dielectrics, polarisation.

14. Magnetic Fields & Materials :

Dia, Para and Ferro-magnetism, Ferrites, Hysteresis, Methods of plotting, Hysteresis curve of a ferro magnetic materials and their uses, Magnetic circuits, Energy stored in magnetic fields, Basic idea of super conductivity, Meissner's effect, Applications.

15. Semiconductor Physics

Energy bands in solids, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semiconductors, Electrons and holes as charge carriers in semiconductors, Effect of temperature in conduction in semiconductors, P-type and N-type semiconductors, P-N junction formation, barrier voltage, Forward and reverse biasing of a junction diode, P-N junction device characteristics, Formation of transistor, transistor-action, Majority and Minority charge carriers, Base, emitter and collector currents and their relationship LED's, Photo-electric effect and photo devices.

16. Nuclear physics

Radioactivity, Nuclear stability, Radioactive emission, radiation damage, Nuclear fission and fusion, Nuclear reactors (PHWR-type and fast breeder) and their application, Mass-energy relation, Atomic mass unit, Mass defect and binding energy.

17. Lasers and its Applications

Absorbtion and Emission of energy by atom, Spontaneous and Stimulated Emission, Einstein's co-efficients, Poluation inversion, Main component of laser and types of laser- Ruby Laser, He-Ne and Semi-conductor laser and their applications. Principles of Holography, Introduction to MASER.

18. Non-conventional energy sources:

- (a) Wind energy : Introduction, scope and significance, measurement of wind velocity by anemometer, general principle of wind mill, Indian wind energy programme.
- (b) Solar energy: Solar radiation and potentiality of solar radiation in India, unit of solar radiation, Solar constant measurement of solar radiation by pyrometer, and by Insolation meter (suryamapi) uses of solar energy: Solar Cooker, solar water heater, solar photovoltaic cells, solar energy collector, Solar PV plants in India, Modern applications in technology.

PHYSICS LAB

Note: Any ten experiments are to be performed.

1. Determination of coefficient of friction on a horizontal plane.
2. Determination of 'Y' (Young's Modulus) by Searle's Method.
3. Determination of 'g' by plotting a graph T^2 versus l and using the formula $g=4n^2/\text{Slope of the graph line}$
4. Determination of Spring constant.
5. Determination of viscosity coefficient of a lubricant by Stoke's law.
6. Determination of 'k' for good conductor (Searle's Method).
7. Determination of frequency of AC mains by melde's methods (Transverse and Longitudinal Mode)
8. Determination of velocity of sound by resonance tube.
9. Determination of E_1/E_2 by potentiometer.
10. Determination of specific resistance by Carry Foster bridge.
11. Determination of resistivity by P.O.Box.
12. Verification of Kirchoff's Law.
13. To observe Characteristics of p-n Junction diode on oscilloscope.
14. To measure instantaneous and average wind velocity by indicating cup type anemometer/hand held anemometer.
15. To measure solar intensity (determine solar constant) with the help of Insolation meter (Suryamapi).
16. Demonstration of He-Ne laser (Interferometer)
17. Determination of internal resistance by potentiometer.

NOTE :

Students should be asked to plot a graph in experiments (where possible) and graph should be used for calculation of results. Results should be given in significant figures only.

1.4 APPLIED CHEMISTRY

[Common to All Engineering Courses]

L T P
3 - -

Rationale:

Engineering Chemistry has profound and deep relationship with the industrial and environmental technology. This curriculum intends to impart technical knowledge alongwith productive practice to the students of the diploma engineering. The teachers are expected to guide the students in the classroom and the laboratories according to the curriculum by demonstrations and by showing relevant materials and equipments to inculcate interests in learning among students.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Atomic Structure	4	-	-
2.	Chemical Bonding	6	-	-
3.	Classification of Elements	3	-	-
4.	Instrumental Methods	4	-	-
5.	Electro Chemistry	6	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	3	-	-
8.	Solid State	3	-	-
9.	Colloids	3	-	-
10.	Lubricants	3	-	-
11.	Environmental Pollution and Control	3	-	-
12.	Water Treatment	5	-	-
13.	Corrosion	3	-	-
14.	Fuels	3	-	-
15.	Glass and Ceramics	3	-	-
16.	Streochemistry of Organic Compounds	4	-	-
17.	Organic Reactions	6	-	-
18.	Organic Materials	9	-	-
		75	-	-

DETAILED CONTENTS:

1. ATOMIC STRUCTURE :

Basic concept of atomic structure, Matter wave concept, Schrodinger wave equation, Quantum number, Haisenberg's Uncertainty Principle, Shaples of orbitals.

2. CHEMICAL BONDING :

Overview of basic concept, Hydrogen bonding, Valence bond theory, Hybridisation, VSEPR theory, Molecular orbital

theory, Co-ordination bond, Crystal field theory for tetrahedral carbon.

3. CLASSIFICATION OF ELEMENTS :

Modern classification of elements (s,p,d and f block elements), Periodic properties : Ionisation potential, electro negativity, Electron affinity, Born-Haber cycle.

4. INSTRUMENTAL METHODS :

UV-visible, IR and NMR spectroscopy, Basic principles, Beer-Lamberts Law and Application of spectroscopy.

5. ELECTRO CHEMISTRY :

Arrhenius Theory of electrolytic dissociation, Transport number, Electrolytic conductance, Ostwald dilution law. Concept of Acid and bases : Bronsted, Arrhenius and Lewis theory. Concept of pH and its measurement by pH meter. Buffer solutions, Indicators, Solubility product, Common ion effect with their application, Redox reactions, Electrode potential(Nernst Equation), Electro-chemical cell (Galvanic and Electrolytic). EMF of a cell and free energy change. Standard electrode potential, Electro chemical series and its application.

Concentration cells, reference electrodes (Hydrogen electrode) cells - Primary, Secondary and Fuel cell, Laclanche's or dry cell, Acid storage cell (Lead accumulator) and Alkali storage cell (Edison accumulator), Fuel cell, Solar cell (Photovoltaic cell), Numerical problems based on topics.

6. CHEMICAL KINETICS :

Introduction, order and molecularity of reaction. Activation energy, Rate law, rate constants, 1st order reactions and 2nd order reactions.

7. CATALYSIS :

Definition Characteristics of catalytic reactions, Catalytic promoters and poison , Autocatalysis and Negative catalysis, Activation energy, Theory of catalysis, Application

8. SOLID STATE :

Types of solids (Amorphous and Crystalline), Classification (Molecular, Ionic, Covalent, Metallic), Band theory of solids (Conductors, Semiconductors and Insulators), types of Crystals, FCC, BCC, Crystal imperfection.

9. COLLOIDAL STATE OF MATTER :

Concept of colloidal and its types, Different systems of

colloids, Dispersed phase and dispersion medium. Methods of preparation of colloidal solutions, Dialysis and electro dialysis. Properties of colloidal solution with special reference to absorption, Brownian Movement, tyndal effect, Electro phoresis and coagulation. relative stability of hydrophillic and hydrophobie colloids. Protection and protective colloids. Emulsion, Types, preparation, properties and uses. Application of colloids chemistry in different industries.

10. LUBRICANTS :

Definition, classification, Necessasity and various kinds of lubricants. Function and mechanism of action of lubricants and examples. Properties of lubricants, Importance of additive compunds in lubricants, Synthetic lubricants and cutting fluids. Industrial application, its function in bearing.

11. ENVIRONMENTAL POLLUTION AND ITS CONTROL :

Concept and various types of environmental pollution with special reference to air pollution and water pollution. General measures to control environmental pollution. depletion of Ozone layer, Green house effect, Acid rain, Smog formation, Chemical and photochemical reaction, Various species in atmosphere. Specific industrial pollution like Euro-I and Euro-II.

12. WATER TREATMENT :

Concept of hard and soft water, Hardness of water, Its limits and determination of hardness of water by EDTA method. Softening methods (Only Sods lime, Zeolote and Ion exchange resin process). Disadvantage of hard water in different industries, Boiler feed water boiler scale formation, Corrosion, Caustic embrittlement, primming and foarming.

Characteristics imparted by various impurities or contaminants such as colour, odour, taste and sediments and their analysis.

Analysis of Water :

- A. Estimation of chlorides in water.
- B. Determination of dissolved oxygen.

Disinfecting of Water :

By Chloramic, Ozone and Chlorination with its mechemism, Advantage and disadvantage of chlorinational, Break point chlorination (Free residual chlorination). Industrial waste and sewage, Municipality waste water treatment, Definition of BOD and COD. Recycling of water-Theory and Process. Numerical problems based on topics.

13. CORROSION :

Concept of metallic corrosion, Types of corrosion and factors affecting the corrosion rate, Chemical and electrochemical theory of corrosion, Oxide film formation and its characteristics, tarnishing fogging and rusting, Prevention of corrosion by various methods.

14. FUELS :

Definition of fuel, its classification and their composition, Calorific value and determination of calorific value of solid and liquid fuels by Bomb calorimeter by Dulong's formula.

Liquid fuel - Petroleum and its refining, distillate of petroleum (Kerosene oil, Diesel and Petrol), Benzol and Power alcohol.

Knocking, Anti-knocking agents, Octane number and Cetane number.

Cracking and its type, Gasolining from hydrogenation of coal (Bergius process and Fischer tropesch's process)

Gaseous Fuel - Coal gas, Oil gas, Water gas, Producer gas, Bio gas, LPG, CNG and Solar energy

Numerical Problems based on topics

15. GLASS AND CERAMICS :

Concept of glass and its constituents, Classification and uses of different glass, Elementary idea of manufacturing process of glass. Introduction to ceramics materials, Its constituent. Industrial application of glass and ceramic.

16. STEREOCHEMISTRY OF ORGANIC COMPOUND:

- Isomerism
- Types of isomerism
 1. Structural isomerism
 2. Stereoisomerism (a) Geometrical (b) Optical
- Definition of chiral, achiral stereogenic centre, plane of symmetry.
- Types of stereoisomers-
 1. Conformers or Rotamers (Only ethanes)
 2. Configurational isomers
 - a. Enantiomers
 - b. Diastereoisomers

17. ORGANIC REACTIONS :

1. Fundamental aspects -
 - A. Regents electrophiles and nucleophiles
 - B. Reaction Intermediates
 - i. Free radical
 - ii. Carbocation
 - iii. Carbanion
 - C. Various effects of substituents - Inductive, Mesomeric, Electromeric.
- 2.A. Mechanism of addition reaction (Markonico's Rule, Cyanohydrin and Peroxide effect),
- B. Mechanism of Substitution reactions (Nucleophilic-hydrolysis of alkyl halide, electrophilic substitution halogenation, Sulphonation, Nitration and Friedel-Craft reaction.
- C. Mechanism of Elimination reaction - Dehydration of primary alcohol, Dehydrohalogenation of primary alkyl halide.
18. ORGANIC MATERIALS :
 - A. POLYMERS :
 1. Introduction to basic terms used in polymer chemistry and technology. Monomers, Average degree of polymerisation, Average molecular weight, Polymers, Polymerisation.
 2. Characteristics of Polymers and their classification
 - A. Addition polymers and their industrial application- Polystyrene, PVA, PVC, PAN, PMMA, Buna-S, Buna-N, Teflon.
 - B. Condensation polymer and their industrial application : Nylon 6, Nylon 6,6, Bakelite, Melamine formaldehyde, Urea formaldehyde, Terylene or Decron, Polyurethanes.
 3. Free radical polymerisation (Mechanism)
 4. General idea of Bio polymers
 5. Brief idea of bio degradable polymers.
 6. Inorganic polymers - Silicones
 - B. SOAPS AND DETERGENTS :
 1. Introduction - A. Lipids, B. Fats and Oils
 2. Saponification of fats and oils , Manufacturing of soap.
 3. Synthetic detergents, types of detergents and its manufacturing.
 - C. EXPLOSIVES: TNT, RDX, Dynamite.
 - E. Paint and Varnish
 - F. Adhesives

1.5 ENGINEERING MECHANICS AND MATERIALS

	L	T	P
RATIONALE	3	-	-

TOPIC WISE DISTRIBUTION OF PERIODS

SL.No.	Topic	L	T	P
1.	Introduction	5	-	
2.	Force Analysis	12	-	
3.	General condition of equilibrium	12	-	
4.	Stress & Strain	12	-	
5.	Beam & Trusses	12	-	
6.	Materials & Concepts Use In Electronics	22	-	
Total		75	-	-

DETAILED CONTENTS

1. Introduction:

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. Forces Analysis:

Concept of coplaner and non-coplaner forces including parallel forces. Concurrent and non-concurrent forces. Resultant force. 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, conditions of equilibrium of coplaner concurrent force system.

3. General Condition of Equilibrium:

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

4. Stresses and strains:

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, CI Al and etc.

5. Beams & Trusses:

Definition of statically determinate and indeterminate trusses. Types of supports. Concept of tie & strut, calculation of reaction at the support of cantilever and simply supported beams and trusses. (simple problems only)

6.A. MATERIALS & CONCEPT USED IN ELECTRONICS :

Soldering materials - Type, chemical composition and properties, Soldering alloys - 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, Polyimide), Properties of copper clad laminates, Material (Filler, Resin, Copper Foil) Photo printing basic for double side PCB, Photo resin materials coating process materials, Screen printing and its materials Etching agent, Film processing and used materials.

(B) Soldering & Brazing:

For black Galvanised and Tincoated Iron sheet, brass and copper sheets only.

- (1) Its concept, comparison with welding as joining method and classification, electric soldering and forge soldering.
- (2) Soldering operation- edge preparation of joints, Pickling and degreasing, Fluxing, Tinning and Soldering. Wave soldering, solder mask, Dip soldering, Drag soldering,
- (3) Materials Used-Common fluxes, soft and hard solder, solder wire (Plain and Resin core) and sticks, spelters and their specifications and discription (For Identification Only), forge soldering bits.
- (4) Electric soldering iron, other soldering tools.
- (5) Common defects likely to occurs during and after soldering.
- (6) Safety of Personnel, Equipment & Tools to be observed.

1.6 ELECTRICAL ENGINEERING-I

(Common with Instrumentation & Control Engineering and Computer Engg.)

L	T	P
3	-	2

RATIONALE

Electrical energy is most convenient neat and clean source of energy for industrial applications. The student is supposed to possess basic knowledge of electrical engineering materials such as conducting, non conducting, insulating, magnetic, semi conductor and some special purpose materials. Fundamental knowledge of electrostatics, electromagnetism will be helpful in understanding the performance of D.C. and A.C. circuits. To face the routine problems of world of work chapters on batteries, transients and harmonics have also been added.

TOPIC WISE DISTRIBUTION OF PERIODS

Sr. No.	Units	Coverage Time		
		L	T	P
1.	Classification	3	-	-
2.	Conducting Materials	8	-	-
3.	Insulating Materials	8	-	-
4.	Magnetic Materials	6	-	-
5.	Semi Conductor & Special Purpose Materials	6	-	-
6.	D. C. Circuits	6	-	-
7.	Electrostatics	8	-	-
8.	Electromagnetism	8	-	-
9.	A. C. Theory	8	-	-
10.	Batteries	6	-	-
11.	Transients & Harmonics	8	-	-
Total		75	-	50

DETAILED CONTENTS

1. CLASSIFICATION:

Classification of materials into Conducting materials, Insulating materials, Semi-conducting materials with reference to their atomic structure.

2. Conducting Materials:

A. Resistivity and factors affecting resistivity such as temperature, alloying and mechanical stressing.

B. Classification of conducting materials into low

resistivity and high resistivity materials. Some examples of each and their typical applications.

3. Insulating Materials:

A. Electrical Properties:

Volume resistivity, Surface resistance, Dielectric loss, Dielectric strength (Break down voltage) and Dielectric constant.

B. Chemical Properties:

Solubility, Chemical resistance, Weather ability.

C. Physical Properties:

Hygroscopicity, tensile and Compressive strength, Abrasive resistance, Brittleness.

D. Thermal Properties:

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

E. Plastic Insulating Materials:

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

4. MAGNETIC MATERIALS:

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

B. Soft and Hard magnetic materials, their examples and typical applications.

5. SEMI CONDUCTOR AND SPECIAL PURPOSE MATERIALS:

N-type and P-type materials, application of semi-conductor materials, materials used in transistor and I.C. manufacture.

6. D.C. CIRCUITS:

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

(ii) Kirchoff's laws, application of Kirchoff's laws to solve, simple d.c. circuits.

(iii) Thevenin's theorem, maximum power transfer theorem,

Norton's theorem and super position theorem, simple numerical problems.

7. ELECTROSTATICS:

- (i) Capacitance and capacitor, definition, various types.
- (ii) Charging and discharging of a capacitor, growth and decay of current in a capacitive circuit.
- (iii) Energy stored in a capacitor.
- (iv) Capacitance in terms of dimensions of parallel plate capacitor.
- (v) Dielectric constant of material, Break down voltage of a capacitor.
- (vi) Series and parallel connection of capacitors.

8. ELECTRO MAGNETISM:

- (i) Concept of mmf, flux, reluctance and permeability.
- (ii) Energy stored in a magnetic field and an inductor.
- (iii) Solution of problems on magnetic circuits.
- (iv) Faraday's laws of electromagnetic induction, Lenz's law, Physical explanation of self and mutual inductance.
- (v) B-H curve, Hysteresis, Eddy currents elementary ideas and significance.
- (vi) Growth and decay of current in an inductive circuit.
- (vii) Force between two parallel current carrying conductors and its significance.
- (viii) Current carrying conductor in a magnetic field and its significance.

9. A.C. THEORY:

- (i) Concept of alternating voltage and current, difference between A.C and D.C..
- (ii) Generation of alternating voltage, equation of sinusoidal waveform.
- (iii) Definition and concept of cycle, frequency, Time period, amplitude, instantaneous value, average value, RMS value, peak value, form factor, Peak factor.
- (iv) Phase and phase difference, representation of alternating quantities by phasor, addition and

subtraction of alternating quantities.

10. BATTERIES:

- (i) Construction of lead acid and nickel cadmium batteries.
- (ii) Charging and maintenance of batteries.
- (iii) Rating of batteries.
- (iv) Back up batteries (Lithium & Silver Oxide batteries)
- (v) Shelf life of batteries.

11. TRANSIENTS & HARMONICS:

Introduction, Types of transients, Important differential equations, First and Second order equations, Transients in R-L series circuits (D.C.), Short circuit current, Time constant, Transients in R-L series circuits (A.C.), Transients in R-C series circuits (D.C.), Transients in R-C series circuits (A.C), Double energy transients.

Fundamental wave and harmonics, Different complex waveforms, General equation of complex wave, R.M.S. value of a complex wave, Power supplied by complex wave, Harmonics in single phase a.c. circuits, Selective resonance due to harmonics, Effect of harmonics on measurement of inductance and capacitance

ELECTRICAL ENGINEERING-I LAB:

LIST OF PRACTICALS:

1. Ohm's law verification
2. To verify the laws of series and parallel connections of resistances i.e. to verify:-
 - (i) The total resistance in series connections.
$$R_T = R_1 + R_2 + R_3 + \dots$$

Where R_T is the total resistance and R_1, R_2, R_3 etc. are the resistances connected in series.
 - (ii) The total resistance in parallel connections.
$$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 + \dots$$

Where R_T is the total resistance and R_1, R_2, R_3 etc. are the resistances connected in parallel. Also to conclude that the total resistance value of a parallel circuit is less than the any individual resistance.
3. To verify Kirchoff's following laws:-
 - (i) The algebraic sum of the currents at a junction is zero
 - (ii) The algebraic sum of the e.m.f. in any closed circuit is equal to the algebraic sum of IR products (drops) in that circuit.
4. 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.
5. To verify Thevenin's and maximum power transfer theorems
6. 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 a magnetic material inside the coil, the inductance value of the coil is substantially increased.
7. To verify the relation:-
$$C_T = (C_1 * C_2) / (C_1 + C_2)$$
and
$$C_T = C_1 + C_2$$

For two capacitors, connected in series and parallel respectively.
8. To test a battery for charged and discharged conditions and to make connections for its charging.
9. To show that the range of an ammeter (d.c. and a.c.) and a voltmeter (d.c. and a.c.) can be extended with the use of shunts and multiplier.
10. To convert the given galvanometer into a voltmeter and an ammeter.

1.7 ELECTRONIC COMPONENTS & DEVICES

(Common with Instrumentation & Control Engineering & Computer Engineering)

L	T	P
3	-	3

RATIONALE

Knowledge of Electronic components & devices is quite essential for a student of electronics engineering diploma programme. With the knowledge of these active and passive components he will work successfully 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, FET and integrated circuits for successful handling of industrial problems.

TOPIC WISE DISTRIBUTION OF PERIODS

Sr. No.	Units	Coverage Time		
		L	T	P
1.	Introduction To Electronics, Its Component and Decives, Its Application	4	-	-
2.	Passive Components	9	-	-
3.	Voltage & Current Source	4	-	-
4.	Semiconductor Diode	12	-	-
5.	Introduction To Bipolar Transistor	10	-	-
6.	Transistor Biasing & Stabilization	9	-	-
7.	Single Stage Transistor Amplifier	9	-	-
8.	Field Effect Transistor	6	-	-
9.	Metal Oxide Field Effect Transistor	4	-	-
10.	Complementary Metal Oxide Field Effect Transistor	4	-	-
11.	Integrated Electronics	4	-	-
Total		75	-	75

DETAILED CONTENTS

1. INTRODUCTION TO ELECTRONICS:
 - 1.1. Application of Electronics in different fields.
 - 1.2. Brief introduction to active components and devices.
2. PASSIVE COMPONENTS:
 - 2.1. Resister- 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 dependance and noise consideration, specification Testing, mutual comparison and typical applications, Voltage Dependent Resistor (VDR).

2.2. Capacitors- Working characteristics/properties, Capacitors-polyster, Metallized polyster, 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:

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 source into a current source and vice-versa

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

4. SEMICONDUCTOR DIODE:

4.1. P-N junction diode, Mechanism of current flow in P-N junction drift and diffusion currents, depletion layer, potential barrier, 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 devariation).

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, capacitor input filter, bleeder resistance, working of the filters and typical applications 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, LED's and photo diodes.

4.5. Important specifications of rectifier diode and zener diode.

5. INTRODUCTION TO BIPOLAR TRANSISTOR:

5.1. Concept to bipolar transistor as a two junction three terminal device having two kinds of charge carriers, PNP and NPN transistors, their symbols and mechanisms of current flow, explanation of fundamental current relations. Concept of leakage current (ICBO) effect of temperature on leakage current.

Standard notation for current and voltage polarity.

5.2. CB, CE and CC configurations.

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

(b) Common emitter configuration: current relations in CE configuration, collector current in terms of base current and leakage current (ICEO), 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 β from the characteristics.

(c) Common collector configuration: 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.

(a) DC load line, Its equation and drawing it on collector characteristics.

(b) Determination of small signal voltage and current gain of a basic transistor amplifier using CE output characteristic 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:

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 analysing potential divider biasing circuit.
- 6.3 Simple design problems on potential divider biasing circuit.
- 7 SINGLE STAGE TRANSISTOR AMPLIFIER:
 - 7.1 Analysis of Single Stage CE, CB and CC amplifier.
 - 7.2 Single stage CE amplifier circuits with proper biasing components.
 - 7.3 AC load line and its use in :
 - (a) Calculation of current and voltage gain of a single-stage amplifier circuit.
 - (b) Explanation of phase reversal of the output voltage with respect to input voltage.
 - 7.4 Transistor hybrid low frequency model in CE configuration, 'h' parameter and their physical significance, typical values of 'h' parameters and their determination by transistor characteristics.
 - 7.5 Expressions for voltage gain, current gain, input and output impedance for a single stage CE amplifier circuit in 'h' parameters, appropriate approximations.
- 8. FIELD EFFECT TRANSISTOR (FET)
 - 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 :
 - 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 :
 - 10.1 Construction, operation and Characteristics of CMOS in both depletion and enhancement modes.
 - 10.2 Use of CMOS as Invertor, Different application of CMOS, CMOS IC.
 - 10.3 Comparison of JEET, MOSFET and Bipolar transistor.

11 INTEGRATED ELECTRONICS

- 11.1 Introduction to IC and its importance in modern electronics, types of IC's, some examples of popular IC's (74 & 40 series i.e. 741, 714, 555, 810, 4046 etc.).
- 11.2 Fabrication of transistor by planer process. A typical fabrication process for Ics (brief explanation).
- 11.3 Difference between SSI, MSI, LSI, VLSI.

LIST OF BOOKS

- 1. Bhargava, Kulshreshtha & Gupta - "Baisc Electronics & Linear Circuits" - Tata Mcgraw-Hill.
- 2. Malvino, A. P. - "Electrinics Principles" - Tata Mcgraw-Hill.
- 3. Sedra, Adel S. Smith, Kenneth. C. " Micro Electronics Circuits" - Oxford University Press 5th Edtion

ELECTRONIC COMPONENTS & DEVICES

LIST OF PRACTICALS

1. Semiconductor diode characteristics :
 - (i) Identifications of types of packages, terminals and noting different ratings using data books for various types of semiconductor diodes (Germanium, point contact, silicon low power and high power and switching diode).
 - (ii) Plotting of forward V-I characteristics for a point contact and junction P-N diode (Silicon & Germanium diode).
2. 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)
3. To Plot forward and reverse V-I characteristics for a zener diode.
4. To Plot wave shapes of a full wave rectifier with shunt capacitor, series inductor and n filter circuit.
5. To Plot the input and output characteristics and calculation of parameters of a transistor in common base configuration.
6. To Plot input and output characteristics and calculation of parameters of a transistor in common emitter configuration
7. 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.
8. Plot the FET characteristics and determination of its parameters from these characteristics.
9. Measurement of voltage gain and plotting of the frequency response curve of a JFET & MOSFET amplifier circuits.
10. Single stage Common Emitter Amplifier Circuits
 - (i). Measurement of voltage gain at 1 KHZ for different load

resistance.

- (ii) Plotting of frequency response of a single stage amplifier circuit.
- (iii) Measurement of input and output impedance of the amplifier circuit.

11. Single stage common base amplifier circuit

- (i) Measurement of voltage gain at 1 KHZ for different load resistances.
- (ii) Plotting of frequency response of a single stage amplifier circuit.
- (iii) Measurement of input and output impedance of the amplifier circuit.

12. Identification of Some Popular IC of 74 and 40 series with Pin Number and other details.

1.8 TECHNICAL DRAWING:

(Common with Instrumentation & Control Engineering)

L	T	P
2	-	4

ENGINEERING DRAWING SCOPE OF THE SUBJECT :

A diploma holder in electronics is likely to be employed in industries where fabrication manufacturing, marking and servicing of electronics products & instruments are carried out. In such a job situation, he/she will come across various types of drawing of components, circuits & system. A knowledge of engineering drawing will be useful to interpret those drawing. In case he/she gets employment in documentation service in an electronics industry, he himself may have to prepare such drawing & for this work and understanding of the basis of concepts & principles involved in engineering drawing will be useful and have the necessity of this subject.

INSTRUCTIONAL OBJECTIVES :

At the end of the instruction in the subject, the learner should be able to :-

1. Draw free hand sketches of the schematic diagrams of electronic circuits, using standard symbols.
2. Prepare drawing from the rough sketches provided and/or enlarge/reduce the given drawing to the desired scale.
3. Draw exploded views of components & assemblies in preparation of service drawing.
4. Draw wiring diagram & make parts list;
5. Draw various views of the object using orthographic projection.
6. Identify the object when plan, elevation & views of the same are given .
7. Re arrange block representation of the given circuits.

Prat-1 (Mechanical Drawing)

DETAILED CONTENTS.

1. Free hand sketching :
 - 1.1 Introduction of Engineering drawing & its significance in the field of engineering.
 - 1.2 Need of standard practices in engineering drawing.
 - 1.3 Standard practice as per IS-696-1972.
 - 1.4 Free hand sketching; different types of lines, free hand lettering of different types
2. Care, handling & proper use of drawing instruments & materials:
 - 2.1 Drawing instruments.
 - 2.2 Materials used in drawing work.
 - 2.3 Sheet size, layout & planning of drawing sheet (familiarity sheet size, layout & planning of drawing sheet (familiarity with standard paper sizes, e.g A4, A3 & A2 and their mutual relationship).
3. Lettering techniques and practice
 - 3.1 Free hand drawing of letters & numerals in 3, 5, 8 & 12 mm series, vertical upright and inclined at 75°.
 - 3.2 Instrumental single stroke lettering in 12 mm.
4. Dimensioning Techniques :
 - 4.1 Necessity of dimensioning, appropriate methods of dimensioning, their merits and demerits, selection of proper dimension technique.
 - 4.2 Requirements of view for complete dimensioning.
5. Projection :
 - 5.1 Principle of Projection-I
 - (a) Recognition of objects from the given pictorial view.
 - (b) Identification of surfaces from different objects & pictorial views.
 - (c) Exercise on missing surfaces (views).
 - (d) Sketching practice of pictorial views objects given.

5.2 Principle of Projection-II.

- (a) Principle of orthographic projections.
- (b) Three views of given object.
- (c) Six views of given object.
- (d) From shapes of inclined surfaces.
- (e) Invisible lines, centre lines, extension & dimensioning lines.
- (f) Location & drawing of missing lines.

6. Sections :

- 6.1 Importance of sectioning.
- 6.2 Method of representing the section.
- 6.3 Conventional sections of different materials.
- 6.4 Types of sections ;types of breaks, aligned sections.
- 6.5 Sectioning of simple objects like brackets, pulleys etc.

7. Details & Assembly drawing :

- 7.1 Symbols used to show joints in chasis & frames.
- 7.2 Principles of detail & assembly drawing ;part cataloguing.
- 7.3 Practical exercises of drawing exploded views of machine components & making assembly drawing.

NOTE :

- 1. Whenever possible drawing work should involve examples relevant to electronics discipline.
- 2. Examples from electronics parts catalogue, views of machine electronic equipment, chasis, consoles, PCB (Printed Circuit Board) Hi Fi cabinets etc. may be used.

PART-II (ELECTRONICS DRAWING)

1. Draw the standard symbols of the following :

(Different pages of ISI standard IS; 2032 may be referred):

- 1.1 (a) Resistors Capacitors: Fixed, preset, variable, electrolytic and ganged types.
- (b) Inductors : Fixed, tapped and variable types, RF & AF

chokes, Air cored, Solid cored & laminated cored.

- (c) Transformers : Step-up, step-down. AF & RF types, Auto-transformer, IF transformer.

Antenna, Chassis, Earth, Loudspeaker, Microphone, Fuse Indicating lamp, Coaxial cable, Switches-double pole single throw (DPST), Double pole throw (DPT) and Rotary types, terminals and connection of conductors.

1.2. Active Devices:

- (a). Semiconductor : Rectifier diode, Zener diode, Varacter diode, Tunnel diode, Photo, Light emitting diode (LED), Bipolar transsitor, junction field effect transistor (JFET), Mosfet, Photo transistor, Uni junction transistor (UTJ), Silicon control rectifier (SCR), Diac, Triacs outlines (with their types numbers e.g TO3, TO5, TO18, TO39, TO65 etc) of the different types of semiconductor diodes, Transistors Scrs, Diacs, Triacs and ICs (along with indicators for pin identification etc.)

1.3. Telephone components :

- (a). Telephone Instrument/Components : Transmitter, Receiver, Filters & Hybrid transformer.

- 1.4. Draw standard symbols of NOT, AND, NAND, OR, NOR XOR, Expandable & Tristate gates, Op, Amp, Ic, Flip-flops (Combination of 2,3,4 input gates should be drawn).

2. Draw the following : (With the help of rough sketch/clues given).

2.1 Circuit diagram of a Wein's bridge oscillator.

2.2 Circuit diagram of a Battery eliminator.

2.3 Block diagram of a typical Radio receiver.

2.4 Block diagram of an Electronic multimeter.

2.5 Circuit of Emergency light.

2.6 Circuit diagram of Voltage stabilizers.

2.7 Circuit diagram of Fan regulator.

3. Connection wiring diagrams.

3.1 Point to point pictorial.

3.2 Highway or trunk line.

3.3 Base line or air line.

Exercise on reading & interpreting of wiring diagrams.

4. Graphical Representation of Data : General concept, selection of variables & curve fitting, curve identification zero point location. Use of various graph paper and preparation of diagram from given data. Bar charts, pie graph, pictorial graph.
5. Given the block diagram of a radio receiver on A-4 size, enlarge the same to A-2 size.
6. Given the block diagram of a TV receiver in A-1/A-2 size, reduce it to A-3 size.
7. Convert a rough block diagram sketch on A-4 size to a finished block diagram on A-2 size.
8. P.C.B layout of a single electronic circuit on a graph sheet. Keeping in view the actual size of the components.

PART-III (INSTRUMENTATION & CONTROL DRAWING)

Drawing of common symbols use in instrumentation and signal flow graph in control systems. (Only For Instrumentation & Control Engineering)

INSTRUMENTATION SYMBOLS :

Locally mounted instruments, Instruments at control centre, Instrument with two services, Transmitter, Pneumatic control valve, Hydraulic control valve, Solenoid valve, Safety valve, Self operated controller, Process line On-Fire sensor, Point of measurement, Fluid Pressure Line, Electric line, Pneumatic line, Capillary line, Special type of valves, Method to differentiate various process line using current, Identification table for instrumentation diagram.

Instrumentation diagram of process unit (At least two diagram should be drawn on one sheet)

1.9 ELEMENTARY WORKSHOP PRACTICS

(Common with Instrumentation & Control Engineering)

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- - 6

I- FITTING SHOP

Topic	Knowledge/Skill
1. Types and use of making and measuring tools including micrometer, slide callipers, vernier gauge, feeler gauge, spherometer.	Select and use correct tools to and measure as needed, Ability to measure wire and Sheet gauge, diameter, Radius dimension.
2. Types and use of vice, Clamps Chisel, Hammer, Punch for metal work.	Select and made correct use of appropriate tool for specified job.
3. Types and use of files for Soft and Hard metal/Alloys, Sheets.	Select and made correct use of files on specified materials.
4. Types and use of Grinding Machine, Grinding polishing Machine on Metals/Laminates.	Select and made correct use of appropriate machines and tools for specified grinding, buffing polishing operations.
5. Types and use of Hacksaw Power saw and Blades on soft and hard metals / Alloys / Laminates/Sheets.	Select and made correct use of appropriate saw and blade for specified job.
6. Types and use of Drilling Machine, Drill Bits, Drill Speeds, Including counter sinking on Metals, Alloys, Sheet Metal.	Select and made correct use of appropriate Drilling machine tools for Drilling and counter on specified job.
7. Types and use of Tapes and Dies for internal and external threading.	Select and made correct use of appropriate tools to cut specified job.
8. Types and use of fastening tools and accessories such as nuts, bolts, washers, self tapping, screws drivers, allen key, riveting tools and rivet for metal and sheet metal.	Select and made correct use of appropriate tools and fastening materials to carry out a fastening operation on specified job.
9. Techniques of Binding and Folding Aluminium pipes upto 12 mm. diameter. (Exemple Practice Antenna marking)	Ability to bend aluminium pipes of a given size to a specified job shape.

Jobs to be Made :

1. Hacksawing and Chipping of M.S.
2. Filling Chipped M.S job.
3. Fitting on rectangular or square M.S. job.
4. Making triangular square or Hexagonal figure inside of M.S. job.
5. Utility article to prepare calliper, screw driver or try square.

II-SHEET METAL SHOP

Topic	Knowledge/Skill
1. Types and use hand tools for sheet metal work cross peen, straight peen, ball peen mallet selection.	Select and make correct use of appropriate materials and tool for specified sheet metal job.
2. Types and use of hand shear quilltiness for sheet cutting.	Select and make correct use of appropriate tools/machine for cutting sheet metal specified dimensions.
3. Techniques of grooving creasing, folding, corner making, bending, circle cutting.	Ability to perform the specified operation on sheet metal to a given tolerance.
4. Types and use of engraving tools and machines or sheet metal.	Ability to engrave simple words on sheet metal.

Jobs to be Made :

1. (a) Cutting shearing & bending.
(b) Brazing practice on small pieces.
2. Making a soap case with M.S. sheet.
3. Making a funnel with tin sheet & soldering the same.
4. Making a cylinder & soldering the same.
5. Preparation of different types of joints such as Lap joint-single seam, Double seam & Cap joint & Hemp & Wired edge.

III-PAINTING SHOP

Topic	Knowledge/Skill
1. Techniques of sheet metal cleaning and surface treatment for spray painting.	Ability to prepare and treat surface appropriate before spray painting.
2. Types of paints, solvents, thinners, removers, brushes, use and care of brushes, paint preparation.	Ability to select and correctly use of appropriate paint remover, solvent, brush, ability to prepare paint and take care brushes.

3. Technique of spray painting and use of stencils on paint letters and figures on sheet metal.	Ability to spray paint on Sheet metal to a specified finish.
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Job to be Made :

1. Preparation of wooden surface for paper basket or paper tray & painting & polishing the same.
2. To prepare a metal surface

IV-WOOD AND LAMINATE SHOP

Topic	Knowledge/Skill
1. Types important properties comparative costs of wood, plywood various particle board, veneers, formica, Bakelite, perspex and common amenities used for making Cabinets, Frames, consoles in the electronics field.	Identify commonly used materials state important properties, estimate cost. Select correct material(s) for a given assignment.
2. Types important properties comparative cost use of covering materials such as artificial leather, Felt, Cloth, Frames, various types of Trims such as Aluminium strips channels corners grills.	Identify commonly used state important properties estimate cost, select correct materials (s) for the given assignment.
3. Types and use of planner, big saw, band saw, circular saw, various blades, Gullotine for Laminate and wood cutting, Necessary precautions.	Select and correctly use of appropriate Saw / Machine for wood, Laminate paring, cutting to specified shape and size.
4. Types and uses of hand saw, wood chisel, Wood files, Auger, Drill Counter, Sinking, sanding for woods and Laminates.	Select and correct use of appropriate tools for carrying out specified operation to a finish.
5. Techniques of fastening wood and laminates with nails, screws, adhesives.	Ability to fasten wood and laminates as specified.
6. Techniques of working on perspex-cutting shaping, Drilling, hole cutting joining with chloroform	Ability to cut, Join, Drill shape perspex to a given specification.
7. Techniques of fixing formica, venner, felt, artificial leather, rexin, foam, grills, trims on wood, chip	Ability to perform given fastening operation to given specification.

board and laminates using adhesives, nails as required.

8. Techniques of engraving simple pattern, letters on bakelite, perspex, formica and similar. Ability to engrave simple patterns and letters on laminates.

Jobs to be Made :

1. Plaining & Sawing Practice.
2. Lap joint.
3. Motric & Tenon joint.
4. Dovetial joing.

NOTES :

1. Each three period pratical session is to be precebed by one period tutorial session for demonstration/theory lessons.
2. Extensive use of illustrative display showing correct use, limitations precautions, properties (As applicable) of materials, tools, Machines should be used for teaching purpose. Teacher-student activity schedule should be prepared to ensure that the required knowledge / skill transfer takes place.

1.10 COMPUTER APPLICATION FOR ENGINEERING

[Common with Civil Engg., Civil (Spl. With Rural), Mechanical Engg., (Specialisation in Production, Automobile, Refrigeration and Air conditioning), Electronics Engg., Instrumentation and Control Engg., Dairy Engg., Leather Technology, Footwear and Leather Goods Tech., Ceramics, Chemical Engg. (Four year Sandwich), Chemical Tech. (Rubber & Plastic), Chemical Tech. (Fertilizer)]

L T P
1 - 3

Rationale:

Computers are being used for design and information processing in all branches of engineering. An exposure to fundamentals of computer programming is very essential for all diploma holders. This subject has been included to introduce students in the use and application of computers in engineering.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction to Computer	5	-	-
2.	Introduction To Operating System MS DOS/Windows	3	-	-
3.	Ms-Word	4	-	-
4.	Ms-Excel	3	-	-
5.	Ms-Power Point	3	-	-
6.	Ms-Access	3	-	-
7.	Introduction to Internet	2	-	-
8.	Concept of Programming	2	-	-
		25	-	75

DETAILED CONTENTS

1. Introduction to Computer:

Block Diagram of Computer, Types of Computer Central Processing unit (Control unit, A.L.U.) & memory Unit. Types of Input and Output devices and memories. Visual Display Unit, Keyboard, Floppy disk drive, Hard disk drive, CD-ROM Drive, Magnetic & Tape Drive

Number system (Conversion) Binary, Octal, Hexa decimal number system, Conversion from Decimal to Other System and vice-versa Bit, Byte and Word.

2. INTRODUCTION TO OPERATING SYSTEMS (MS-DOS/MS-WINDOWS:)

What is operating system, its significance, Commands of DOS, Features/Application of window.

3. MS WORD:

File : Open, Close, Save, Save as, Search, Send to, Print Preview, Print and Page Setup
Edit : Cut, Copy, Paste, Office Clipboard, Select All, Find, replace, Goto, etc.
View : Normal/Web Layout/Print Layout; Tool Bars; Header/Footer; Zoom, etc.
Insert: Break, Page Number, Date & Time, Symbol, Comment, Reference, etc.
Format: Font, Paragraph, Bullets & Numbering, Borders & Shading, Column, Change case, Back ground, etc.
Tools : Spelling & Grammer, Language, Word Count, Letters & Mailing, Options, Customize, etc.
Table : Draw, Insert, Delete, Select, Auto Format, AutoFit, Convert, Sort, Formula, etc.

4. MS EXCEL:

Introduction, Use of Tools/Icons for preparing simple applications.

5. MS POWER POINT :

Introduction, Use of Tools/Icons for preparing simple presentation on Power Point.

6. MS ACCESS :

Introduction, Use of Tools/Icons for preparing simple applications.

7. Introduction to Internet:

What is Network, How to send & receive messages, Use of Search Engines, Surfing different web sites. Creating Mail ID, Use of Briefcase, Sending./replying emails.

8. Concept of Programming :

Flowcharting, Algorithm techniques, etc.

List Of Practicals

1. Practice on utility commands in DOS.
2. Composing, Correcting, Formatting and Article (Letter/Essay/Report) on MS Word and taking its print out.
3. Creating, editing, modifying tables in MS ACCESS.
4. Creating labels, report, generation of simple forms in MS ACCESS.
5. Creating simple spread sheet, using in built functions in MS EXCELL.
6. Creating simple presentation on Power Point.
7. Creating mail ID, Checking mail box, sending/replying e-mails.
8. Surfing web sites, using search engines.

SECOND YEAR DIPLOMA COURSE IN "ELECTRONICS ENGINEERING"

2.1 APPLIED MATHEMATICS II

[Common to All Engineering Courses]

L T P
3 1 -

Rationale :

The study of mathematics is an important requirement for the understanding and development of concepts of Engg. The purpose of teaching mathematics to the Diploma Engg. students is to give them basic foundation and understanding of mathematics so that they can use the same for the understanding of engineering subjects and their advancements.

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Matrices	15	5	-
2.	Ordinary Differential Equations	15	5	-
3.	Differential Calculus-II	15	5	-
4.	Integral Calculus-II	15	5	-
5.	Probability & Statistics	15	5	-
		75	25	-

DETAILED CONTENTS

1. MATRICES :

1.1 Algebra of Matrices, Inverse :

Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Determinant of a matrix, Cofactors, 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 a 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 Types of Matrices :

Symmetric, Skew symmetric, Hermitian, Skew hermitian, Orthogonal, Unitary, diagonal and Triangular.

1.5 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. ORDINARY DIFFERENTIAL EQUATION :

2.1 Formation, Order, Degree, Types, Solution :

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

2.2 First Order Equations :

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

2.3 Second Order Linear Equation :

Property of solution, Linear equation with constant coefficients, Cauchy type equation. Homogeneous and Non-homogeneous equations, equations reducible to linear form with constant coefficients.

2.4 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

3. DIFFERENTIAL CALCULUS-II :

3.1 Function of two variables, identification of surfaces in space

$$z = x^2 + y^2, \quad x^2 + y^2 = a^2, \quad x + y = 2$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1 \qquad \frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

3.2 Partial Derivatives :

Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians.

3.3 Vector Calculus :

Vector function, derivatives, gradient, divergence and curl

Some identities among these. Five integrals, double and triple integral, surface integral, Green, Gauss and Stokes theorem and application

4. INTEGRAL CALCULUS - II

4.1 Laplace Transform :

Definition, Basic theorem and properties, Unit step and Periodic functions, Solution of ordinary differential equations.

4.2 Beta and Gamma Functions :

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

4.3 Fourier Series :

Fourier series of $f(x)$ in $-n < x < n$, Odd and even function, Meaning of the sum of the series at various points.

5. PROBABILITY AND STATISTICS :

5.1 Probability :

Laws and Conditional probability

5.2 Distribution :

Discrete and continuous distribution.

5.3 Binomial Distribution :

Properties and application through problems.

5.4 Poisson Distribution :

Properties and application through problems

5.5 Normal Distribution :

Properties and applications through problems

5.6 Method of Least-square.

2.2 ELECTRICAL ENGINEERING-II

(Common with Instrumentation & Control Engineering)

L	T	P
3	-	2

Rationale :

Electricity is said to be the life of industries. We can not 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 fascilitate him in routine working.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	A. C. Theory	15	-	-
2.	Three Phase Supply	12	-	-
3.	Transformers	12	-	-
4.	D. C. Machines	12	-	-
5.	Synchronous Machines	12	-	-
6.	Induction Motor	12	-	-
		75	-	50

DETAILED CONTENTS

1.0 A.C.THEORY

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 Solution and phasor diagrams for simple R-L-C circuits (Series and parallel); Impedance, Impedance triangle, phase angle.
- 1.6 Power in pure resistance, inductance and capacitance; power in combination of R-L-C circuits; power factor.
- 1.7 Active and reactive currents and their significance; practical importance of power factor.
- 1.8 Series and parallel resonance in R-L-C circuits, Q-factor of coils and capacitance.
- 2. THREE PHASE SUPPLY:
 - 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:
 - 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:
 - (a) D. C. Generator:

Working principle, constructional details, e.m.f equation, types of generators and their applications.
 - (b) 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).
 - (c) Starters for D.C. Machines

5. SYNCHRONOUS MACHINES:

(a) Alternators:

Working principle, types of alternators, constructional details. e.m.f. equation, condition for parallel operation.

(b) Synchronous Motors:

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

(c) Application of synchronous machines.

6. INDUCTION MOTORS:

(a) Three Phase Induction Motor:

Working principle and constructional details, types of induction motor, slip ring and squirrel cage, slip in induction motors, speed torque characteristics, starting and speed control, application of induction motors in industry.

(b) 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).

(c) Starters for Induction motors.

ELECTRICAL ENGINEERING-II LAB

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 find for a filament lamp :-
 - (a) Variation of resistance with temperature.
 - (b) Variation of temperature with voltage.
 - (c) Variation of resistance with voltage.
 - (d) Variation of power with voltage.
4. To measure power and power factor in three phase system by two wattmeter method.
5. To determine the efficiency and regulation of a transformer by performing direct loading.
6. To measure the induced emf of separately excited D.C. generator as a function of field current.
7. To measure the terminal voltage of a separately excited D.C. generator as a function of load current.
8. To measure the terminal voltage of a D.C. shunt generator as a function of load current.
9. To measure the speed of a separately excited D.C. motor as a function of load torque at rated armature voltage.
10. 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.
11. To start a Three Phase induction motor and to determine its slip at various loads.
12. To determine V curves of a synchronous motor.

2.3 INDUSTRIAL ELECTRONICS AND TRANSDUCERS

L T P
3 - 2

Rationale :

Measurement of different parameters in required in industries to maintain the product within specified limits. The measurement can be done by direct or indirect methods. Transducers are used as sensing elements in indirect system of measurements. The student equipped with the knowledge about thyristers, optoelectronic devices will prove useful in the world of work.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Thyristers & Their Application	18	-	-
2.	Induction Heating	3	-	-
3.	Dielectric Heating	6	-	-
4.	Transducers	18	-	-
5.	Processing of Transducers Signals	9	-	-
6.	Optoelectronic Devices	21	-	-
		75	-	50

DETAILED CONTENTS

1. THYRISTORS AND THEIR APPLICATIONS
 - 1.1 Name, symbol and typical applications of members of thyristor family.
 - 1.2 SCR, Triac and Diac-Basic structure, operation, V-I characteristics and ratings, gate circuits, ratings, triggering process and triggering circuits, turn off methods and circuits, selections of heat sinks, mounting of thyristor on heat sinks, basic idea of protection of thyristor circuits.
 - 1.3 Operation, V-I characteristics, equivalent circuit and parameters of an UJT: Description of UJT relaxation oscillator, use of UJT relaxation oscillator for triggering thyristors.
 - 1.4 Diac SCR and Triac switching circuits like automatic battery charger, voltage regulator, emergency light, alarm circuits, time delay relay circuits and circuits for over current and over voltage protection.

1.5 Single phase, various types of phase controlled rectifiers using SCR for resistive and inductive load explanation using waveshapes and appropriate mathematical equation (No derivation).

A.C. phase control using SCRs and triacs, Application of phase controlled rectifiers and A.C. phase control circuits in illumination control, temperature control, variable speed drives using d.c. moters and small a.c. machines.

1.6 Half wave, full wave (including bridge) poly phase rectifiers using SCRs; explanation using wave shapes and formula (no derivation). Operation of three phase bridge controlled rectifier and its applications.

1.7 Principle of operation of basic inverter circuits, basic series and parallel commutated inverters, principle of operation of cycloconverter, choppers and dual converter, mention of applications.

2. PRINCIPLES AND APPLICATIONS OF INDUCTION AND DIELECTRIC HEATING (No Mathematical Treatment)

Introduction, improtance of heating in industry, Principle of induction heating, Industrial applications of induction heating, Principle of dielectric heating, Industrial applications of dielectric heating.

3. TRANSDUCERS:

Basic idea and principle of operation and their use in measuring physical parameters of the following types of transducers.

Transducer	Typical Applications
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3.1 Variable Resistance Type

Potentiometric Resistance strain gauge.	Displacement and force Torque and Displacement.
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Resistance Thermometer.	Temperature.
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Thermister.	Temperature.
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3.2 Variable Capacitance Type

Variable capacitance pressure gauge.	Displacement and pressure.
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Capacitor microphone.	Speed, noise
-----------------------	--------------

- | | |
|-------------------|---------------------------|
| Dielectirc gauge. | Liquid level & Thickness. |
|-------------------|---------------------------|
- 3.3 Variable Inductance Type
- | | |
|---------------------------|---|
| Differential Transformer. | Pressure, force, displacement and position. |
| Magnetostriction gauge. | Force, pressure, sound. |
- 3.4 Piezoelectric Type
- Crystal Microphone, Crystal Oscillator
4. PROCESSING OF TRANSDUCER SIGNALS:
- 4.1 Characteristics of instrumentation amplifiers in respect of input impedance, output impedance, drift, dc offset, noise, gain common mode rejection, frequency response etc. Relating the suitability of these characteristics for amplifying signals from various transducers.
- 4.2 Block diagram and basic concept of open loop and closed loop systems.
5. OPTOELECTRONIC DEVICES:
- 5.1 Basic principle and characteristics of photo sources and photo detector, Photo resistors, photo diodes, photo transistors, photo electric cells, LCDs, LEDs and photocouplers.
- 5.2 LED- Material, Construction, Working, Power & Efficiency, Characteristics and modulation BW. Laser, Semiconductor Laser
- 5.3 Photo Detectors - Optical detection Principles, P-N photodiode, Avalanche Photodiode.
- 5.4 Electro-Optic Effect- Integrated optical Devices, Magneto-Optic Effect, Acousto-Optic Effect.
- 5.5 Sensors & Display Devices - Optical Fiber Sensors, Display Devices, LCD display, Numeric Display.
(Only Brief description of above)

LIST OF BOOKS

1. M. H. Rashid-" Power Electronics Circuits, Devices & Application"- P.H.I
2. J. Michael Jacob - " Power Electronics : Principle and Application" - Viks Publishing House Pvt. Ltd.
3. Singh Jasprit - " Optoelectronics An Introduction to Materials and Devices" - McGraw-Hill
4. C. S. Ranjan- "Instrumentation Devices & Systems"- Tata McGraw Hill.

INDUSTRIAL ELECTRONICS AND TRANSDUCERS LAB

List Of Experiment

1. Identification of various types of packages and terminals of various low and high power thyristors (SCR and Triac).
2. To determine and plot firing characteristics of SCR :-
 - (a) By varying the anode to cathode voltage.
 - (b) By varying the gate current.
3. Observing voltage waveshapes at various points of UJT relaxation oscillator circuit.
4. Observation of waveshapes at relevant points of the circuit of a single phase controlled rectifier using SCR and UJT relaxation oscillator.
5. To determine the firing characteristics of Triac in different mode i.e. Mode-I (plus), Mode-I (minus), Mode-III (plus), Mode-III (minus).
6. Observe the waveshapes and measure a.c. and d.c voltage at various points of a three phase bridge rectifier circuit.
7. Observe the waveshapes and measure a.c. and d.c. voltage at various points of a three phase SCR controlled bridge rectifier circuit.
8. Test an a.c. phase control circuit using triac and observe waveshapes and voltages at relevant points in circuit (while using for lamp intensity control and/or a.c. fan speed control).
9. To study the working of a single phase SCR/ transistor inverter circuit by observing waveshapes at input and output.
10. To measure force and pressure by using strain gauge transducer.
11. To observe the working of crystal microphone.
12. To observe the working principle of following devices in practical circuit :-
 - (a) Light Dependent Resistor (LDR).
 - (b) Photo electric cell.
 - (c) LED and LCDs.
 - (d) Avalanche Photodiode
 - (e) Optical fibre sensor
13. To measure voltages at different points of a circuit using a light sensitive device as ON-OFF control.

2.4 NETWORK, FILTERS AND TRANSMISSION LINES

(Common with Instrumentation & Control Engineering and Computer Engineering)

L	T	P
2	2/2	2

Rationale :

The electronic circuits are too much complicated. To understand the working of electronic circuitry a systematic knowledge of the tools of circuit analysis is required. A student having knowledge of the basic tools like network theorems one port/two port network, symmetrical/asymmetrical network, attenuators, filters and transmission lines will be able to share any type of responsibility in the industry atmosphere.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Review of Network Theorems	2	1	-
2.	Networks	9	4	-
3.	Symmetrical & Asymmetrical Network	10	5	-
4.	Attenuators	4	2	-
5.	Filters	9	5	-
6.	Transmission Lines	16	8	-
		50	25	50

DETAILED CONTENTS

1. REVIEW OF NETWORK THEOREMS:

Review of the following, network theorem; superposition, Thevenin's Norton's and maximum power transfer.

2. NETWORKS:

2.1 One Port Network : Series and parallel tuned circuit, expression for their impedance at any frequency and at resonance in terms of Q and component values (L, C, & R). Band width of tuned circuit in terms of resonance frequency and Q.

2.2 Two Port (Four Terminals Networks : Basic concept of the following terms :

(a) Symmetrical and asymmetrical networks.

(b) Balanced and unbalance network,

- (c) T-network, Ladder network, Lattice network, L Network, Bridge T-network.
- (d) Representation of a two port " Block Box" in terms of Z, Y and H parameters and mention of application to transistor as a two port network.

3. SYMMETRICAL AND ASYMMETRICAL NETWORK :

3.1 Symmetrical Network :

- (a) Concept and significance of characteristic impedance, propagation constant, attenuation constant, phase shift constant and insertion loss.
- (b) Expression for characteristic impedance, propagation constant, attenuation constant and phase-shift constant in terms of Z_0 , Z_{oc} and Z_{sc} for the following
 - (i) T Network.
 - (ii) π Network.

3.2 Asymmetrical Network :

- (a) Concept and significance of iterative impedance image impedance, image transfer constant and insertion loss.
- (b) The half section (L-section) : Splitting of symmetrical T & π sections into half sections, derivation of iterative impedance, image impedance open and short circuit impedance of half section.

3.3 Star-Delta Transformation : Equivalence of T and π network.

4. ATTENUATORS:

4.1 Units of attenuation (decibel and nepers)

4.2 General characteristics of attenuators.

4.3 Analysis and design of simple attenuator of following types

- (a) Symmetrical T and π type.
- (b) L type.

5. FILTERS:

5.1 Brief idea of the uses of filters networks in different communication system.

5.2 Connecting of low pass, high pass, band pass and band stop filters.

5.3 Theorem connecting attenuation constant α and characteristic impedance (Z_0) determination of cut off

frequency constant K section.

5.4 Prototype filter section

- (a) T and n low pass filter section.
 - Reactance frequency characteristics of low pass and its significance.
 - Attenuation Vs frequency; phase shift Vs frequency characteristics impedance Vs frequency of T and n.
 - Simple design problems of prototype low pass section.

5.5 Active Filter:

Basic Concept of active filter and comparison with passive.

- (a) Op. amp. integrator circuit, basic low pass active filter, First and Second order low pass Butter worth filter - Frequency response.
- (b) Op. amp. differentiator circuit, basic high pass active filter, First and Second order high pass Butter worth filter- Frequency response.
- (c) Basic concept of band pass filter, Wide and narrow band pass active filter.
- (d) Basic concept of band reject filter, wide and narrow band reject filter.
- (e) All pass filter, Frequency response

5.6 Crystal Filter :

- (a) Crystal and its equivalent circuit.
- (b) Design properties of piezoelectric filters and their use.

5.7 Equalizers :

General Introduction.

6. TRANSMISSION LINE:

- 6.1 Transmission lines and their application : Shapes of different types of transmission lines; including 300 ohm antenna feeder cable, 75 ohm co-axial cable, optical fibre cable, Also other different types of cables.
- 6.2 Distributed (or primary) constants of a transmission line equivalent circuit of infinite line;
- 6.3 Necessity of the concept of an infinite line; Definition of characteristic impedance of line ; concept of short line

termination in Z_0 currents no voltages long an infinite line; graphical representation; propagation constant, attenuation and phase shift constant of the line.

- 6.4 Relationship of characteristics impedance, propagation constant, attenuation constant and phase constant in term of distributed constants of the line, smith charts.
- 6.5 Conditions for minimum distortion and minimum attenuation of signal on the line; necessity and different methods of loading the communication lines.
- 6.6 Concept of reflection and standing waves on a transmission line; definition of reflection coefficient in terms of characteristics impedance and load impedance; Definition of standing wave ratio (SWR), relation between VSWR and voltage reflection coefficient, maximum impedance on a line in term of characteristics impedance and VSWR.
- 6.7 Transmission line equation; expression for voltage, current and impedance at a point on the lines for lines with and without losses. Expression for the input impedance of the line. Solving Transmission line problems using Smith Chart.
- 6.8 Input impedance of an open and short circuited line and its graphical representation.
- 6.9 Transmission line at high frequency, effect of high frequencies on the losses of a transmission line; Application of transmission line as a reactive components and impedance transformer (e.g. quarter wave and half wave transformer).
- 6.10 Principle of impedance matching using single stub; comparison of open and short circuit stubs.
- 6.11 Expression for characteristic impedance of open wire and coaxial lines (No derivation).

LIST OF BOOKS

1. J. P. Ryder- Network Filters & Transmission Line- PHI
2. A. Chakravorty- An Introduction to Network, Filters & Transmission Line- Dhanpat Rai & Co.
3. D. R. Chaudhry- Network Analysis- Dhanpat Rai & Co.
4. V. K. Aatre- Network Theory & Filter Design- New Age International Pub.

NETWORK, FILTERS AND TRANSMISSION LINES LAB

List Of Experiment

1. Experimental verifications of the Thevenin's and Norton's theorem with an a.c. source.
2. Experimental verifications maximum power transfer theorem.
3. To measure the characteristics impedance of a symmetrical T/n (π) network.
4. To measure the image impedance of a given asymmetrical T/n (π) networks.
5. To design and measure the attenuation of a symmetrical T/n(π) type attenuator.
6. For a prototype low pass filter :
 - (a) Determine the characteristics impedance experimentally.
 - (b) Plot the attenuation characteristics.
7. For a prototype high pass filter :
 - (a) Determine the characteristics impedance experimentally.
 - (b) To plot the attenuation characteristic.
8.
 - (a) To plot the impedance characteristic of a prototype band pass filter.
 - (b) To plot the attenuation characteristic of a prototype band pass filter.
9.
 - (a) To plot the impedance characteristic of m-derived low pass filter.
 - (b) To plot the attenuation characteristic of a m-derived high pass filter.
10. To design 1st order and 1st order active LPF filter using IC 741 and draw the frequency response curve.
11. To design 1st order and 1st order active HPF filter using IC 741 and draw the frequency response curve.
12. Measurement of characteristics of a short transmission line.
13. Measurement of L & C of lossless transmission line.
14. Measurement of Z_0 of lossless transmission line.
15. Measurement of Attenuation of lossless transmission line.
16. Measurement of Velocity of Propagation in lossless transmission line.

2.5 ELECTRONIC DEVICES AND CIRCUITS

(Common with Instrumentation & Control Engineering and Computer Engineering)

L T P
3 - 2

Rationale :

Electronics has become so much closely associated with normal life and industries that basic knowledge about the active and passive devices used in electronics instrumentation has become an important tool for the middle level technical man power. Routine problems of maintenance and repair can be dealt successfully by a diploma student if he is equipped with the working and circuitry associated with different type of amplifiers, tuned voltage amplifiers, oscillators, multivibrator, tuned based circuits used in CRO, operational amplifier and waveshaping circuits.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Multistage Transistor Amplifier	6	-	-
2.	Transistor Audio Power Amplifiers	6	-	-
3.	Feed Back Amplifiers	6	-	-
4.	Tuned Voltage Amplifiers	4	-	-
5.	Sinusoidal Oscillators	6	-	-
6.	Waveshaping Circuits	9	-	-
7.	Multivibrator Circuits	6	-	-
8.	Operational Amplifier	16	-	-
9.	Timer Ic	4	-	-
10.	Regulated Power Supply	6	-	-
11.	Introduction To Micro Electronics	6	-	-
		75	-	50

DETAILED CONTENTS

1. MULTISTAGE TRANSISTOR AMPLIFIERS:
 - 1.1 Need of multistage amplifier, different coupling schemes and their working, brief mention of application of each of the type of coupling.
 - 1.2 Working of R.C. coupled and transformer coupled multistage amplifier, approximate calculation of voltage gain for a two stage R-C coupled amplifier.
 - 1.3 Frequency response of R-C coupled and transformer coupled amplifiers and its physical explanation, definition and physical significance of the term as bandwidth, upper and

lower cross over frequencies etc.

1.4 Direct coupled amplifier and its limitations differential amplifier typical circuits diagram and its working.

2. TRANSISTOR AUDIO POWER AMPLIFIERS:

2.1 Difference between voltage and power amplifier, importance of impedance matching in power amplifier, collector efficiency of power amplifier.

2.2 Typical single ended power amplifier and its working, graphical method for calculation of output power, heat dissipation curve and importance of heat, sinks, class A, class B, class C amplifier (without derivation).

2.3 Working principle of push pull amplifier and circuits, its advantages over single ended power amplifier, cross over distortion in class B operation and its reduction, different driver stages for push pull amplifier circuit.

2.4 Working principle of complementary symmetry push pull circuit and its advantages.

2.5 Boot strap technique in amplifiers.

2.6 Transformer less audio power amplifiers and their typical application.

2.7 Mention of at least one popular IC with its block diagram, Pin configuration and its working of each type of power amplifier.

3. FEED BACK AMPLIFIERS:

3.1 Basic principle and types of feed back.

3.2 Derivation of expression for the gain of an amplifier employing feed back.

3.3 Effect of negative feedback on gain, stability, distortion and band width (Only physical explanation)

3.4 Typical feedback circuits :

(a) A.C. coupled amplifiers with emitter by-pass, capacitor removed.

(b) Emitter follower and its application, simple mathematical analysis for voltage gain and input impedance of above circuits.

4. TUNED VOLTAGE AMPLIFIERS:

4.1 Classification of amplifiers on the basis of frequency.

4.2 Review of basic characteristics of tuned circuits, (Series

and Parallel)

- 4.3 Single and Double tuned amplifier, their working principles and frequency response (no mathematical derivation). Concepts of neutralization.
- 4.4 Staggered tuned amplifier and typical applications in brief.
- 4.5 Mention of at least one popular IC with its block diagram, Pin configuration and its working of each type of Tuned amplifier.
5. SINUSOIDAL OSCILLATORS:
 - 5.1 Application of oscillators.
 - 5.2 Use of positive feedback/negative resistance for generation of oscillation, Barkhausen's criterion for oscillations.
 - 5.3 Different oscillator circuits, tuned collector, Hartley, Colpitts, phase shift, Wien's bridge and crystal oscillator and their working principles (no mathematical derivation).
 - 5.4 Mention of at least one popular IC with its block diagram, Pin configuration and its working of each type of oscillators.
6. WAVESHAPING CIRCUITS:
 - 6.1 General idea about different waveshapes.
 - 6.2 Review of transient phenomena in R-C and R-L circuits.
 - 6.3 R-C and R-L differentiating circuits and integrating circuits. Their applications (physical explanation for square/rectangular input waveshapes only).
 - 6.4 Diode clippers series and shunt biased type double clipper circuits.
 - 6.5 Zener diode clipper circuits.
 - 6.6 Use of transistor for clipping.

Diode clamping circuit for clamping to negative peak, positive peak or any other levels for different input waveforms (e.g sine, square, triangular).
7. MULTIVIBRATOR CIRCUITS:
 - 7.1 Ideal transistor switch; explanation using C.E. output characteristics, calculation of component values (collector and base resistors) for a practical transistor switch.
 - 7.2 Transistor switching time. Use of speed up capacitor (Physical explanation).

- 7.3 Basic concept of working of collector coupled bistable, monostable and stable multivibrator circuits including principle of triggering.
- 7.4 Operation of Schmitt trigger, calculation of upper trigger potential (UTP) and lower trigger potential (LTP).
- 7.5 Mention of applications of multivibrators and Schmitt trigger. Its use as waveform generator.
- 7.6 Transistorised voltage controlled oscillator (basic) principle only.
- 7.7 Mention of at least one popular IC with its block diagram, Pin configuration and its working of each type of Multivibrator circuits.
8. OPERATIONAL AMPLIFIERS:
 - 8.1 Specifications of ideal operational amplifier and its block diagram.
 - 8.2 Definition of inverting and noninverting inputs, differential voltage gain and input and output offset, voltage input offset current, input bias current, common mode rejection ratio (CMRR), power supply rejection ratio (PSRR) and slew rate.
 - 8.3 Method of offset null adjustments, use of op.amp. as an inverter, scale changer, adder, subtractor, differential amplifier, buffer amplifier, differentiator, integrator, comparator, Schmitt Trigger, Generation of Square and Triangular Waveform, log and anti-log amplifiers, PLL and its application and IC power amplifier.
 - 8.4 IC OP-AMP Application :

Inverting/Noninverting VCVS integrators, Differentiators CCVS and VCCS instrumentation amplifiers, Active filter (LP, HP and Notch), Oscillators. Log/Antilog modules, Precision rectifier, Peak detector, Sample and Hold Circuit, IC analog multiplier application, Analog multiplexer and demultiplexer.
9. Timer IC.:

Block diagram of IC timer (such as NE 555) and its working, use of 555 timer as monostable and astable multivibrator, and waveform generator.
10. Regulated Power Supply
 - 10.1 Concept of regulation.
 - 10.2 Basic regulator circuits (using zener diode).

- 10.3 Concept of series and shunt regulator circuits.
- 10.4 Three terminal voltage regulator Ics (positive negative and variable) application. Block diagram, Pin configuration and working of popular regulator IC.
- 10.5 OP-AMP regulators, IC regulators, Fixed Voltage regulators, (78/79, XX) 723 IC regulators (Current Limiting, Current Fold Back), SMPS.
11. Introduction to Microelectronics-
- Advantages of integration, Tyes of integrated circuits, Monolithic and Hybrid circuits.
 - Different stages of fabrication of ICs- Epitaxial Growth, Oxidation and film deposition, Diffusion and Ion Inplation, Lithography & Etching. (Only brief idea of all)
 - Masking, Selective doping, Fine-line lithography and isolation for Monolithic circuits.
 - Introduction to monolithic device elements such as BJT, MOS, transistor and integration of other circuit elements.
 - Very large scale ingegration (V.L.S.I.).
(Only brief idea)

LIST OF BOOKS

1. Bhargava, Kulshreshtha & Gupta - "Baisc Electronics & Linear Circuits" - Tata Mcgraw-Hill.
2. Malvino, A. P. - "Electrinics Principles" - Tata Mcgraw-Hill.
3. Sedra, Adel S. Smith, Kenneth. C. " Micro Electronics Circuits" - Oxford University Press 5th Edtion

ELECTRONIC DEVICES AND CIRCUITS LAB

List of Experiment

1. To measure the overall gain of two stage R.C. coupled amplifier at 1 KHz and note the effect of loading of second stage on the first stage.
2. To plot the frequency response of R-C coupled amplifier.
3. (a) To plot the load Vs output power characteristics to determine the maximum signal input for undistorted signal output.

(b) The above experiment is to be performed with single ended power amplifier; Transistorized push; pull amplifier; Compl-ementary Symmetry power Amplifier.
4. To observe the effect of a by-pass capacitor by measuring voltage gain and plotting of frequency response for a single stage amplifier.
5. To measure input and output impedance of a feedback amplifier with and without by-pass capacitor.
6. Measurement of voltage gain input and output impedance and plotting of frequency response of an emitter follower circuit.
7. Measurement of resonant frequency, plotting of the response curve (i.e. graph between input frequency and impedance) and calculation of Q with the help of this curve for series and parallel resonant circuit.
8. To measure the frequency response of a single stage tuned voltage amplifier and calculation of the Q of the tuned circuit load.
9. Observe and plot the output waveshapes of ;

(a) R-C differentiating circuits.

(b) R-C integrating circuits for squarewave input (Observe the effect of R-C time constant of the circuits on the output waveshape for both the circuits).
10. (a) Observe the output waveforms of given biased and unbiased series and shunt clipping circuits, for positive and negative peak clipping circuits, for positive and negative peak clipping of a sine wave using switching diodes and D-C sources and compare it with input wave.

(b) Observe the output wave shape of given double clipper circuit using diodes and D-C sources.

- (c) Observe the output wave shape of given zener diode and transistor clipper circuits for positive peak, negative peak and double clipping sine (or other) waveshapes.
11. To clamp square wave to their positive and negative peaks and to a specified level.
 12. To measure I_c and V_{ce} for transistor when I_b is varied from zero to maximum value and measure the value of V_{ce} and I_c for saturation at a given supply, voltage and load.
 13. To test a transistor schmitt trigger circuit, observe and plot the waveshapes at various points.
 14. Use of Op-Amp. (for IC-741) as Inverting and non-inverting amplifier, adder, comparator, buffer, scale changer.
 15. Simple working circuits using NE555.
 16. To determine the range of frequency variation of a RC phase shift oscillator.
 17. To test adjustable IC regulator and current regulator.
 18. Identification, Pin configuration and basic working of different popular IC's - Exm.- Power amplifier, Oscillator, Tuned amplifier, Multivibrator, Timer.

2.6 PRINCIPLES OF COMMUNICATION ENGINEERING

(Common with Computer Engineering)

L T P
3 - 2

Rationale :

Communication of signals at distant places plays an important role in modern industrial, commercial and scientific research organisations. A student having basic knowledge about the components of communication such as modulation, demodulation, transmitters, receivers and receiving elements will be useful for the industries.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	3	-	-
2.	Amplitude Modulation	3	-	-
3.	Frequency Modulation	3	-	-
4.	Phase Modulation	4	-	-
5.	Pulse Code Modulation	6	-	-
6.	Principle of A.M. Modulators	6	-	-
7.	Principle of F.M. Modulators	6	-	-
8.	Demodulation of A.M. Waves	6	-	-
9.	Demodulation of F.M. Waves	6	-	-
10.	Transmitters	6	-	-
11.	Radio Receivers	6	-	-
12.	Antenna & Wave Propagation	10	-	-
13.	Communication Media	4	-	-
14.	Modems & Multiplexers	6	-	-
		75	-	50

DETAILED CONTENTS

1. INTRODUCTION
 - 1.1 Brief idea of various types of communication system.
 - 1.2 Need of modulation and demodulation in communication system.
 - 1.3 Types of modulation-Brief description and typical application of AM, FM, phase modulation and pulse modulation (PAM, PPM and PCM).
2. AMPLITUDE MODULATION
 - 2.1 Derivation of expression for an amplitude modulated wave. Carrier and side bands, modulation index and depth of modulation.
 - 2.2 Relative power distribution in carrier and side bands.

- 2.3 Elementary idea of DSB, DSB-SC, SSB, SSB-SC modulation and their comparison.
- 2.4 Vestigial side band modulation and its application.
3. FREQUENCY MODULATION
- 3.1 Derivation of an expression for frequency modulated wave and its frequency spectrum (without analysis of Bessel = function) Modulation index, Maximum frequency deviation and deviation ratio.
- 3.2 Advantages and disadvantages of FM over AM in communication systems based on consideration of band width requirement and noise.
4. PHASE MODULATION
- Expression of phase modulated wave and its comparison with frequency modulation. (Brief introduction only)
5. PULSE CODE MODULATION
- 5.1 Elementary idea of sampling theory and pulse modulation; Shannon's theorem and coding technique, Quantization (Brief idea only).
- 5.2 Time Division and frequency division multiplexing, CDMA, WDMA, FDMA and TDMA (Brief Idea Only).
- 5.3 PCM system, Types of PCM and its application.
- 5.4 Digital Modulation Techniques (ASK, FSK, PSK, DPSK) (Brief Idea Only).
6. PRINCIPLE OF AM MODULATORS
- 6.1 Working principles and typical application of
- Collector Modulator.
 - Base Modulator.
 - Balanced Modulator.
- 6.2 Single-Side-Band (SSB) generation and its typical applications.
7. PRINCIPLE OF FM MODULATORS
- 7.1 Working principle and applications of reactance tube modulator, varactor diode modulator and armstrong phase modulator.
- 7.2 Limiter, pre-emphasis and de-emphasis in FM communication system.

8. DEMODULATION OF AM WAVES
 - 8.1 Principle of demodulation of AM wave using diode detector circuit; concept of diagonal clipping and formula for RC time constant for minimum distortion (No derivation).
 - 8.2 Comparison of typical diode detector circuits in a Radio and TV receiver.
9. DEMODULATION OF FM WAVES
 - 9.1 Basic principles of detection of FM waves.
 - 9.2 Foster-seely discriminator and its working principles.
 - 9.3 Working of Ratio-detector circuit and its advantage over Foster-seely discriminator circuits.
 - 9.4 Basic principle of Quadrature detection.
10. TRANSMITTERS
 - 10.1 Classification of transmitters on the basis of power, frequency and modulation.
 - 10.2 Block diagram of an AM transmitters and working of each stage. Low level and High level modulation.
 - 10.3 Block diagram and working principle of reactance tube and Armstrong FM transmitters.
11. RADIO RECEIVER
 - 11.1 Brief description of crystal and TRF radio receivers; Need for and principles of superheterodyne radio receiver.
 - 11.2 Block diagram of super-heterodyne AM receiver, function of each block and typical waveforms at the input and output of each block.
 - 11.3 Block diagram of an FM receiver, function of each block and wave/forms at input and output at different blocks.
12. ANTENNA AND PROPAGATION
 - 12.1 Physical concept of radiation of electromagnetic energy from an antenna, relationship between the direction of electric and magnetic fields with direction of propagation; concept of polarisation of EM waves.
 - 12.2 Electromagnetic spectrum and its various range VLF, LF, HF, VHF, UHF, Micro wave, Optical waves etc.
 - 12.3 Definition and physical concepts of the terms used with antennas like point source, gain, power gain, directivity aperture, effective area, radiation pattern, (field strength, power and phase) beam angle, beam width and

radiation resistance.

- 12.4 Types of antennas-Brief description, characteristics and typical applications of medium wave antenna, shortwave antenna, HF antenna, VHF, UHF and Microwave antenna e.g., half wave dipole, ground plane, yagi and ferrit rod antenna in transistor receiver.Brief idea about Rhombic antenna, dish antenna, Horn, Parabolic reflector and Lens antenna.
- 12.5 Antenna arrays-Brief description of broad side and end fire arrays, their radiation pattern and application (without analysis);
- 12.6 Basic idea about different modes of radio wave propagation-ground wave propagation, space wave propagation and sky wave propagation, their characteristics and typical areas of application. (e.g. medium wave, short wave,TV communication.)
- 12.7 Explanation of the terms-critical frequency, maximum usable frequency (MUF) and skip distance.
13. Communication Media:- Telephone Lines, Twisted Pair Wire, Co-axial Cable, Fibre optics.
14. Modems - Basic working principle of modems and their application
15. Multiplexers- Digtal Multiplexers- Synchronous and Asynchronous(Brief Idea Only).

List of Books

1. Simon Haykin-Communication System- John Wiley & Sons.
2. Kennedy & Davis- Electronic Communication System - Tata Mcgraw Hill.

PRINCIPLE OF COMMUNICATION ENGINEERING LAB

List Of Experiments

1. (a) To observe an AM wave on CRO produced by a standard signal generator using internal and external modulation.
(b) To measure the modulation index of the wave obtained in above experiment.
2. (a) To obtain an AM wave from a collector modulator circuit and observe the Am pattern on CRO.
(b) To measure index of modulation of the AM signal for different level of modulation signal.
3. To obtain a FM wave from reactance tube modulator/voltage controlled oscillator (using 8038 or 566) circuit and measure the frequency deviation for different modulating signal.
4. To obtain modulating signal from an AM detector circuit and observe the pattern for different RC time constants and obtain its optimum value for least distortion.
5. To obtain modulating signal from a FM detector (Foster-seely/ Ratio detector/quadrature detector) Circuit (or using 2211 or PLL 565) and plot the detector characteristics.
6. To obtain AM-SB from Balanced modulator.(BM025 may be used).
7. To detect AM-SB by using SSB detector. (SL 640C may be used).
8. To identifying different stages of radio receiver and IC used at each stage and plot the sensitivity characteristics of a radio receiver and determination of the frequency for maximum sensitivity.
9. To plot the selectivity characteristics of a radio receiver.
10. To plot the fidelity characteristics of a radio receiver.
11. (a) To plot the radiation pattern of directional and omndirectional antenna.
(b) To plot the variation of field strength of radiated wave, with distance from a transmitting antenna.
12. Tuning and alignment of radio receiver.
13. Circuit tracing and fault finding of different stages of radio receiver.
14. Simple demonstration, ASK, FSK and PSK through training kits

NOTE :- Antenna simulator developed by TTTI can be used for this experiment.

2.7 PRINCIPLE OF DIGITAL ELECTRONICS

(Common with Instrumentation & Control Engineering and
Computer Engineering, Information Technology)

L T P
3 - 3

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
Part-1				
1.	Introduction	3	-	-
2.	Number System	6	-	-
3.	Codes, Code Conversion & Parity	3	-	-
4.	Logic Gates	6	-	-
5.	Logic simplifications	6	-	-
6.	Logic Families & Digital ICs	6	-	-
Part2- Combinational Logic Circuits				
7.	Arithmetic operations	6	-	-
8.	Encoder, Decoders & Display Devices Associated Circuits, Multiplexer & Demultiplexer	9	-	-
Part-3 Sequential Logic Circuits				
9.	Flip Flops	4	-	-
10.	Counters	6	-	-
11.	Shift Registers	4	-	-
Part-4				
12.	Memories	6	-	-
13.	A/D and D/A Converters	6	-	-
14.	Arthametic Circuits	4	-	-
		75	-	75

DETAILED CONTENTS

1. INTRODUCTION TO DIGITAL ELECTRONICS:
 - 1.1 Basic difference between analog and digital signal.
 - 1.2 Application and advantages of digital signal processing.
2. NUMBER SYSTEM:
 - 2.1 Binary, Octal and Hexadecimal number system; conversion from decimal octal and hexadecimal to binary and vice-versa.
 - 2.2 Binary addition, subtraction, multiplication and division including binary points.
 - 2.3 1's and 2's complements method of subtraction.
3. CODES, CODE CONVERSION AND PARITY:

- 3.1 The 8421 and excess-3 codes; mention of other popular BCD codes.
- 3.2 Addition of 8421, BCD coded numbers its limitations and excess-3 coded numbers.
- 3.3 Gray code, Gray to binary conversion and vice-versa.
- 3.4 Basic concept of parity, single and double parity and error detection.
4. LOGIC GATES:
 - 4.1 Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates.
 - 4.2 Concept of negative and positive logic.
5. LOGIC SIMPLIFICATIONS
 - 5.1 Boolean algebra, Karnaugh-mapping (upto 4 variables) and simple application in developing combinational logic circuits.
 - 5.2 Implementation of logic equations with gates.
 - 5.3 Use of NAND and NOR gates as universal gates.
6. LOGIC FAMILIES AND DIGITAL ICs:
 - 6.1 Logic family classification :
 - (a) Definition of SSI, MSI, LSI, VLSI.
 - (b) Bipolar Logic, Diode Logic, Transistor Logic Inverter, TTL logic, MOS, CMOS logic, logic ECL
 - (c) Sub-classification of TTL and MOS logic families.
 - (d) Characteristics of TTL and MOS Digital gates delay, speed of noise margin, logic levels, power dissipation, FAN-IN, FAN-OUT, power supply requirements and comparison between TTL and MOS ICs.
 - 6.2 Logic Circuits :
 - (a) Open collector and totem pole output circuit operation for a standard TTL, NAND gate.
 - (b) MOS circuit operation for a standard gate (NOR).
 - 6.3 Tristate Switch : Normally open and normally closed switch.
 - 6.4 Familiarisation with commercial digital IC gates, Their number identification and Pin configuration.

7. ARITHMETIC OPERATIONS:
 - 7.1 Design of Exclusive Or, Half adder and Half subtractor.
 - 7.2 Design of Full adder circuits and its operation.
 - 7.3 Design of Full subtractor circuits and its operation.
 - 7.4 Some examples (circuits) of code convertors.
8. ENCODER, DECODERS & DISPLAY DEVICES ASSOCIATED CIRCUITS:
 - 8.1 LED, LCD, seven segment display, basic operation of various commonly used types.
 - 8.2 Four Decoder circuits for 7 segment display.
 - 8.3 Basic decimal to BCD encoder circuits.
 - 8.4 Use of decoders/driver ICs with reference to commercial ICs.
 - 8.5 Basic Multiplexer and Demultiplexer
9. FLIP FLOPS:
 - 9.1 Operation using waveforms and truth tables of following flip flops.
RS, T, RST, D, JK, Master/Slave JK Flip Flops mention of commonly used ICs Flip flops.
10. COUNTERS:
 - 10.1 Counters classification.
 - 10.2 Binary and decade counters.
 - 10.3 Divide by N counters.
 - 10.4 Programmable asynchronous counters.
 - 10.5 Down counters up/down counter operations.
 - 10.6 Presetable asynchronous counters.
 - 10.7 Difference between asynchronous and synchronous counters.
 - 10.8 Ring counters with timing diagram.
 - 10.9 Familiarization with commercial TTL/CMOS counter ICs.
11. SHIFT REGISTERS:
 - 11.1 Introduction and Basic concepts including shift left and shift right.
 - 11.2 Serial in serial out.

Serial in parallel out.

Parallel in serial out.

Parallel in parallel out.

11.3 Universal shift register.

11.4 Familiarisation with common TTL/CMOS ICs.

11.5 Buffer register, Tristate Buffer Register.

12. MEMORIES:

12.1 Classification according to the following heads.

(a) Volatile and non-volatile memories.

(b) Random access memories and sequential access.

(c) Semiconductor and non-semiconductor memories.

(d) Destructive and non-destructive memories.

12.2 Semi-conductor ROMs, PROMs, EPROM, SRAM, DRAM, Basic structure and working of CCD, R/W memory.

13. A/D AND D/A CONVERTERS:

13.1 Use of A/D and D/A converters.

13.2 Binary resistor network R-2R network.

13.3 D/A converter using R-2R.

13.4 UP, UP/Down counter type A/D converter.

13.5 Successive approximation.

13.6 Basic concepts of parallel A/D converter.

13.7 Two bit A/D converter.

14. ARITHMETIC CIRCUITS: Ideas About

14.1 Basic Arithmetic logic units applications.

14.2 Block diagram explanation of binary multiplier circuit.

List of Books

1. Malvino & Leach- Digital Principles & Application- Mcgraw Hill- 5th Edition.
2. Mano, M. Morris- Digital Logic and Computer Design- Prentice Hall (India)

PRINCIPLE OF DIGITAL ELECTRONICS-LAB

List Of Experiments

1. Do atleast 20 experiments familiarization with bread-board.
Familiarization With TTL And MOS ICs.
2. Identification of Ic-nos, Pin-nos, Ic types.
3. To observe that logic low and logic high do not have same voltage value in input and output of logic gate.
4. To observe the propagation delay of TTL logic gate.
5. Observation of the difference between MOS and TTL gates under the following heads
 - (a) Logic levels.
 - (b) Operating voltages.
 - (c) Propagation delay.Display Devices And Associated Circuits.
6. Familiarisation and use different types of LEDs common anode and common cathode seven segment display.
7. Use of 7447 BCD to 7-segment decoder.
Logic Gates.
8. Verification of truth table for 2 Input NOT, AND, OR, NAND, NOR, XOR Gates.
Design And Implementation Of Simple Logic Circuits.
9. To construct a 4-bit even/odd parity generator/checker using XOR gates and to verify their truth tables.
10. To construct half adder and half subtractor using XOR and NAND gates verification of their truth tables.
11. To construct a full adder circuit with XOR and NAND gates.
12. (a) Study of 3 bit adder circuit implemented with or and NAND gates.
(b) To construct 4 bit adder and full subtractor using full adder chip 7480 and NAND gates.
13. (a) To verify the truth table of 4 bit adder IC chip 7483.
(b) To construct the 4 bit adder/2's complement subtractor

using 7483 and NAND gates.

Flip Flops.

14. To verify the truth table for selected positive edge triggered and negative edge triggered F/F of J-K and D type.

Counters

15. To construct and verify truth table for asynchronous binary and decade using J-K flip flops.
16. (a) To construct divide by 60 counter using ripple.
(b) To use counter IC chip 7493 in the divide by eight mode and divide by sixteen mode.
(c) To construct a divide by 100 counter using CMOS.
17. To construct a divide by 60 counters using synchronous counter IC chips.

Registers.

18. To construct a 4 bit buffer register using 4 bit register IC chip.
19. To construct a 4 bit universal shift register using flip flops.
20. To use a 4035 B universal shift register.

Multiplexers And Demultiplexers.

21. To decode a 3 line to 8 line encode from 8 line to 3 line and to observe inputs and outputs.
22. Single plus to 16 line decoder and observation output after a 16 to 4 line encoder.
23. To use ALU chip for selected arithmetic and logic operations.

2.8 ELECTRONICS WORKSHOP
(Common with Instrumentation & Control Engineering and
Computer Engineering)

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PART-A ELECTRICAL WORKSHOP

GENERAL OBJECTIVES

After the completion this course the learner will be able to

1. Become familiar with domestic and semi-domestic industrial wiring practice.

INSTRUCTIONAL OBJECTIVES

After completing this course the learner will be able to

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

Exercises To Be Performed	No. of turns reqd.
1. Identification and study of commonly used electrical materials such as wires, cables, switches, fuses, coiling, roses, battens, cleats and allied items.	1
2. Identification and study of various tools used in Electrical Workshop and safety measures.	1
3. Making connection of single lamp and three pin plug socket to supply using batten wiring.	1
4. Making Electrical connection for staircase wiring.	1
5. Making Electrical connection for a tube light and door bell.	1
6. Wire a mains outlet pannel consisting of a specified combination of 5 AMP; 15 AMP, Socket, Main switch, Indicating lamp and Fuse links.	1
7. Given the load requirements, prepare the wiring diagram for a small Electronic/ Electrical Laboratory/ Workshop using energy	2

meter, MDB and SDBS and details of sub-circuits, Protective device, cables/wires should be specified. The wiring should assume the availability of 3 phase 4 wire mains supply near the laboratory/workshop.

Total turns required -----
8

PART-B. ELECTRONICS WORKSHOP

GENERAL OBJECTIVE

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

1. Develop skill in selection and use of commonly used tools, equipment, components in a given situation.
2. Develop skill in wiring, soldering and desoldering works.
3. Develop skill in tracing circuits of simple (analogue and digital) electronic assembly.

INSTRUCTIONAL OBJECTIVE

After completion of instruction in the subject the student will be able to :-

1. State the correct name and function of different tools and accessories, such as :-

Tools

Pliers, Wire cutter, Wire stripper, Tweezer, Soldering iron, Desoldering tools, Neon tester and Screw drivers.

Accessories

1. Including Tapes, Solders, Solders tips, Fluxes; De-soldering wick, Solder cleaning fluids, Sleeves, Tags.
2. Demonstrate the correct use of accessories mentioned in (1) above.
3. Selection and use of general purpose Electronic test and measuring equipemnt :-
 - 3.1 Given any of the wavefrom generators specified in equipment

type (a) below with its controls set at random, the student should be able to operate/adjust the necessary control to demonstrate/any desired waveform on the appropriate measuring equipment, specified in (b) below.

- 3.2 Given any measurement equipment specified in (b) below (with its controls set at random) the student should be able to operate adjust the necessary controls to measure/display electrical parameter(s) such as specified on the right side margin.
- Parameter for being measures:
Amplitude, Frequency phase
Time Period, Rise and Fall
time of pulse Wavefrom,common
transistor parameters,circuit
resistance.
- 3.3 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.

- (a) Test Wavefrom Generator :- Audio oscillator, Function Generator, Signal Generator, Spectrum Analyzer.
- (b) Measurement Equipment ; Single beam CRO, Double beam/ Dual trace CRO, electronic and Digital multimeters, Transistor tester/Curve tracer, IC tester etc.
- (c) Power Supply - UPS, Invertor, Different types of DC/AC power supplies
4. Students should be able to identify and use the item mention below (a), (b), (c) and (d).
- (a) Various types of Single/Multicores, Insulated screened, Power type/ Audio/ Video/ General purpose wires and cables.
- (b) Various types of plugs, sockets, connectors suitable general purpose audio, vidio use. Some of such commectors are : Banana plug and Sockets, ENC, DIN, UHF, VHF, Earphone connectors, Telephone jacks and similar male and female connectors and terminal strips.
- (c) Various types of switches such as : Normal/miniature Toggle, Slide, Push botton, Piano key rotary, SPST, DPDT, Band selector multiway, Master main switch.
- (d) Various types of protective devices such as : Wire fuse, Cartridge fuse, Single/Multiple miniature circuit breakers over and under current relays.

5. Exercises to be performed :

- i. Study and testing of different types of Resistor, Capacitor, Inductor, Diode, Transistor (BJT, FET, MOS, CMOS) and ICs (All Popular Families).
- ii. Study of different processes by performing in assembling-Soldering, Desoldering, Cutting, Stripping and connecting.
- iii. Study of equipment - their control and operation mentioned in no. 3 part of accessories.
- iv. Study of the items mentioned in part 4-a,b,c,d by using them in different types of circuits.
- v. Students should design and assemble at least seven working circuits (Full Fabricated Form) selecting at least three from each group A and B given below

Group A

1. Single Stage Amplifier
2. Halfwave and Full Rectifier
3. Filters
4. RC Coupled Amplifier
5. Power Amplifier (Push Pull)
6. Tuned Amplifier
7. Oscillator
8. Waveshaping Circuits

Group B

1. Clap Switch
2. Door Bell
3. Burglar Alarm
4. Porch Light
5. Water level Indicator
6. Fan regulator
7. .25 Kva Manual Stabilizer
8. Single band transistor radio receiver

Note :

1. The above list of Group B suggestive, more items may be added to the list depending upon students choice and materials availability but the item should belong consumers interest category.
2. Student should be encouraged for self market survey for each material.

PART-C PREPARATION OF PRINTED CIRCUIT BOARDS

Instructional Objective

*

After the completion of instruction in this area of the subject the learner will be able to :-

1. Acquire skill in silk screen printing techniques for the purpose of making the printed circuit boards.
2. Acquire knowledge of non dry-method of PCB making using photoprocessing techniques.
3. Acquire skill in preparing, checking, drilling and proper storing PCBs.

Suggested Task/Exercises

No. of turns
required.

- | | |
|--|---|
| 1. Familiarisation with tools, equipment, materials and processes of a single and double sided PCB making using direct etching method (Artwork to be done by students) . | 1 |
| 2. As above expect using photoprocessing techniques. The initial exposure is to include the following | 2 |
| 2.1 Dark Room Practice. | |
| (a) Exposure using UV light/daylight | |
| (b) Developing (including dye developing) | |
| (c) Fixing | |
| (d) Printing (including contact printing) | |
| (e) Enlarging/Reducing | |
| 2.2 Techniques of photo-resist coating. | |
| 2.3 Baking and cleaning procedures. | |

2.4	Etching procedures.	
2.5	Procurement and storage of materials and equipment.	
2.6	Safety rules for PCB laboratory and darkroom.	
3.	Exercises in making simple single and double sided PCB using direct etching method.	2
4.	Exercises in making single and double sided PCB using photoprocessing method.	2
5.	Familiarisation with tools equipments, materials and process of silk screen printing for PCB making.	2
6.	Exercises in PCB making using silk screen printing techniques.	2
7.	Exercises in drilling, assembling and testing of single and double sided PCB; proper storage of PCBs.	1
	Total Turns Required	----- 12 -----

2.9 PROGRAMMING IN C & C++

(Common to Post Graduate Diploma In Computer Application, Post Diploma In Information Technology, Instrumentation & Control Engg.)

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Rationale :

For solution of different problems, C is a very powerful high level language. It is widely used in research and engineering problems. A software technician must be aware of this language for working in computer environment.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Concept of Programming	10	4	
2.	Programming in C	20	7	-
3.	Classes & Objects	20	7	
3.	Programming in C++	25	7	
		75	25	75

DETAILED CONTENTS

1. CONCEPT OF PROGRAMMING:

Concept of Flowcharting, algorithm, programming, Structured Programming Various techniques of programming, Use of programming.

2. Programming in C:

Data Types, Operators and Expressions; Input & Output printf, scanf, library Control Statement: IF- ELSE, While, For, Do- While, Switch; Functions and modular programming; Scope of variables, parameter passing, recursion, block structure; preprocessor statements; pointers and arrays; structures and unions; File handling.

3. CLASSES & OBJECT:

What is a class, what is an object, constructors, types of object (external, automatic static, Dynamic objects) Metaclass, role of meta class. Scope of classes, array of objects, objects as a function argument.

4. Programming in C++:

What is object-orientation, area of object technology, C++, getting to grips with C++ (data types, escape sequence, characters, variables, operator, notation, Arrays, Function conditional statements. call by value, call

by reference.Pointer : C++ memory map, dynamic allocation pointers,pointers with arrays.Structure,structure with arrays,passing, structure of function.Enumerated data types, Inherentance, apolymorphism & Overloading.

PROGRAMMING IN C & C++

List of Experiments

1. Exercises involving output and input format controls in Pascal.
2. Exercises involving control transfer statements in C & C++
3. Exercises with arrays & Pointers in C & C++.
4. Exercises with functions in C & C++.
5. Exercises with files in C & C++.

FINAL YEAR DIPLOMA COURSE IN "ELECTRONICS ENGINEERING"
 3.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L T P
 2 2/2 -

Rationale:

The knowledge of this subject is required for all engineering technicians, but it becomes more important for those technicians who wish to choose industry as their career. This course is designed to develop understanding of various functions of management, role of workers, and engineers, industrial safety, trade unions, wages and incentives, marketing, entrepreneurship, inventory control and industrial legislation.

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Principles of Management	10	4	-
2.	Human Resource Management	3	2	-
3.	Human and Industrial Relations	4	3	-
4.	Personnel Management	6	3	-
5.	Financial Management	6	3	-
6.	Material Management	4	3	-
7.	Labour, Industrial and Tax Laws	4	2	-
8.	Entrepreneurship Development	8	4	-
9.	Intellectual Property Rights	5	1	-
		50	25	-

DETAILED CONTENTS

1. PRINCIPLES OF MANAGEMENT :

Definition of management, Administration organisation, Functions management, Planning, Organizing, Co-ordination and control, Structure and function of industrial organisations, Leadership- Need for leadership, Factors to be considered for accomplishing effective leadership, Communication -Importance, Processes, Barriers to communication, Making communication, Effective, formal and informal communication, Motivation - Factors determining motivation, Positive and negative motivation, Methods for improving motivation, Incentives, Pay promotion and rewards, Controlling - Just in time, Total quality management, Quality circle, Zero defect concept. Concept of Stress Management

2. HUMAN RESOURCE DEVELOPMENT :

Introduction, Staff development and career development, Training strategies and methods.

3. HUMAN AND INDUSTRIAL RELATIONS :

Human relations and performance in organisation, Understand self and others for effective behaviour, Industrial relations and disputes, Characteristics of group behaviour and Trade unionism, Mob psychology, Labour welfare, Workers participation in management.

4. PERSONNEL MANAGEMENT :

Responsibilities of human resource management - Policies and functions, Selection - Mode of selection - Procedure - training of workers, Job evaluation and Merit rating - Objectives and importance wage and salary administration - Classification of wage, Payment schemes, Components of wage, Wage fixation.

5. FINANCIAL MANAGEMENT :

Fixed and working capital - resource of capital, Shares, types preference and equity shares, Debenture types, Public deposits, Factory costing, Direct cost, Indirect cost, Factory overhead, Fixation of selling price of product, Depreciation- Causes, Methods.

6. MATERIAL MANAGEMENT :

Objective of a good stock control system - ABC analysis of inventory, Procurement and consumption cycle, Reorder level, Lead time, Economic order quantity, Purchasing procedure, Stock keeping, Bin card.

7. LABOUR, INDUSTRIAL AND TAX LAWS :

Importance and necessity of industrial legislation, Types of labour laws and dispute, Factory Act 1948, Payment of Wages Act 1947, Employee State Insurance Act 1948, Various types of taxes - Production Tax, Local Tax, Trade tax, Excise duty, Income Tax.

8. ENTREPRENEURSHIP DEVELOPMENT :

Concept of entrepreneurship, need of entrepreneurship in context of prevailing employment conditions of the country. Successful entrepreneurship and training for entrepreneurship development. Idea of project report preparation.

9. INTELLECTUAL PROPERTY RIGHTS :

Introduction to IPR (Patents, Copy Right, Trade Mark), Protection of undisclosed information, Concept and history of patents, Indian and International Patents Acts and Rules, Patentable and Nonpatentable invention including product versus Process.

NOTE : Entrepreneurship Awareness camp to be organised at a stretch for Two or Three days. Lectures will be delivered on Entrepreneurship by industries experts at institute level.

3.2 ENVIRONMENTAL EDUCATION & DISASTER MANAGEMENT

L T P
2 - -

RATIONALE:

A diploma student must have the knowledge of different types of pollution caused due to industrialisation and construction activities, so as he may help in balancing of eco-system and control pollution by providing controlling measures. They should be also aware of the environmental laws for effectively controlling the pollution of environment. The topics are to be taught in light of legislation Para-3.

TOPIC WISE DISTRIBUTION OF PERIODS:

SL. NO.	TOPIC	L	T	P
1.	Introduction	6		
2.	Pollution	3		
2.1	Water Pollution	8		
2.2	Air Pollution	8		
2.3	Noise Pollution	3		
2.4	Radio Active Pollution	4		
2.5	Solid Waste Management	5		
3.	Legislations	3		
4.	Environmental Impact Assessment	4		
5.	Disaster Management	6		
TOTAL		50	-	-

DETAILED CONTENTS

1. INTRODUCTION :

- Basics of ecology, Ecosystem, Biodiversity Human activities and its effect on ecology and eco system, different development i.e. irrigation, urbanization, road development and other engineering activities and their effects on ecology and eco system, Mining and deforestation and their effects.
- Lowering of water level , Urbanization.
- Biodegradation and Biodegradability, composting, bio remediation, Microbes .Use of biopesticides and biofungicides.
- Global warning concerns, Ozone layer depletion, Green house effect, Acid rain,etc.

2. POLLUTION :

Sources of pollution, natural and man made, their effects on

living environments and related legislation.

2.1 WATER POLLUTION :

- Factors contributing water pollution and their effect.
- Domestic waste water and industrial waste water. Heavy metals, microbes and leaching metal.
- Physical, Chemical and Biological Characteristics of waste water.
- Indian Standards for quality of drinking water.
- Indian Standards for quality of treated waste water.
- Treatment methods of effluent (domestic waste water and industrial/ mining waste water), its reuse/safe disposal.

2.2 AIR POLLUTION :

Definition of Air pollution, types of air pollutants i.e. SPM, NOX, SOX, CO, CO₂, NH₃, F, CL, causes and its effects on the environment.

- Monitoring and control of air pollutants, Control measures techniques. Introductory Idea of control equipment in industries i.e.
 - A. Settling chambers
 - B. Cyclones
 - C. Scrubbers (Dry and Wet)
 - D. Multi Clones
 - E. Electro Static Precipitations
 - F. Bog Fillers.
- Ambient air quality measurement and their standards.
- Process and domestic emission control
- Vehicular Pollution and Its control with special emphasis of Euro-I, Euro-II, Euro-III and Euro IV.

2.3 NOISE POLLUTION :

Sources of noise pollution, its effect and control.

2.4 RADISACTIVE POLLUTION :

Sources and its effect on human, animal, plant and material, means to control and preventive measures.

2.5 SOLID WASTE MANAGEMENT :

Municipal solid waste, Biomedical waste, Industrial and Hazardous waste, Plastic waste and its management.

3. LEGISLATION :

Preliminary knowledge of the following Acts and rules made thereunder-

- The Water (Prevention and Control of Pollution) Act - 1974.
- The Air (Prevention and Control of Pollution) Act - 1981.
- The Environmental Protection (Prevention and Control of Pollution) Act -1986. Rules notified under EP Act - 1986 Viz.
 - # The Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000
 - # The Hazardous Wastes (Management and Handling) Amendment Rules, 2003.
 - # Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003.
 - # The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002.
 - # Municipal Solid Wastes (Management and Handling) Rules, 2000.
 - # The Recycled Plastics Manufacture and Usage (Amendment) rules, 2003.

4. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) :

- Basic concepts, objective and methodology of EIA.
- Objectives and requirement of Environmental Management System (ISO-14000) (An Introduction).

5. DISASTER MANAGEMENT :

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benefit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.

Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

3.3 COMMUNICATION SYSTEMS

L T P
4 - 3

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction To communication System	3	-	-
2.	Telegraphy	6	-	-
3.	Telephony	6	-	-
4.	Digital Switching Systems	18	-	-
5.	Carrier Telephony	4	-	-
6.	Digital Communication	12	-	-
7.	Microwave Communication	6	-	-
8.	Optical Fibre Communication	12	-	-
9.	Satellite Communication	9	-	-
10.	Mobile Communication	12	-	-
11.	Data Communication	12	-	-
<hr/>		100	-	50

DETAILED CONTENTS

1. INTRODUCTION TO COMMUNICATION SYSTEM :

Basic idea of telegraphy, telephonic, digital, microwave, fibre optics, sttellite, mobile and data communication.
- 2.A TELEGRAPHY:

Telegraphic code (Morse and 7.5 unit), Instruments (Key, Sounder, relay), Telegraph system (types of circuits), Equipment (Teleprinter, Telex), Voice Frequency Telegraphy . (Only brief idea, No detail required).
- B. Facsimile transmission- Elementary idea of Fax machine and its operation, Transmission and Receiving process
3. TELEPHONY :
 - A Telephone component- Construction and working of transmitter and receiver components, parts, curcuit and working of subscriber's push button telephone sets.
 - B. Brief idea of Automatic Exchanges
 - C. Brief Idea of Electronic Exchanges and PCO.
4. DIGITAL SWITCHING SYSTEM :

Salient feature, architecture and services of C-DOT 128, C-DOT 256, C-DOT 512, E-10B, EWSD (Electronic Digital Switching Network, OCB-283.
5. CARRIER TELEPHONY:

Features of carrier telephone system; conception of

frequency division multiplexing; hybrid coils; frequency allocation and formation of groups; schematic diagram and working of 3 channel and 12 channel carrier systems. Carrier and pilot frequency generation.

6. DIGITAL COMMUNICATION SYSTEM :

Pulse code modulation- Sampling, Quantization, Encoding, Decoding, PCM Transmission formats and systems, Basic of digital multiplexing. Brief idea of multiplexing hierarchy. FSK, PSK, QAM, Demodulation, Error control (Detection and correction

7. MICROWAVE COMMUNICATION :

Basic features of microwave communication, Block diagram and explanation of microwave system.

8. OPTICAL FIBRE COMMUNICATION SYSTEM :

Characteristics of optical fibre, Brief idea of optical fibre cable, Components and equipments, Block diagram of optical fibre communication system and its brief description.

9. SATELLITE COMMUNICATION :

Brief idea of RF uplink and down link, Multiplexing and modulation, Block diagram and brief explanation of satellite communication system.

10. MOBILE COMMUNICATION :

Radio pager, Cellular telephony system - Brief history cellular structure and planning, Frequency allocation, Propagation problem. Types of mobile system- Analog and Digital cellular radio. Architecture of GSM network, GSM services.

11. DATA COMMUNICATION :

Basic idea and standards, ISO/OSI reference model, ISDN- Its devices, services and operation, Internet- Fundamental, Brief idea of its different services-E-Mail, FTP, Tel-Net, www.

LIST OF BOOKS

1. Roody, Dennis and Coolen, John- Electronic Communications- 4th Edition-PHI
2. Kennedy, George and Davis, Bernard- Electronic Communication System- 4th Edition-Tata Mcgraw Hill.
3. Haykin, Simon - Communication System - 4th Edition- John Wiley.
4. Tanenbaum, Andrew S. - Computer Network- 3rd Edition-PHI
5. For Digital Switching System- Learning Material compiled by I.R.D.T. is provided to all polytechnic.

COMMUNICATION SYSTEMS LAB

List Of Practicals

1. Study of FAX machines and its working.
2. To study the parts of telephone hand set :
 - (a) Frequency response of telephone receiver.
 - (b) To observe the wave form of impulses by dialling a number.
3. Visit and study of Digital Switching System.
4. Visit and study of Microwave transmission system.
5. Visit and study of Satellite transmission system.
6. Demonstration of sampling, FSK and PSK by simple experiment.
7. Demonstration of optical fibre communication through simple kits.
8. Study of working of mobile phones and its services.
9. Study and use of ISDN and Internet services.

NOTE: Report of every visit has to be submitted by each student along with the practical record to be examined by the examiner.

3.4 ELECTRONIC INSTRUMENTS AND MEASUREMENTS

(Common with Instrumentation & Control Engineering and Computer Engineering)

L	T	P
3	-	3

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	3	-	-
2.	Multimeters	6	-	-
3.	Electronic Multimeter	6	-	-
4.	A. C. Millivoltmeter	6	-	-
5.	Cathode Ray Oscillograph	12	-	-
6.	Audio Power Meter	6	-	-
7.	Signal Generator	9	-	-
8.	Impedance Bridges & Meters	9	-	-
9.	Regulated Power Supply	9	-	-
10.	Digital Instrument	9	-	-
		75	-	75

DETAILED CONTENTS

1. INTRODUCTION TO THE PROCESS OF MEASUREMENTS:
 - 1.1 Review of the terms, accuracy, precision, sensitivity range and errors, difference between accuracy, precision and resolution.
 - 1.2 Precaution against high frequency noise pick up and remedies, shielding and grounding (two terminal and three terminals).
 - 1.3 Concept of selective wide band measurements.
2. MULTIMETERS:
 - 2.1 Principle of measurement of D.C. voltage and D.C. current, A.C. voltage and A.C. current and resistance in a multimeter.
 - 2.2 Specifications of a multimeter and their significance.
 - 2.3 Limitations with regards to frequency and impedance.
3. ELECTRONIC MULTIMETER:
 - 3.1 Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity, principles of voltage, current and resistance measurements.

- 3.2 Specification of electronic multimeter and their significance.
4. A. C. MILLIVOLTMETER:
 - 4.1 Types of AC millivoltmeters: Amplifier-rectifier and rectifier amplifier, block diagram and explanation of the above types of A.C. milli voltmeter.
 - 4.2 Typical specifications and their significance.
5. CATHODE RAY OSCILLOSCOPE:
 - 5.1 Construction of CRT, Electron gun, Electrostatic focussing and acceleration (Explanation only-no mathematical treatment) Deflection sensitivity, Brief mention of screen phosphor for CRT. Internal Block Diagram of CRO.
 - 5.2 Explanation of time base operation and need for blanking during flyback, synchronisation.
 - 5.3 Block diagram and explanation of a basic CRO and a triggered sweep oscilloscope, front panel controls.
 - 5.4 Specifications of CRO and their significance.
 - 5.5 Use of CRO for the measurement of voltage (D.C. & A.C.) frequency using Lissajous figure, time period, phase.
 - 5.6 Special features of dual trace, delayed sweep and storage CROs (Brief mention only).
 - 5.7 CRO probes including current probes.
 - 5.8 Working Principle of Spectrum Analyzer.
6. AUDIO POWER METER:
 - 6.1 Block diagram of an audio power meter.
 - 6.2 Principles of working its application and high frequency limitations.
 - 6.3 Scale conversion from power to db.
7. SIGNAL GENERATORS:
 - 7.1 Block diagram explanation of laboratory type low frequency and RF signal generators, pulse generator and function generator.
 - 7.2 Specification for low frequency signal generator, RF generator, pulse generator and function generator. Brief idea of testing specification for the above instruments.
 - 7.3 Standard signal generator.

8. IMPEDANCE BRIDGES Q METERS:
 - 8.1 D.C. and A.C. Bridges :

D.C. bridges- Wheat stone bridge, Kelvins bridges, Sensitivity- Null indicators.

A. C. Bridges - Inductance bridges (Maxwell bridge), Capacitance bridges, Hays bridge, Anderson bridge, Schering bridge, Wein bridge, Twin network, Storage factor, Dissipation factor and their measurements.
 - 8.2 Block diagram explanation and working principle of laboratory types (balancing type) RLC bridge. Specifications of a RLC bridge, Principle of digital RLC bridge.
 - 8.2 Block diagram and working principles of a Q meter.
9. REGULATED POWER SUPPLY:
 - 9.1 Block diagram of regulated power supply, IC based power supply.
 - 9.2 Major specifications of regulated power supply, and their measurement (line and load regulation, output ripple and transients).
 - 9.3 Basic working principles of switched mode power supply.
 - 9.4 Concept of floating and grounded power supplies and their interconnections to obtain multiple output supplies.
 - 9.5 Basic working principle of uninterrupted power supply
10. DIGITAL INSTRUMENTS:
 - 10.1 Comparison of Analog and Digital instruments, characteristics of digital meter.
 - 10.2 Working principle of Ramp, Dual slope and integrating type of digital voltmeter.
 - 10.3 Block diagram and working of a digital multimeter.
 - 10.4 Working principle of time interval frequency and period measurement using universal counter, frequency counter, time base stability and accuracy and resolution.

List of Books

1. A. K. Sawhney - A course in Electrical & Electronic Measurement & Instrumentation - Dhanpat Rai & Sons
2. Helfric & Cooper - Modern Electronic Instrumentation and Measurement Techniques- PHI

ELECTRONIC INSTRUMENTS AND MEASUREMENT LAB

List Of Practicals

1. Loading effect of a multimeter and its limitations to measure high frequency voltages.
2. Measurement of Q of a coil and its dependence on frequency using a Q meter.
3. Measurement of voltage, frequency, time period, phase angle and delay time using CRO : (use of Lissagious Figures).
4. Measurement of time period, frequency, average period using universal counter frequency counter.
5. To test a power supply for ripple, line and load regulation, Tracing of wave form, To findout operating range of power supply.
6. Measurement of rise, fall and delay time using a CRO.
7. Measurement of distortion of a LF signal generator using distortion factor meter.
8. Measurement of R.L. and C using a LRC bridge/universal bridge.

3.5 AUDIO AND VIDEO SYSTEM

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TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
Part A: Audio System				
1.	Electro Acoustic Transducers	12	4	-
2.	Sound Recording	16	5	-
3.	Hi-Fi Stereo & Its System	8	3	-
4.	Acoustic Reverberation	3	1	
Part B: Video System				
5.	VCR	9	3	
6.	VCD	9	3	
7.	DVD	9	3	
8.	Video Camera	9	3	
		75	25	75

DETAILED CONTENTS

Part A: Audio System

1. ELECTRO ACOUSTIC TRANSDUCERS:
 - 1.1 Microphones-carbon, condensor, moving coil, crystal, ribbon and lavalier microphones, their construction and basic working principles, frequency response, impedance, sensitivity and directional patterns, typical applications of different types of microphones. Idea of other commercial microphones.
 - 1.2 Loudspeakers-direct radiating and horn loader type their construction, working principles characteristics and applications. Baffles and Enclosures. Introduction to tweeters and woofers and crossover networks, Speakers column.
2. SOUND RECORDING:

Magnatic Recording :

 - 2.1 Principles of sound recording on Disc. Brief idea of microgrooves, playback needles, ceramic and magnetic cartridges.
 - 2.2 Principles of sound recording on magnetic tape, Need for AC biasing, Consideration of tape speed, Tape and coating materials, Constructional features of heads, Need for pre-emphasis and Equalisation. Definitions of WOW and Flutter.

Block diagram of tape recorder and explanation of a typical tape transport mechanism.

2.3 Optical Recording of Sound :

Basic ideas of optical recording of sound on films.

2.4 Digital Recording of Sound :

Basic ideas of Digital Recording and Reproduction of Sound. Basic concepts of sampling quantization and encoding. formats of digital audio recording, basic of recording-Servo system. Material and formation of CD, Block diagram of audio CD player. Description of its main component.

3. HI-FI STEREO AND ITS SYSTEM:

3.1 Concept of Fidelity, noise and different types of distortions in an audio system. Stereophony, comparison of monophonic and stereophonic sound. Brief description of stereophonic recording on tape and disc. Block diagram of hi-fi stereo system, Function of bass, Treble, Loudness and Balance control. Consequences of mismatch between amplifier output and speaker impedance. Need for a multi-speaker column. Cross over network in speaker columns with a separate heading as PA system.

3.2 General ideas about public address system and its block diagram.

4. ACOUSTIC REVERBERATION :

Reverberation of sound. Absorption and Insulation of sound. Acoustics of auditorium sound in enclosures. Absorption coefficient of various acoustic materials. (No mathematical derivations.

Part -B Video System

5. VCR AND VIDEO RECORDING:

5.1 Principle of video recording on magnetic tape. Relationship of tape speed and band width. Familiarities with the terms such as VHS, BETAMAX, U-MATIC. Idea of Video formats - 1/2", 3/4", 1" formats.

5.2 Block diagram of a VCR and explanation of its working.

6. VCD :

6.1 Basic principles of video recording and reproduction on discs by LASER technology.

6.2 Material and formation of CD.

6.3 Encoding of video signal, video format, Encoding of audio data for VCD.

6.4 Block diagram of VCD player and description of main component

7. DVD :

7.1 Basic principles of video recording and reproduction on discs by Digital technology.

7.2 Basic concept of sampling and encoding, DVD Video format, DVD audio format.

7.3 Block diagram of DVD player and description of main component. Comparison of VCD and DVD.

8. VIDEO CAMERA :

Main features, Working principle, Area of application, Identification of various stages and main components, of single tube camera, ENG camera. Basic concept of Digital camera and its main features and working principles.

LIST OF BOOKS

1. A. Sharma- Audio Video & TV Engineering- Danpat rai & Sons.
3. Benson & Whitaker - Television and Audio Handbook- McGraw Hill Pub.

AUDIO AND VIDEO ENGINEERING LAB

List Of Practicals

1. Study of different features and Measurement of directivity of various types of microphones and loudspeakers. (Approximate).
2. Draw the frequency response, bass and treble response of stereo amplifier.
3. Channel separation in stereo amplifier and measurement of its distortion.
4. Installation and operation of a stereo system amplifier. Fault finding in stereo chain.
5. Frequency response of crossover networks in speaker columns.
6. Familiarity with the working of drive mechanism of a tape recorder. Fault finding and preventive maintenance in tape recorders.
7. Installation and operations of PA system. (Preferably in auditorium).
8. Operation of VCR and familiarity with DC voltage wave shapes at major points and identification of different faults in a faulty VCR and their rectification.
9. Familiarity with the working of audio CD player and identification of main stages and components.
10. To study the operation and control of CD and DVD player and identification of main stages and components.
11. To study the operation and control of Colour Video Camera and identification of main stages and components.

3.6 TELEVISION ENGINEERING

L T P
3 2/2 3

Rationale :

Television is an important media of distant audio & video communication. It finds major application in consumer electronics in the form of B/W and coloured receiver. It also plays an important role education, research and space application. A student having knowledge about the composite video signals, TV camera tubes, TV receiver circuitry, Antenna, Booster and Feeder, Formation of colour TV signals. Their modulation and demodulation will be able to share any type of responsibility assigned to him.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Topic 1	2	1	-
2.	Topic 2	6	1	-
3.	Topic 3	6	2	-
4.	Topic 4	4	1	-
5.	Topic 5	6	2	-
6.	Topic 6	3	1	-
7.	Topic 7	6	2	-
8.	Topic 8	3	1	-
9.	Topic 9	6	2	-
10.	Topic 10	3	1	-
11.	Topic 11	6	2	-
12.	Topic 12	6	2	-
13.	Topic 13	6	2	-
14.	Topic 14	6	2	-
15.	Topic 15	3	2	-
16.	Topic 16	3	1	-
		75	25	75

DETAILED CONTENTS

1. INTRODUCTION TO TV COMMUNICATION:
 - 1.1 Elements of telecast TV chain giving elementary idea of the role of TV camera, TV transmitter, propagation of signal, reception through antennas, TV receiver.
 - 1.2 Brief mention of other types of TV communication such as CCTV, CATV, MATV, Sattelite TV and their applications.
 - 1.3 Brief mention of factors affecting range of TV coverage such as:-
 - (a) Line of sight propagation.
 - (b) Effect of earth's curvature.

- (c) Receiving and transmitting antenna heights.
- (d) Power of transmitter.

2. PRINCIPLES OF SCANNING AND FORMATION OF COMPOSITE VIDEO SIGNALS:

2.1 Basic of photoelectric conversion from scene to electrical signal through camera tube.

2.2 Sequential and interlaced scanning, line frequency field frequency.

2.3 Concept of :-

- (a) Field and Frame.
- (b) Persistence of vision and flicker.
- (c) Horizontal and vertical resolution.
- (d) Picture element.
- (e) Relationship between interlacing and bandwidth.
- (f) Aspects ratio.
- (g) Relationship between line frequency, field frequency and video bandwidth.

2.4 Specifications of CCIR standard composite signal used in India for monochrome TV, including the need of synchronisation blanking, and equalizing pulses signals (line and field) complete explanation of need for front and back porch in the VHF.

2.5 Frequency range of various bands and channels in the VHF range used in India.

2.6 Channel specifications (Monochrome) :

2.6.1 Channel frequency limits, vision and sound carrier frequencies.

2.6.2 Need for VSB and VSB specifications.

2.6.3 Vision bandwidth, vision modulation types, sound bandwidth, sound modulation type, reasons for employing AM for vision FM for sound and negative modulation for TV transmission.

2.7 Composite Video Signal.

3. TV CAMERA TUBES:

3.1 Constructions and principles of operation of vidicon, plumbicon and saticon camera tubes.

- 3.2 Basic concepts of LAG, sensitivity, Dark current.
4. B/W TV TRANSMITTER :
 - Block diagram of TV transmitter and function of each block.
5. BLOCK DIAGRAM OF B/W TV RECEIVER:
 - 5.1 Block diagram of a TV receiver (B and W) function of each block including nature and level of signals at the input and output of each block.
 - 5.2 Explanation of working principles of the following circuits; video detector, syncseparator horizontal and vertical deflections circuits including EHT.
 - 5.3 Function of various controls and their location in actual stage of a TV receiver.
6. PICTURE TUBE (B AND W):
 - 6.1 Construction and operating principles of a B and W picture tube.
 - 6.2 Functions, mounting procedures and adjustment of picture tube, components and assemblies such as deflection coils, magnets, EHT lead, Earthing strap. Need for metallic band around the periphery of CRT screen.
7. TV ANTENNA, BOOSTER AND FEEDER CABLES:
 - 7.1 Types of TV antenna, dimensions of elements, installation procedures.
 - 7.2 The need of booster for fringe area reception.
 - 7.3 The comparison of 300 ohm, flat twin lead parallel wire cable and 75 ohm co-axial cable for TV signal distribution.
8. LIGHT, VISION AND COLOUR:
 - 8.1 Chromacity charts colour fundamentals chromionance and luminance signals.
 - 8.2 Brief explanation of the mechanism of colour vision, colour response curve of the eye.
 - 8.3 Additive and subtractive colour mixing.
 - 8.4 Colour standard, measurement and sources (elementary concepts only)
 - 8.4.1 Colour temperature and standard illuminants, 3000o k and 6500o k.
 - 8.4.2 Subjective and objective colour terms and their

interpretations such as HUE & Brightness, saturation, luminance, chrominance. Basic concept of LUX, Lumen and Candila

9. FUNDAMENTALS OF COLOUR TELEVISION SIGNALS:

9.1 Need for compatibility with B & W system .

9.2 Luminance and colour difference signals.

9.3 Basic concept of chrominance bandwidth requirement.

10. COLOUR CAMERA :

10.1 Single tube colour camera system.

10.2 Solid state imagers.

11. COLOUR AND BAR SIGNAL:

11.1 Basic principle of quadrature amplitude modulation.

11.2 Quadrature amplitude modulation of colour difference signal on colour sub carrier.

11.3 Calculation of luminance, colour difference and chrominance, amplitude of different types of colour bar signal (10./. amplitude 100./. saturated unweighted and weighted).

12. NTSC & PAL FUNDAMENTALS:

12.1 Basic principles of NTSC system.

12.2 Basic pal coder block diagram and PAL coding process including the expression for final output signal.

12.3 Basic PAL transmitter block diagram and its operation.

13. COLOUR PICTURE TUBE:

13.1 Construction and operation of :-

13.1.1 Delta three gun shadow mask tube in brief.

13.1.2 In line three gun shadow mask tube.

13.1.3 Single gun in line trinitron tube (Brief discription only).

13.2 Convergence degansing and purity :-

13.2.1 General principles.

13.2.2 Static and dynamic convergences.

14. CHROMINANCE SIGNAL DEMODULATORS:

- 14.1 Basic principle of PAL_S and PAL_D demodulation.
- 14.2 Basic principle of synchronous demodulation.
- 15. DIGITAL VIDEO :
 - 15.1 Basics of digital video - Sampling quantization, encoding. Digital transmission and reception, MPEG-2 & OFDM (Orthogonal frequency Division Multiplexing).
 - 15.2 Digital Multimedia.
 - 15.3 Brief idea of Teletext system.
 - 15.4 Basic concept of High definition television (HDTV).
- 16. VIDEO DISPLAY UNITS (VDU):
 - 16.1 Block diagram and specifications of B&W VDU.
 - 16.2 Block diagram and specifications of colour VDU.
 - 16.3 Brief details and fault finding of those circuits which are not common with a TV receiver.
 - 16.4 Interfacing of VDU with computers.

TELEVISION ENGINEERING LAB

List Of Practicals

1. Familiarisation with the physical layout, location of stages (transistors, ICs), major components, measurement of D.C. voltage & tracing of signal in B & W TV receiver. The student should be required to identify components from circuit diagram with physical layout of corresponding parts, marks hazardous areas and note opening and closing procedures.
2. Determination of cut off point and the effect of variation of E.H.T. voltage on the picture size and the blooming effects of low heater voltage on the screen.
3. Familiarisation with all controls and effects of adjustments of controls on the performance of a B & W TV receiver.
4. Testing of B & W CRT and associated circuits for defective operation, familiarity with pin connections, typical operating voltages and currents, typical circuit resistances of deflection coils.
5. Familiarisation with the physical layout, location of stages (transistors, ICs), major components, measurement of D.C. voltage & tracing of signal in Colour TV receiver. The student should be required to identify components from circuit diagram with physical layout of corresponding parts, marks hazardous areas and note opening and closing procedures.
6. Familiarisation with all controls and effects of adjustments of controls on the performance of a Colour TV receiver.
7. Testing of Colour CRT and associated circuits for defective operation, familiarity with pin connections, typical operating voltages and currents, typical circuit resistances of deflection coils.
8. Installation of a TV receiver antenna and measurement of its impedance.
9. Fault finding in each stage of a B/W & Colour TV receiver.

NOTE:-

1. A demonstration model of a Colour TV receiver should be developed in the lab itself to perform the above related experiments.
2. Visit to the nearest TV studio and transmitter is necessary for idea of digital video communication.

LIST OF BOOKS

1. R. R. Gulati - Modern Television Practices, Principles Technologies and Services- New Age International Pub.
2. Benson & Whitaker - Television and Audio Handbook- McGraw Hill Pub.

3.7 MICROPROCESSORS AND APPLICATIONS

(Common with Instrumentation & Control Engineering and Computer Engineering)

L T P
3 2/2 4

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Over View of Microcomputer System	6	2	-
2.	Memory of A Microcomputer	12	4	-
3.	C.P.U. and Control	12	4	-
4.	Introduction To 8085 Microprocessor	12	4	-
5.	Architecture of 8086 Microprocessor	12	4	-
6.	Assembly Language Programming	12	4	-
7.	Basic I/O Interfacing	12	4	-
8.	Memory Interfacing	12	4	-
9.	Advance Microprocessor & Micro Controllers	12	4	-
		75	25	100

DETAILED CONTENTS

1. OVERVIEW OF MICROCOMPUTERS SYSTEM:
 - 1.1 Functional block.
 - (a) CPU.
 - (b) Memory.
 - (c) Input/Out devices (Key board, Floppy drive, Harddisk drive, Tape drive, VDU, Printer, Plotter).
 - 1.2 Concept of programme and data memory.
 - (a) Registers (general purpose).
 - (b) external memory for storing data and results.
 - 1.3 Data transfer between registers.
 - 1.4 Concept of tristate bus.
 - 1.5 Control on registers.
2. MEMORY OF A MICROCOMPUTER:
 - 2.1 Concept of byte organised memory.

- (a) Address inputs.
 - (b) Address space.
 - (c) Data input/output.
- 2.2 Addressing and Address decoding.
- (a) Memory system organisation.
 - (b) Partitioning of total memory space into small blocks.
 - (c) Bus contention and how to avoid it.
- 2.3 Memory chips.
- (a) Types of ROM, RAM, EPROM, PROM.
 - (b) Read/Write inputs.
 - (c) Chip enable/select input.
 - (d) Other control input/output signals.
 - Address latching.
 - Read output.
 - Address strobes.
 - (f) Power supply inputs.
- 2.4 Extension of memory.
- In terms of word length and depth.
3. C P U & CONTROL:
- 3.1 General microprocessor architecture.
- 3.1 Instruction pointer and instruction register.
- 3.2 Instruction format.
- Machine and Mnimonics codes.
 - Machine and Assembly language.
- 3.3 Instruction decoder and control action.
- 3.4 Use of Arthematic Logic Unit.
- Accumulator.
 - Temporary Register.
 - Flag flip-flop to indicate overflow, underflow,

zero result occurrence.

3.5 Timing and control circuit.

- Crystal and frequency range for CPU operation.
- Control bus to control peripherals.

4. INTRODUCTION OF 8085 MICROPROCESSOR:

Evolution of Microprocessor, Register Structure, ALU, BUS Organization, Timing and Control.

5. INTRODUCTION OF 8086 MICROPROCESSOR:

Internal organization of 8086, Bus Interface Unit, Execution Unit, Unit, register, Organization, Sequential Memory Organization, Bus Cycle.

6. ASSEMBLY LANGUAGE PROGRAMMING :

Addressing Modes, Data Transfer, Instructions, Arithmetic and Logic Instruction, Program Control Instructions (Jumps, Conditional Jumps, Subroutine Call) Loop and String Instructions, Assembler Directives.

7. BASIC I/O INTERFACING :

Programmed I/O, Interrupt Driven I/O, DMA, Parallel I/O (8255-PPI, Centronics Parallel Port), Serial I/O (8251/8250, RS-232 Standard), 8259-Programmable Interrupt Controller, 8237-DMA Controller, 8253/8254-Programmable Timer/Counter, A/D and D/A conversion.

8. MEMORY INTERFACING :

Types of Memory, RAM and ROM Interfacing with Timing Considerations, DRAM Interfacing.

9. ADVANCE MICROPROCESSOR AND MICRO CONTROLLERS :

Pentium and Power PC

NOTE :

Study of Popular ICs Read/Write Chips-8155/8156, 2114,2148,2164. ROM Chips- 8355,2716,2732,8755. Other support chips - 8279,8257,8275,8205.

LIST OF BOOKS

1. Singh, B. P. - Advanced Microprocessor and Microcontrollers- New Age International.
2. Singh, B. P. - Microprocessor Interfacing and Application - New Age International.

3. Brey, Barry B. - INTEL Microprocessor - Prentice Hall (India)-4th Edition.
4. Liu and Gibson G.A. - Microcomputer System - The 8086/8088 Family-Prentice Hall (India) 2nd Edition.

MICROPROCESSORS AND APPLICATIONS LAB

List Of Practicals

1. Assembly language programming :- Programming of simple problems.
2. Simple programming problems using 8085 and 8086 microprocessor. Trainer kit to gain competence in the use of
 - (a) 8085 and 8086 Instruction set.
 - (b) Support chips of 8085 and 8086.

3.8 PROJECT

L	T	P
0	0	4

GENERAL OBJECTIVE:

Purpose of the project work is :

- (i) To develop abilities of diagnosing problems.
- (ii) To develop the abilities to :
 - (a) Make literature survey.
 - (b) Design/develop/frbricate/test simple circuits.
 - (c) Prepare documents for electronic work.
 - (d) Work as a team.

LIST OF PROJECTS (TO BE ASSESSED INTERNALLY):

The list of projects shown below is indicative of general nature and the complexity of work to be entrusted to students. (Teachers can modify this list to shut local needs and constraints keeping the level of complexity as suggested here).

1. To make simple circuit which will demonstrate the use of tranistor as a switch. (The student should measure I_c and V_{ce} in this circuit when I_b is varied from zero to a maximum value and measures the value of I_b (sat), I_c (sat), V_{ce} (sat) and H_{fe} (min) for saturation at a given supply voltage and load.
2. To calculate the values and assemble and test simple transistor switching circuit to switch on a
 - (a) LED.
 - (b) Relay.
 - (c) 200/500 ma. lamp. (6v/12v).
3. Make a battery eliminator
4. Make a battery charger.
5. Fabricate (including making PCB) and testing of regulated power supply (series and shunt circuit using zener diode and IC type).

6. Assembly and testing of a two band transistor radio receiver.
7. Fabrication and testing of any ICs of consumer interest, For example.
 - (a) Fan regulator/Light dimmer.
 - (b) Timer using IC 555.
 - (c) Burglar's alarm.
 - (d) Digital clock.

The list is only suggestive, more items may be included

LIST OF PROJECTS

NOTE: The list of projects shown below is to be used as a guideline by the BTE(UP) for drawing up the project list for the diploma examination. Expert team formulating the final list may consult this list to ensure that the complexity level is consistent with the guideline set here.

1. AMPLIFIERS:
 - 1.1 Simple transistor / FET / IC amplifier to meet the given specifications.
 - 1.2 Audio frequency mono/stereo amplifier including usual control facilities (including power amplifier and power supply stages).
2. OSCILLATORS:
 - 2.1 Sine wave oscillators of given specifications using transistors/FETs/ICs (tuned oscillators, phase shift, including Wein's Bridge oscillators).
 - 2.2 Multivibrators of different types to produce square wave output signals of given specifications (Monostable, Bistable and Astable) using transistor FET or IC circuits.
 - 2.3 Simple function generators.
3. POWER SUPPLIES:
 - 3.1 Single dual and multiranged low voltage and low power fixed variable D.C. power supplies of different specifications using transistor and regulator ICs.
4. TIMERS AND OPERATIONAL AMPLIFIERS:
 - 4.1 Timers of different types using 555/556 ICs.
 - 4.2 Amplifiers, oscillators, active filters, differentiations, integrator, scale changer and other simple circuits using

operational modules.

5. DIGITAL CIRCUITS:

- 5.1 Simple three digit counter.
- 5.2 24 hour and 12 hour digital clock.
- 5.3 Electronic multimeter.
- 5.4 A/D and D/A convertors.
- 5.5 Interface circuits using Microprocessors.

6. MISCELLANEOUS CIRCUITS:

- 6.1 Fan regulators, motor speed control, phase controlled rectifier and similar circuits using Thyristor/Triac/Diac/UJT and similar PNP devices.

7. RADIO RECEIVER:

- 7.1 Simple one or two band AM radio receiver.
- 7.2 Simple transreceiver.

NOTE:-

- 1. Depending upon the complexity of the work, the teacher may assign any number of project work to a group. The group size will also be similarly decided by the teacher, normally between 2 to 4 students per group.
- 2. The board may request all heads of Electronics Engineering Departments of U.P. Polytechnics to provide list of projects. An expert committee may be appointed to screen the project list.
- 3. The BTE (UP) may adopt the following format for the project report.

FORMAT

A project report (of about 100 hand written pages) should submitted covering the following points.

- 1. Basic design procedure for the project circuit.
- 2. Full block diagram and/or circuits diagram showing the component values.
- 3. Component layout diagram, including component and copper side details of the PCB used.
- 4. List of components used showing types voltage/current ratings, tolerance values and other specifications.

5. Details of heatsink used IC and Transistor pin connections and types of packages.
6. Front panel layout and chassis details. (as relevant)
7. Test and measurement procedure.
8. Discussion on the deviation of the results from the given specifications.
9. Estimating and costing with discussion about selection of components from cost point of view.

NOTE:

For specialisation Digital Electronics and Microprocessors and Radio and Television Engineering more project in these subjects should be given by the teachers.

3.9 (i) MODERN COMMUNICATION SYSTEMS

L	T	P
3	1	-

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Optical Communication	15	5	-
2.	Digital Communication	18	6	-
3.	Setellite Communication	12	4	-
4.	Mobile Communication	12	4	-
5.	Data Communication	18	5	-
		75	25	-

DETAILED CONTENTS

1. OPTICAL COMMUNICATION:
 - 1.1 Introduction : Block diagram of optical fiber communication system, advantages of optical communication
 - 1.2 Optical Fibre : Structure of optical wave guide, light propagation in optical fiber, Ray and wave theory, Modes in optical fiber, Step and Graded index fibers.
 - 1.3 Transmission Characteristics of Optical Fibers : Signal degradation in optiecal fibers, Attenuation losses in optical fibers. Dispersion and pulse broadening in different types of fibers, Modal birefringence and polarisation maintaining fibers.
 - 1.4 Principle laser action types of lasers, fabrication and characteristics of semiconductor lasers and L.E.D.'s
 - 1.5 Requirements for Photo detectors, Types of photo detectors, Characteristics of photo detectors. Principle of APD and Pin diodes. Phot transistor and Photo Conductors.
 - 1.6 Components of an optical fiber communication system, Digital and Analog Optical Communication System.
2. DIGITAL COMMUNICATION:
 - 2.1 Elements of Digital Communication and information theory : Model of a digital communication system, Logarithmic measure of information. Source coding fixed in and variable length code words. Hartely-Shannon law for channel.

- 2.2 Sampling Theory and Pulse Modulation : Sampling theorem, Signal reconstruction in time domain. Types of analog pulse modulation, Method of generation and detection of PWM, PNM and PPM.
- 2.3 Waveform Coding Technique : Quantization, Quantization noise, Encoding and Pulse code modulation, Differential pulse code modulation, Delta modulation, Comparison of PCM and DM.
- 2.4 Digital Multiplexing : Fundamentals of time division multiplexing electronic commutator.
- 2.5 Digital Modulation Techniques : Types of digital modulation, Wave forms for amplitude, Frequency and phase shift keying, Method of generation and detection of coherent and non-coherent binary ASK,FSK & PSK, Differential phase shift, Quadrature modulation techniques. (QPSK and MSK) Probability of error and comparison of various digital modulation techniques.
- 2.6 Error Control Coding : Error free communication over a noisy channel, Hamming sphere, Hamming distance and Hamming bound, Relation between minimum distance and error detecting and correcting capability.
- (3) SATELLITE COMMUNICATION:
- (i) Introduction, historical background and basic Concepts of satellite communication. Elements of satellite communication link.
 - (ii) Geostationary orbits, Orbit mechanisms and launching of satellite
 - (iii) Satellite space craft- Satellite sub system, Tracking and Command, Communication subsystem, Transponders, Space Craft antenna
 - (iv) Satellite Channel and Link Design : Design of down links and uplinks
 - (v) Earth stations technology : Earth Station Design, Earth Station Tracking, Low noise amplifiers.
 - (vi) Multiple access techniques : Frequency Division Multiple Access (FDMA), FDM/FM/FMFDMA, Time division Multiple Access, Frame Structure and Synchronization, Code division Multiple Access, random Access.
4. MOBILE COMMUNICATION :
- Evaluation of mobile communication, A simplified reference model for mobile communications.

A brief introduction of frequency for radio transmission, signals, propagation, Multiplexing, Modulation, Spread spectrum, Cellular system.

Medium Access Control : Introduction To MAC. Introduction to GSM.

System Architecture, Protocol Architecture, Physical Layer and MAC layer.

Mobile Networks

5. DATA COMMUNICATION :
1. Data Transmission Basics : Review of digital data analog modulation and digital formats. Data rates, Baud Rates, Channel capacity, Mediums for communication, Synchronous and asynchronous data communication.
2. ISO-OSI model and TCP/IP model of network, Protocols and services. Connection oriented and connectionless services, their interpretation at different layers. Quality of services, Design issue for different layers.
3. Data Links Layer Design Issues : Services provided to network layer froming: Necessity and techniques. Error control feature and review of techniques.
4. IEEE 802 standards for computer networks.
5. Brief idea of network layer, transport layer.
6. Internet and ISDN services.

LIST OF BOOKS

1. J. Gowar - Optical Communication - PHI.
2. G. E. Keiser - Optical Fibre Communication - Mc Graw Hill Pub.
3. S. Haykin - Communication System - John Willy & Sons (IV Edn.)
4. D. Roddy - Satellite Communication - PHI 1998
5. D. C. Agarwal - Satellite Communication - Khanna Pub.
6. J. Schiller - Mobile Communication - Pearson Education IInd Ed.
7. Tanenbaum Andrew S. - Computer Networks - Prentice Hall (India) IIIrd Ed.

3.8 (ii) ADVANCE MICROPROCESSOR AND INTERFACE

L T P
3 - 1

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Topic 1	25	10	-
2.	Topic 2	20	5	-
3.	Topic 3	15	5	-
4.	Topic 4	15	5	-
		75	25	-

DETAILED CONTENTS

1. 80286- A MICROPROCESSOR WITH MEMORY MANAGEMENT & PROTECTION:

Salient features of 80286, Internal architecture of 80286, Signal descriptions of 80286, Real addressing mode, Protected virtual address mode, Privilege, Protection, Special operation, 80286 Bus interface, Basic Bus operation, Fetch cycles of 80286, 80286 Minimum system configuration, Interfacing memory and I/O devices with 80286, Priority of bus use by 80286, Bus Hold and HLDA sequence, Interrupt acknowledge sequence, Instruction set features.

2. 80386, 80486 - THE 32 BIT PROCESSOR :

Salient feature of 80386, Architecture and signal description of 80386, Register organization of 80386, Addressing modes.

3. AN INTRODUCTION TO THE PENTIUM MICROPROCESSOR :

Introduction, real mode and protected mode operation, The software model of the Pentium, A functional description of the Pentium, Pentium processor registers, Pentium data organization, Pentium instruction types, Pentium addressing mode, Interrupts.

4. AN INTRODUCTION TO MICROCONTROLLER 8151 AND 80196 :

Intel's family of 8-bit microcontroller, Architecture of 8051.

LIST OF BOOKS

1. A. K. Ray & K. M. Bhurchandi- Advanced Microprocessor and Peripherals- Tata Mcgraw Hill.
2. B. P. Singh - Advanced Microprocessor and Microcontrollers- New Age International.

3.9 (iii) BIO-MEDICAL ELECTRONICS

L	T	P
3	1	-

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	6	2	-
2.	Transducers & Electrodes	14	5	-
3.	Source of Bio-electric Potential	12	4	-
4.	Cardiovascular Measurment	15	5	-
5.	Measurment in Repiratory System	14	5	-
6.	Diagonostic Technique	14	4	-
		75	25	-

DETAILED CONTENTS

1. INTRODUCTION :

The age of Biomedical engineering, Development of biomedical instrumentation, Man- Instrumentation System, Components, Physiological system of the body, Problem encountered in measuring a living system.

2. TRANSDUCERS AND ELECTRODES :

The transducers and transduction principles active transducers, Passive transducers, Transducer for Biomedical application.

Electrodes : Electrode theory, Biopotential Electrodes - Microelectrodes, Body surface, Electrodes, Needle Electrodes, Biochemical transducers, Reference Electrodes. PH electrodes, Blood Gas Electrodes.

3. SOURCE OF BIOELECTRIC POTENTIALS :

Resting and action potentials, propagation of active potential, The bioelectric potential-ECG,EEG, EMG and Envoked response.

4. CARDIOVASCULAR MEASUREMENT :

Electrocardiography - ECG amplifiers, Electrodes and leads, ECG recorder - Three channel, Vector Cardiographs, EGC system for stress testing, Continous ECG recording (Holter Recording), Blood pressure measurement, Blood flow measurement, Heart sound measurements.

5. MEASUREMENT OF RESPIRATORY SYSTEM :

Physiology of respiratory system, Measurement of breathing mechanics - Spirometer, Respiratory Therapy equipments : Inhalators ventilators and respirators, Humidifiers, Nebulizers and Aspirators.

6. DIAGNOSTIC TECHNIQUES :

Ultrasonic Diagnosis ECo - Cardiography, ECo, Encephalography, Ophthalmic Scans, X-Ray and Radio-isotope instrumentation, CAT Scan, Emission Computerised Tomography, MRI.

7. Other Prosthetic devices like Hearing Aid, Myoelectric Arm, Special aspects-Safety of Medical Electronic Equipments, Shok hazards from Electrical equipment and Prevention against them.

LIST OF BOOKS

1. Cornwell- Biomedical Instrumentation and Measurements-Prentice Hall (India)
2. R. S. Khandpur - Biomedical Instrumentation - Tata Mcgraw Hill.

3.9(iv) MICRO-ELECTRONICS

L T P
3 1 -

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	6	2	
2.	Crystal Properties & Growth of Semiconductors Bulk	6	2	
3.	Review of Semi-Conductor Properties	9	3	
4.	Epitaxial Growth	6	2	
5.	Oxidation & Film Deposition	6	2	
6.	Diffusion & Ion Implantation	6	2	
7.	Lithography & Etching	6	2	
8.	Discrete Device Fabrication	6	2	
9.	Introduction To MOS	6	2	
10.	Integrated Circuits	6	2	
11.	Testing, Bonding & Packaging	6	2	
12.	Basic Circuits For ICs	6	2	
		75	25	-

DETAILED CONTENTS

1. INTRODUCTION :
Importance of micro-electronics in modern technology.
2. CRYSTAL PROPERTIES AND GROWTH OF SEMICONDUCTORS BULK :
 - Crystal Lattices, Periodic structures, Planes and directions, diamond and zinc-blende lattice.
 - Crystal Growth from Melt.
 - Zone Refining.
 - Wafer shaping, Cleaning and polishing.
3. REVIEW OF SEMI-CONDUCTOR PROPERTIES :
 - Nature of intrinsic Silicon, Doping, Electrical conductivity, p-n junction at zero reverse and forward bias, the diode equation, capacitance of p-n junction, electric field and break down voltage of p-n junctions.
 - Energy band diagram ideal MOS, Schottky barriers, Threshold voltage, Non-ideal effects.

4. EPITAXIAL GROWTH :
 - Lattice matching, Need for epitaxy, Vapour phase epitaxy, Liquid phase epitaxy and Molecular-Beam epitaxy.
5. OXIDATION & POLYSILICON FILM DEPOSITION :
 - Thermal oxidation, Dielectric and Polysilicon deposition, Metallization, Basic processes of vacuum evaporation Patterning techniques.
6. DIFFUSION & ION IMPLANTATION :
 - Basic diffusion, Theory and Practice, Distribution and range of implanted ions, Annealings and activation of dopants.
7. LITHOGRAPHY & ETCHING :
 - Optical lithography, Electron beam lithography, Wet chemical etching, Dry chemical etching.
8. DISCRETE DEVICE FABRICATION :
 - Fabrication of p-n junction, Bipolar junction transistor, JFET.
9. INTRODUCTION TO MOS:

MOS, CMOS IC technology, METal Gate, Poly Silicon Gate, P-Channel, N-Channel Devices, Enhancement Mode and Depletion mode, Devices and their characteristics
10. INTEGRATED CIRCUITS :
 - Advantages of integration, Types of integrated circuits, Monolithic and Hybrid circuits.
 - Masking, Selective doping, Fine-line lithography and isolation for Monolithic circuits.
 - Introduction to monolithic device elements such as BJT, MOS, transistor and integration of other circuit elements.
 - Very large scale integration (V.L.S.I.).
11. TESTING, BONDING AND PACKAGING :

Testing, Wire bonding, Flip-chip and Beam-lead techniques, Packings.
12. Basic circuit for analog and digital ICs, functional elements available in the market.

LIST OF BOOKS

1. S. M. Sze - VLSI Technology- Tata McGraw Hill-IIInd Ed.
2. Campbell, Stephen A- The Science & Engineering of Microelectronic Fabrication- Oxford university Press.
3. S. Gandhi-VLSI Fabrication Principle- John Wiley

3.9 (v) MICROWAVE & RADAR ENGINEERING

L	T	P
3	1	-

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	E.M. Theory	6	2	-
2.	Antena	18	6	-
3.	Microwave	18	6	-
4.	Radar System	18	6	-
5.	Radio Aids To Navigation	12	4	-
6.	Setellite Communication	12	4	-
7.	Fascimile Transmission	9	3	-
		75	25	-

DETAILED CONTENTS

1. E.M. WAVE THEORY:
 - 1.1 Boundary Condition and different forms of Maxwell Equation
 - 1.2 Concept of polarization of EM waves.
 - 1.3 Concept of the electromagnetic radiation and propagation.
2. ANTENNA :

A study of Microwave antena
3. MICROWAVE:
 - 3.1 Introduction to microwave and its applications, classification on the basis of its frequency band according ITU standards.
 - 3.2 Effects of interelectrode capacitance, lead inductance and transit time on the signal frequency performance of conventional operations.
 - 3.3 Construction, Operating Principles, Performance characteristics and Applications of the following -
 - (a) Microwave Tubes- Multi-cavity Klystron, Multi-cavity Magnetron, Reflex Klystron, Travelling wave tube and BWO.
 - (b) Microwave Semiconductor Devides - PIN, Tunnel Diode, IMPATT and TRAPATT and Gun diode .
 - 3.4 Different types of waveguides and their applications. Propagation constant of a rectangular waveguide, cut off

wavelength, guide wavelength. (No Mathematical Derivation)

- 3.5 Microwave components-Tees, Bends, Matched termination, Detector mount, Slotted section, directional coupler, Circulator and duplexar-their constructional features characteristics and application.
- 3.6 Microwave antennas-horn and parabolic disk antennas-their characteristics and typical applications.
- 3.7 Block diagram and working principles of microwave systems.
- 3.8 Microwave power measurements thermal convertors.
- 3.9 Planning of microwave links-Line of sight, fresnel zones reflecting surfaces and fade margin.
- 3.10 Troposcatter links-Basic idea only.
4. RADAR SYSTEMS:
 - 4.1 Introduction to Radar, its various application. Radar range equation (No Derivation) and its application.
 - 4.2 Block diagram and operating principle of basic pulse radar, concept of ambiguous range.
 - 4.3 Block diagram, operating principle of CW (Doppler) and FMCW radars and their application.
 - 4.4 Block diagram and operating principle of MTI radar.
 - 4.5 Radar display-PPI.
5. RADIO AIDS TO NAVIGATION:
 - 5.1 Application of loop antenna in direction finding, Errors adock antenna.
 - 5.2 Description of different navigational system-VHF omnirange (VCR). Distance measuring equipment (DME), Long Rang Navigational (LORAN), Instrument Landing System (ILS) and Ground Control Approach.
6. SATELLITE COMMUNICATION:
 - 6.1 Basic idea passive and active satellites.
 - 6.2 Meaning of the terms Orbit, Aporgee and Perigeo.
 - 6.3 Geo-stationary satellite and its need.
 - 6.4 Block diagram and explanation of a satellite communication link.
7. FASCIMILE TRANSMISSION:

- 7.1 Basic concept.
- 7.2 Specifications of facsimile transmitter and receiver.
- 7.3 Block diagram & function of each block.

LIST OF BOOKS

- 1. S. Y. Liao - Microwave Devices and Circuits - PHI III ed.
- 2. M. L. Sisodia - Microwave - New Age Internationals.
- 3. I. M. Skolink - Introduction to Radar System- McGraw Hill.
- 4. N. S. Nagrajan - Elements of Electronic Navigation - McGraw Hill.
- 5. Roddy & Coolen - Electronics Communication - PHI 4th ed.

3.9 (vi) ELECTRONICS EQUIPMENT TESTING

L	T	P
1	-	3

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Familiarisation with Electronic Equipment Testing	3	-	
2.	Instruments Accessories	2	-	
3.	Testing Practices	3	-	
4.	Measuring Techniques	3	-	
5.	Testing of Discrete Semiconductors, Amplifier and Other Linear ICs	4	-	
6.	Testing of Digital and Microprocessor Devices	3	-	
7.	Testing of Micro-Computers	2	-	
8.	Interface and Cabling Conventions	3	-	
9.	Basic Concept of Intrinsically Safe equipment	2	-	
<hr/>		25	-	75

DETAILED CONTENTS

1. FAMILIARISATION WITH ELECTRONIC TEST EQUIPMENT :
 DC Meters, AC Meters, Electronic Multimeters, DC Bridges, AC Bridges, Universal Bridge, Low Frequency Power Measuring Instruments, High Frequency Power Measurements, Wave Meters, General Purpose Oscilloscopes, Storage Oscilloscope, Spectrum Analyzer, AF Signal Generator, RF Signal Generator, Television Signal Generators, Logic Analyzer, Signature Analyser, Transistor Tester, CRD with Component Testing Facility.
2. INSTRUMENTS ACCESSORIES :
 Attenuators Decade resistors, Decade capacitors and Inductors, Dummy loads, Instruments, Probes, Delay lines.
3. TESTING PRACTICES :
 Passive component testing, Safety precautions, Measuring Current, Voltage and Resistance, Practical Technics for testing and measuring capacitors and inductor and transformers.
4. MEASURING TECHNIQUES :

Rotation and vibration frequencies, Audio and Radio frequency, Phase relationship, Interpreting displays spectra measurement measuring amplitude modulations, Frequency modulation field intensity.

5. TESTING OF DISCRETE SEMICONDUCTOR, AMPLIFIERS AND OTHER LINEAR ICs :

Types of semiconductor devices, Testing of diodes, Zener diode, Varactor diode curve trace for testing transistors, Testing miscellaneous solid state components. Typical Op-Amp. circuits, Fault diagnosis in Op-Amp circuits. Testing of voltage regulator ICs, Testing other linear integrated circuits. Solid State Oscillator bias problems, Affect of resistance and cold solder joints, Localising trouble to a circuit, locating a specific trouble testing of power supplies and SMPS.

6. TESTING OF DIGITAL AND MICROPROCESSOR DEVICES :

Characteristics of integrated circuit logic gates, Digital trouble shooting methods, Testing Integrated circuits with pulse generator, Digital IC trouble shooters logic chip, Logic pulsor, Logic Probe, Logic current tracer, Logic comparator, Function and testing of Flip Flops, Counters and registers, Testing of semiconductor memories.

7. TESTING OF MICROCOMPUTER :

System board, Keyboard, Monitors, Printers, Memory Chips Processors.

8. INTERFACE AND CABLING CONVENTIONS :

The RS-232C serial data standard, Modem cables, Monitor adaptor cables, Printer cables, IEEE-488 cable connections.

9. Basic concepts of intrinsically safety and flameproof equipments.

LIST OF PRACTICALS

At least 10 experiments must be performed regarding testing of instruments/equipments of different categories:-

- A. Measuring and Testing Equipments
- B. Semiconductor Devices, All types of amplifiers and ICs.
- C. Digital and Microprocessor devices.
- D. Micro-controller/Micro-computers.

NOTE :

At least 2 experiments from each category of devices mentioned above.

3.9 (vii) MODERN CONSUMER ELECTRONICS APPLIANCES

L	T	P
1	-	3

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Modern Communication Equipments	3	-	-
2.	Micro-Wave Principles & Application	3	-	-
3.	Electronic Controls	4	-	-
4.	Principles of Electro-Optical Equipments	5	-	-
5.	Testing Procedures as per Standards for Radio and T.V. & other Appliances	5	-	-
6.	Safety and Aesthetics of Consumer Electronics Appliances	3	-	-
7.	Introduction to SMCs	2	-	-
		25	-	75

DETAILED CONTENTS

1. MODERN COMMUNICATION EQUIPMENTS:

1.1 Principle of operation with suitable block diagrams of

- (i) Cordless Phones
- (ii) Cellular Phones
- (iii) Pager
- (iv) Fax Machine

2. MICRO-WAVE PRINCIPLES & APPLICATION :

- 2.1 Sources of Micro-wave like KLYSTRON, MAGNETRON etc.
- 2.2 Operation of Domestic Micro-wave oven.
- 2.3 Electronic Regulator, Electronic Ballast, Electronic Iron.

3. ELECTRONIC CONTROLS:

3.1 Scope of Electronics controls

- i) Temperature Control
- ii) Speed Control
- iii) Automatic Cycle control
- iv) Trip at faults
- v) Pressure/Vaccume control

- 3.2 Electronics controls employed in Domestic Appliances.
 - i. Food Processor
 - ii) Washing Machine
 - iii) Rice Cooker
 - etc.
- 3.3 Programming of Equipments
- 4. PRINCIPLES OF ELECTRO-OPTICAL EQUIPMENTS :
 - 4.1 Principles of LASER. Operation of LASER PRINTER.
 - 4.2 Principle and operation of Remote control of T.V.
 - 4.3 Principle and Application of Compact Disc (CD)
 - i. CD Player
 - ii. CD-ROM
 - iii. DVD Player
 - 4.4 Functional block Diagram and operation of XEROX-PHOTO COPY machine.
- 5. TESTING PROCEDURE AS PER STANDARD :
 - 5.1 Need for standards.
 - 5.2 Standards organisation---such as Bureau of Indian Standards (BIS), International Standards Organisation (ISO).
 - 5.3 Concept of Reliability.
 - 5.4 Study of Radio and T.V. Standards.
 - 5.5 Frequency Allocation.
 - Allocation of frequency for various uses like radio, T.V. celluler system, pager, CB-Radio, HAM-Radio. Military and Police communication etc.
 - 5.6 Testing procedure as per standards for Radio and T.V.
- 6. Safety and Anaesthetics of Consumer Electronics Appliances.
- 7. Introduction of surface mount components the identification and salient features of different SMCs.

ANNEXURE -I

MODERN CONSUMER ELECTRONICS APPLIANCES

LIST OF PRACTICALS

		PERFORMING OF PRACTICALS AT IND/INST
1.	To study and test the various parameters such as RF power output, spurious and harmonics, audio distortion and audio response of a Cordless Phone Transmitter.	IND
2.	To study and test the various parameter such as sensitivity, selectivity, spurious response and audio response of a Cordless Phone Receiver.	IND
3.	Familiarisation with the physical layout, location of stages, major components, measurement of DC voltages and tracing of signal in Cordless Phone. The students should be required to identify components from circuit diagram with physical layout of corresponding parts.	IND
4.	To study the working principal of BTS (Base Transreceiver Station) of a Cellular Phone.	IND
5.	To study the working principal of MSC (Mobile Switching Centres) of a Cellular Phone.	IND
6.	To study and test the various parameters such as selectivity, sensitivity, video response, harmonics of a pager.	IND
7.	To study and test the various parameters such as gain, noise, bandwidth and voltages at different points of a microwave amplifier i.e. travelling wave tube.	IND
8.	Identification of different microwave components such as transistor, diodes, along with the testing of various parameters such as frequency, capacitance.	INST
9.	To measure the power gain and beam width of a microwave dish antenna.	IND
10.	Familiarisation with physical layout, location of stages, major components, measurement of dc voltages and tracing of signal in a food processor/washing machine circuit.	INST
11.	Fault finding in each stages of food processor/washing machine.	INST
12.	Familiarisation with different controls - temperature, speed, tripping, pressure etc. and effects of	INST

adjustment of controls in the performance of domestic appliances such as Oven, Electronic Regulator etc.

- | | | |
|-----|---|------|
| 13. | To design and test the various parameters such as audio distortion, audio response, hum and noise, harmonics selectivity, sensitivity of a CD Player. | INST |
| 14. | To design and test the various parameters and fault finding of each stages in a remote control of T.V. | INST |
| 15. | Familiarisation with all manual and automatic controls and effect of adjustment of different controls in a Xerox Machine. | INST |
| 16. | Familiarisation with the basic maintenance such as clearing of paper path, cleaning the document glass and the SADH Belt, adding toner and replacing the toner waste bottle in a Xerox Machine. | INST |
| 17. | Fault finding and correction of each stages of T.V. Receiver. | INST |
| 18. | Fault detection and correction of each stages of Radio Receiver. | INST |

NOTE : IND - INDUSTRIES
 INST- INSTITUTION

DIPLOMA IN ELECTRONICS ENGINEERING
STAFF STRUCTURE

Intake of the Course 30
Pattern of the Course Annual Pattern

Sl. No.	Name of Post	No.
1.	Principal	1
2.	H.O.D.	1
3.	Lecturer Electronics	4
4.	Lecturer in Maths	1--
5.	Lecturer in Chemistry	1
6.	Lecturer in Physics	1
7.	Lecturer in Comm. Tech.	1
8.	Lecturer in Elect. Engg.	1
9.	Computer Programmer	1
10.	Steno Typist	1
11.	Accountant / Cashier	1
12.	Student / Library Clerk	1
13.	Store Keeper	1
14.	Class IV	6
15.	Sweeper	Part time as per requirement
16.	Chaukidar & Mali	as per justification

Note :

1. Services of other discipline staff of the Institute may be utilized if possible
2. Qualifications of Staff : as per service rule
3. The post of "Computer Programmer" is not needed in the institutions where diploma in "Electronics Engineering" is running.

SPACE REQUIREMENT

[A] ADMINISTRATIVE BLOCK

Sl. No.	Details of Space	Floor Area Sq. metres
1.	Principal's Room	30
2.	Confidential Room	10
3.	Steno's Room	6
4.(a)	Office including Drawing Office	80
(b)	Record Room	20
5.	Staff Room	
	(a) Head 1	15
	(b) Lecturer 10 sq.m./ Lect. for 8 Lecturers	80
6.	Library and Reading room	150
7.	Store	100
8.	Students Common room	80
9.	Model Room	90

[B] Academic Block

Sl.No.	Detail of Space	@ Sq.m	Floor Area Sq.m.
1.	Class Room	60	120
2.	Drawing Hall	90	90
3.	Physics Lab		75
4.	Electrical Engg. Lab/Shop		120
5.	Electronics Lab/Shop		120
6.	Radio & TV Engineering Lab		120
7.	Digital Electronics & Microprocessor Lab		120
8.	Electronics Workshop & Project Lab		120
9.	Computer Lab (Air Cond.Glass Partition and Special type pvc flooring and false ceiling)		60

[C] Work shop

I	Workshop Supdt. Room	12
II	Store	20
III	Shops	

(a) Wood & Laminate Shop	50
(b) Fitting Shop	50
(c) Painting Shop	50
(d) Sheet Metal ,Soldering & Brazing shop	50

[D] Student's Aminties

1. Hostel	40	%	of Strength of Students
2. Cycle Stand	50	%	of Strength of Students
3. Canteen and Tuck shop	50		
4. N.C.C. Room	70		
5. Dispensary	40		
6. Guest Room(Attached Bath) including kitchen & store	45		

[E] STAFF RESIDENCES

1. Principal	1	100	100
2. Head of Department	1	100	100
3. Lecturer	4	80	320
4. Non teaching & Supporting staff	8	60	480
5. Class IV	6	30	180

Priority to be given in following order

(1)

- a. Administrative Building
- b. Labs
- c. Workshop
- d. Over head Tank
- e. Boundary Wall
- f. Principal Residence
- g. Forth Class Quarters (2/3)

(2)

- a. Hostel
- b. Students Aminties

(3)

- Residences of employee

LIST OF EQUIPMENTS

Only those of the equipments given below which are essentially required for the conduction of practicals mentioned in the curriculum are to be procured by the institutions. "Machine/Equipments/Instruments of old BTE list which are not included below are to be retained in the Lab/Shop for Demonstration purpose but not to be demanded fresh for purchase."

NOTE : Equipment for different shop and lab of latest version should be purchased.

I. APPLIED PHYSICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Brass ball with hook 2 cm. dia	2	20	40
2.	Stop clock least count 0.1 Sec	2	500	1000
3.	Wall bracket with clamping arrangement	2	50	100
4.	Meter scale	5	20	100
5.	Convex lenses of focal length 10 cm., 20 cm., 50 cm. and 100 cm. 2 nos. of each	8	10	80
6.	Optical bench steel with pin and lens holders	2	500	1000
7.	Astronomical telescope	1	500	500
8.	Searl's conductivity apparatus with copper & steel rods 25 X 4 cm. diameter with all accessories	1 set	1000	1000
9.	Lee's conductivity app. complete with all accessories	1 set	1000	1000
10.	Constant water flow arrangement	2	400	800
11.	Boiler made of copper 2 lt. cap.	4	200	800
12.	Platinum resistance thermometer	2	800	1600
13.	Potentiometer - 10 wires with jockey	1	500	500
14.	Meter bridge complete	1	250	250
15.	Lead accumulator 2.2 V. and 20 amp. hour capacity	2	250	500
16.	Moving coil galvanometer	3	200	600
17.	Moving coil ammeter 0-1 amp., 0-5 amp., 0-10 amp., 1 no of each	3	250	750
18.	Moving coil voltmeter 0-1 V. 0-5 V., 0-10 V. 1 No of each	3	250	750
19.	Leclanchi cell complete	3	100	300
20.	Resonance col. of steel tube with tuning forks and other accessories	1	500	500
21.	Tuning forks set of different frequencies	1 set	1000	1000
22.	App. for determining coefficient of friction on a horizontal plane	1 set	1000	1000
23.	Appratus for determining characteristics of P-N junction diode complete with all accessories	1 set	1500	1500

24.	Post office box dial type	1	1200	1200
25.	Resistance box 0-10 ohm., 0-100 ohm. 2 nos. each	4	400	1600
26.	Rheostat of different ohm.capacity	8	250	2000
27.	Physical balance with weight box	2	800	1600
28.	Set of fractional weights	10	20	200
29.	Fortin's barometer with mercury	1	2500	2500
30.	Battery eleminator 6 V. & 3 amp.	1	250	250
31.	Lab tables	3	8000	24000
32.	Lab stools	10	100	1000
33.	Anemometer cup type	1	1000	1000
34.	Anemometer hand held	1	1000	1000
35.	Suryamapi	1	1500	1500
36.	Insolation meter	1	1500	1500
	Misc.	LS		5000

COMPUTER APPLICATION FOR ENGINEERING (Common to all Trades)

COMPUTER CENTRE

S.No.	DESCRIPTION	QTY.	APPROX. COST (in Rs.)
1	PENTIUM-IV 2.4 Ghz or latest RAM-256 MB or latest HDD-80 GB latest MONITOR COLOUR 17" AGP 16 MB 52X MM KIT(52x CD Drive, Speaker, sound card) FDD - 1.44 MB Key Board - 107 Keys Multimedia Mouse - Optical Fibre Mouse 32 Bit PCI ETHERNET CARD(10/100) Mbps Pre loaded Windows XP OR WINDOWS 2000 Pre loaded Norton Anti Virus with licence media and manual	16 (15+1Server)	8,000,00=00

OR

Computer of latest Specification

Software :

i.	Noval Netware/NT Latest Version	01	55000
ii	WINDOWS - XP/WINDOWS 2000 /Windows NT	01	6000
iii.	MS OFFICE XP	01	17000
iv.	Dos latest version.	01	5,000
v.	FoxPro 2.5 or Latest Version	01	
vi.*	Mechanical DeskTop Power Pack (*->Only For Mechanical Engg.)	01	70000

3. Hardware

i.	Internal Modem 56 kbps		
ii.	Hubs-16 port, all accessories related to Networking.		
iii.	Scanner- A4	01	10,000
4.	132 Column 600 CPS or faster 9 Pin dot matrix printer with 500 million character head life	01	15,000
5.	Laser Jet	01	20,000
6.	5 KVA on line UPS with minimum 30 minute battery backup along with sealed maintenance free batteries. Provision for connecting external batteries with network connectivity.	01	1,75000
7.	Window Air Conditioner 1.5 tones capctity with ISI mark alongwith electronic voltage stablizer with over voltage and time delay circuit	04	30,000(EACH)
8.	Room preparation and furniture		LS

ELECTRONIC WORKSHOP

PART (A)- ELECTRICAL WORKSHOP

S.No.	Name of Equipment /Board/Kit etc.	Equipment required		Rate per Piece @ Rs.	Total cost	
		Intake			Intake	
		30	45		30	45
1.	Coil winding Machine.	2	2	5000	10000	10000
2.	Bench Drilling Machine.	1	1	5000	5000	5000
3.	Bench Lathe.	1	1	10000	10000	10000
4.	Portable Drilling Machine.	3	4	1500	4500	6000
5.	Multimeter (indicating typ and assorted)	4	6	1000	4000	6000
6.	Megger (1000 V) and Growler	1 each	1 each	--	4500	4500
7.	Bearing Pullers Pulley Pullers, wire gauges and blow lamps	LS	LS	--	1000	1500
8.	Ceiling fans of different types (one with solid state speed control)	LS	LS	--	3000	4000
9.	Electric appliances (Iron, Hot Plate to Aster, immersion heater and room heater air heater, water cooler	LS	LS	--	8000	10000
10.	Old burnt out ceiling fan moter, grinder moters, D C moter armatures, and three phase induction moters for winding	LS	LS	--	6000	8000

S.No.	Name of Equipment /Board/Kit etc.	Equipment required		Rate per Piece @ Rs.	Total cost	
		Intake 30	45		Intake 30	45
11.	Starter (3 Point 40 Point D.O.L. star/delta, auto transformer and automatic star/ delta) for fault creation and rectification	LS	LS	--	6500	6500
12.	Single Phase Variac (15 A)	1	2	1000	1000	2000
13.	Dynamic demonst- ration model of automobile ele- ctrical wiring	1	1	5000	5000	5000
14.	Spare starting motor dynamo cut out, wiper moter, ignition coil & horn for car moters	LS	LS	--	3000	4000
15.	Different types of lamps with their fittings	1 set	1 set	--	5000	5000
16.	HV support fitt- ing & insulators	LS	LS	--	1500	2000
17.	HV cable secti- ons and jointing materials	LS	LS	--	2000	2500
18.	Damonstrations boards on fuses, switches, condu- ctors and elect- rical engg. mat- erials(one each)	LS	LS	--	2000	2500
19.	Electric Blower	1	1	2000	2000	2000
20.	Low Voltage circuit breakers & conductors	LS	LS	--	2500	3000

S.No.	Name of Equipment /Board/Kit etc.	Equipment required		Rate per Piece @ Rs.	Total cost	
		Intake 30	45		Intake 30	45
21.	Wiring boards (Wodden)	LS	LS	--	5000	6000
22.	Miscellaneous tools (for ser- vicing & cable jointing, sold- ering irons,neon testers etc.)	LS	LS	--	12000	15000
Total Money Required :-					103500	120500

ELEMENTARY WORKSHOP PRACTICE

MECHANICAL WORKSHOP

(A) Fitting Shop

S.No.	Name Of the Equipment/ Board/Kits etc.	Equipment Required	Approximate Cost.
1.	Work Benches with Vices (4 vices on a bench)	16	48000
2.	Marking Tables with Scribers (40cm x 60cm)	6	3000
3.	Surface plates (450cm x 60cm:CIIII)	4	6000
4.	Bench Grinder	1	4000
5.	Bench Drilling Machines (12 mm capacity with tapping attachment)	2	8000
6.	Power Hacksaw	1	10000
7.	Tool Kits, Chisels, Hammers, Files, Hacksaw etc.	35 Sets	10000
8.	Taps, Dies & fitters tool kits	5	5000
9.	Accessories like cali- pers, V-Block height gauges, steel rules, scribers etc.	LS	25000
Total :-			119000

(B) Sheet Metal Shop

S.No.	Name Of the Equipment/ Board/Kits etc.	Equipment Rrequired	Approximate Cost.
1.	Metal Sheer (Lever type)	4	3000
2.	Sheet Bending Machine	1	2500
3.	Drilling Machine (Pillar type 12 mm capacity)	1	4000
4.	Doall Machine	1	8000
5.	Pipe Bending Devices	1	2000
6.	Mechanical, Power Oper- ated press (5 ton capacity)	1	15000
7.	Fly Press	1	1000
8.	Pipe threading devices	1	2000
9.	Guillatine Shear	1	5000
10.	Seaming & Swaging equipemnt	LS	5000
11.	Tools & Accessories	LS	5000
12.	Miscellaneous	LS	2000
Total :-			54500

(C) Painting Shop

S.No.	Name Of the Equipment/ Board/Kits etc.	Equipment Rrequired	Approximate Cost.
1.	Scrapers	30	1000
2.	Brushes (Including wire type)	30	2000
3.	Spary Painting Plant (Including air compre- ssor)	1 SET	6000
4.	Other Equipment	LS	4500
5.	Miscellaenous	LS	2000
Total :-			15500

(D) Wood & Laminate Shop

S.No.	Name Of the Equipment/ Board/Kits etc.	Equipment Rrequired	Approximate Cost.
1.	Work benches fitted with carpenter vices (1 m x 2 m)	16	26000
2.	Wood turning lathe	4	30000
3.	Wood planer	1	20000
4.	Circular saw grinder	1	4000
5.	Wood cutting band saw	1	10000
6.	Band saw blade brazing unit	1	8000
7.	Bench grinder	1	3000
8.	Tool, Accessories, mea- suring & marking instr- uments, pattern makers scales	35 SETS	30000
9.	Drilling Machine	1	5000
10.	Other equipment	LS	13000
Total :-			149000

ELECTRICAL ENGINEERING LAB

- (i) Electrical Engineering-I (First Year)
(ii) Electrical Engineering-II (Second Year)

Sl. No.	Equipment	Qty.	Price
1.	Ammeter -dynamometer type portable, moving coil, permanent magnet 150 mm uniform scale		
	a. Range 0 - 2.5 - 5 Amp.	2	1200
	b. Range 0 - 50 m A	1	500
	c. Range 0 - 500 mA	2	1000
2.	Ammeter - moving iron type Portable moving iron permanent magnet, 150 mm uniform scale		
	a. Range 0 - 5 Amp.	2	1000
	b. Range 0 - 10/20 Amp.	2	1000
	c. Range 0 - 500 mA/1000 mA	2	1000
3.	Voltmeter dynamometer type portable moving coil permanent magnet 150 mm uniform scale		
	a. Range 0 - 5/10 V	2	1000
	b. Range 0 - 15/30 V	1	1000
	c. Range 0 - 50 mv/100 mv	1	1000
	d. Range 0 - 125/500 V	1	1000
	e. Range 250/500 V		
4.	Digital multimeter 3.5 digit - display D.C. voltage 0 - 1000 V in 5 steps A.C. voltage 0 - 750 V in 5 steps Resistance 0 - 20 M ohm in 6 steps D.C. 0 - 10 A in 6 steps A.C. 0 - 10 A in 6 steps Power supply 9 V.	1	3000
5.	Analog multimeter (Portable) D.C. Voltage 0 0 1000 V AC Voltage 0 2/5/10/25/100/250/1100 V. Resistance 0 200 M ohm DC 0 - 50 micro Amp./1 mA/10 mA/100mA/1A/10A AC 0 - 100 mA/1A/25 A/10A	1	1000
6.	Wattmeter single phase (LPF= 0.2) portable dynamometer type, scale 150 mm current range 0 - 5/10 Amps voltage Range 0 - 250/500 V	2	5000
7.	Decade resistance box constantan coils, single dial 10x10, 10x100, 10x1000, 10x10,000 ohms	1	1000

8.	Continuously variable 0 - 1000 micro farad, 250 V	1	1000
9.	Energymeter single phase induction type, industrial grade 5 A or 10 A, 250 V, 50 Hz.	1	2000
10.	Energymeter(Substandard) single phase, induction type 5 A/10A, 250 V, 50 Hz.	1	3000
11.	Power factor meter dynamometer type, eddy current damping, 50 Hz, scale length 150 mm range upto 20 amp, voltage range 300 V 10 F. range 0.5 log, unity 0.5 load.	1	5000
12.	Frequency meter (Reed type) 230 V, range for having 21 reeds for 40-60 Hz range.	1	500
13.	Rheostat sliding rheostats wound with evenly oxidised iron free nickel copper on vitreous enamelled round steel tube 150 ohms 2 Amps.	1	600
	110 ohms 2.5 Amps.	1	600
14.	Variable inductor single phase, 250 V, 2.5 KVAR continuously variable	1	2000
15.	Battery charger 12 V silicon bridge rectifier AC input 230 V, DC output suitable for charging 6 V And 12 V batteries provided with MC voltmeter 0 - 20 V and ammeter 0 - 5 A	1	1000
16.	Capacitors 2.5 microfarad, electrolytic type	4	200
17.	Q Meter frequency 0 - 30 MHz Q 0 to 500	1	4000
18.	LCR meter (digital) 3.5 digit display capacitance 0 to 20,000 microfarad inductance 0 to 200 Henry resistance 0 to 20 M ohms	1	8000
19.	LCR/Q bridge capable of measuring resistance, inductance and capacitance of range 8 amps, 0.012 to 10 M ohms,	1	5000

4 to 10,000 H, 0.5 pico farad to 10 F.

20.	Kelvin double bridge 10 x 0.1 ohms circular slide wire devided into 200 equal parts		
21.	Energy meter 3 phase induction type, 4 wire, industrial grade, 50 Hz, 10 A, 440 Volt	1	5000
22.	Energy meter (Sub standard) 3 phase, 4 wire, 440 V, 10A, 50 Hz induction type.		
23.	Transformer single phase core type, 230/110 V, 1 KVA, 50 Hz.	1	5000
24.	Universal shunt 0 - 75 A	1	2000
25.	Current transformer 10/25/50/5A as per IS 4201/1967 and 2705/1981	1	2000
26.	Potential transformer 10 VA, 415/110 V as per IS 4201/1967 and 2705/1981	1	2000
27.	Strain guage	1	1000
28.	Maxwells bridge	1	1000
29.	Laboratory D.C. power supply (220 V) static converter input from 3 phase 50 Hz, 415 volts A.C., output rating of 200 watts to 260 watts, 50 amps, continuously varibale.	1	50,000
30.	Diesel generator set 3 phase, 415 volts, 15 kva, 50 Hz, diesel generator set, with suitable control pannel, for a stabilized supply including metering for vantage, current frequency, fuel level storage fuel tank of 200 litre capacity 12/24 volt battery for starting the engine, battery charger mounted on trolley wheels.	1	10,00,000
31.	D.C. motor generator set two identical 220 V, 1 KW 1500 rpm. compound d.c. machines with all terminals of armature, series field, shunt field separately mounted for independent	1	15,000

connections. D.C. motor
 starter, field control rheostat
 suitable for above machines.
 brushes, commutator should be
 visible for study purposes.

32.	D.C. shunt motor 220 V, 3 KW, 1500 rpm dc shunt motor with 3 point starter and ponybrake loading arrangement with loading drum, spring balance with belt.	1	10,000
33.	3 Phase variable inductive loading unit rating 400 V, 50 Hz, 0-10 Amps.	1	8000
34.	3 Phase variable capacitive loading unit: rating 400V, 50 Hz, 0-10 Amps.	1	5000
35.	3 Phase squirrel cage induction motor rating 415 V, 50 Hz, 1440 rpm 3 KW with star/Delta starter	1	1,2000
36.	Starters for squirrel cage induction motor suitable for 3KW, 415V, 50 HZ, 1440 rpm		
	a. Star/delta automatic	1	5000
	b. Star/delta manual	1	3000
37.	Starter for squirrel cage induction motor 3KW, 415 V, 50 Hz, 1440 rpm direct on line	1	3000
38.	Static speed control unit for 3 phase induction motor 3 KW, 425, 0-1500 rpm.	1	5000
39.	3 Phase synchronous motor (induction start) rating 3 KW, 3 phase, 1500 rpm, 50 Hz 415 v A.C. supply with d.c. exciter mounted on the shaft of motor with suitable starter.	1	15,000
40.	Capacitor start single phase induction motor 230 V, 50 Hz 1440 rpm, 500 watts.	1	2500
41.	Watt meter 3 phase induction type 2 element voltage range 0/300/600 V current range 0/5/10 A	1	2000
42.	Frequency meter - portable (Reed type) 45-55 Hz with 21 reeds	1	2000
	Frequency meter digital portable 3.5 digit LED display range 20-99 Hz	1	2000

43.	Phase sequence indicator (Rotary) 3 phase, 415 V, 50 Hz	1	1000
44.	Phase sequence indicator (Indicating type) 3 phase, 400 V, 50 Hz	1	1000
45.	Galvanometer centre zero response time 1.8 sec.	1	1000
46.	VAR meter 1/5 A, 300/600 V	1	2000
47.	Synchroscope - portable 230 V, 50 Hz	1	3000
48.	Loading rheostat single phase	1	3000
	a. 240 V, 2.5 KW, trolley type resistance type		
	b. 240 V, 6 KW insteps of 0.25	1	3000
49.	Lamp load 3 phase 415 V, 6 KW	1	2000
50.	Water load 3 phase 415 V, 5 KW	1	2000
51.	Capacitor bank 415 V, 0-10 A, 50 Hz trolley mounted	1	3000
52.	Wire wound rheostats		
	15 ohms, 10 A	2	1200
	100 ohms, 5 A	2	1200
	250 ohms, 5 A	2	1200
	1000 ohms, 0.5 A	2	1200
	2500 ohms, 0.1 A	2	1200
53.	Stop watch least count 0.01 Sec.	2	2000
54.	Stop watch (digital) LED	2	2000

4	6	3	5.	Multi output Power Supply 0-30V	2	3	-	-	-	-	2	3
			4	2500 7500 10000								
				1 Amp. 0-+-12 V, 1 Amp., 5 V.								
				2 Amp.								
2	3	2	6.	Power Supply 0-300 Volt, 1 Amp.	-	-	2	3	-	-	-	-
			3	2000 4000 6000								
12	15	8	7.	Dual Trace C.R.O. (0-10 MHz)	2	3	5	5	-	-	5	6
			10	15000 120000 150000								
2	3	2	8.	R.F.Signal Generator	-	-	-	-	-	-	2	3
			3	5000 10000 15000								
3	4	3	9.	Function Generator	-	-	-	-	-	-	3	4
			4	4000 12000 16000								
4	5	4	10.	A.C. Millivolt Meter (Elex.)	-	-	-	-	-	-	4	5
			5	2000 8000 10000								
2	3	2	11.	Out Put Audio Power Meter	-	-	-	-	-	-	2	3
			3	1500 3000 4500								
				4 Ohm.- 20 K & 1 MW - 10 W								
6	8	4	12.	A.C. Milliammeter/A.C. Micro-	4	5	2	3	-	-	-	-
			5	200 800 1000								
				meter & A.C. Millivoltmeter								
				(Suitable range)								
25	31	20	13.	D.C. Voltmeter /D.C. Milliamme-	20	25	-	-	-	-	5	6
			25	200 4000 5000								
				ter/D.C. Micrometer (suitable								
				range)								
3	4	3	14.	Decade Resistance Box	-	-	-	-	3	4	-	-
			4	600 1800 2400								
				(Different ranges)								

4	5	15.	Decade Capacitor Box	-	-	-	-	4	5	-	-
		4	5	2000	8000	10000					
			(Different range)								
			Cont.								

S.No.				Name of the Equipment/ Board/Kit Etc.				Elex.		Indus.		Network		Elex.	
Total	Recommen- ded	Total No. Piece	Rate per Total Cost	Elex. Components & Mat.Lab.		Indus. & Instrum- entation Lab.		Network Filters & Transmis- sion Lab.		Elex. Devices & Ckts.Lab.					
Intake		Intake	In Rs.	Intake		Intake		Intake		Intake		Intake		Intake	
30	45	30	45	30	45	30	45	30	45	30	45	30	45	30	45
4	5	4	5	2500	10000	12500		-	-	-	-	4	5	-	-
4	4	LS	LS	5000	20000	20000		-	-	4	4	-	-	-	-
		(4 set of		pressure type, thermo couple,						Demonstr					
		experimen		LVFT, Opto pick electromagnetic						ation					
		tal kit/		pick up; Thermal relay, ultra-						Kit/exp.					
		board)		sonic pick up and potentiometer						kit di-					
				etc. including strain gauge,						fferent					
				Piezoelectric Transduser, Diff.						types of					
				types of Photo sources & Detec-						transdu-					

				tor,Optical Fibre sensors									
4*	6*	18.	LS	Experimental Kit/ LS -- 75000	100000	2*	3*	0	0	2*	3*	0	0
+	+			Teaching Modules/ 		+	+	+	+	+	+	+	+
140	182			Training boards/ 		30	40	40	50	10	12	60	80
				Learning kits. of relevant 									
				subject. 									
8	8	19.	8	Component Storage rack 8 -- 25000	35000	2	2	2	2	2	2	2	2
LS	LS	20.	LS	Consumable Items LS -- 20000	20000	LS	LS	LS	LS	LS	LS	LS	LS
LS	LS	21.	LS	Miscellaneous LS -- 15000	20000	LS	LS	LS	LS	LS	LS	LS	LS

NOTE:- * Represents the quantity of learning kits/teaching module. This item is more costly as compared to training boards/experimental kits etc.

2500	15000	4. Digital A.C. voltmeter True RMS 20000 type with lowest full scale range 200 MV & accuracy 1%	2	3	4	5	6	8	6	8
6000	12000	5. Distortion Factor Meter:Minimum 18000 full scale 1% max. output meas- urable 50 W	1	2	1	2	2	4	2	3
750	3000	6. High Quality 20 W speaker set 4500 (woofer squeaker & tweeter) in cabinet	-	-	4	6	4	6	4	6
500	1000	7. Speaker set (one set consists 1500 of one woofer one squeaker & one tweeter)	-	-	2	3	2	3	2	3
800	2400	8. Commercial Quality Mono Tape 3200 Recorder Wow % Flutter %	-	-	3	4	3	4	3	4
2000	2000	9. Commercial Quality Stereo Tape 2000 Recorder Wow % Flutter %	-	-	1	2	1	2	1	1
2500	5000	10. Analog Multimeter with 20 K Ohm 7500 /Volt 1% accuracy in DC voltage measurable 2500 V DC, Max. Res- istance 20 M Ohm, AC current range also available	1	2	1	2	2	4	2	3

S.No. No.	Rate per Piece	Name of the Equipment/ Total Cost Board/Kit Etc.	Principles		Audio & Video		Total		Total	
			of comm.	Engg. Lab.	Sys. & T.V. Engg	Lab	Intake	Intake	Intake	Intake
			30	45	30	45	30	45	30	45
2000	4000	11. Hand held Digital Multimeter 3 & 1/2 digit 0.3 % accuracy 1000 V DC & 20 M. Ohm ranges Protected against transients	1	2	1	2	2	4	2	3
4000	8000	12. Table Type Digital Multimeters 12000 3 & 1/2 digit 0.3 % accuracy 1000 V DC & 20 M Ohm ranges Protected against transients battery cum mains operation	1	1	1	2	2	3	2	3

20	13.	Head Cleaning Tape	-	-	5	5	5	5	5	5
100	100	100								
4000	14.	Tape deck (Mono) tuner audio	-	-	1	1	1	1	1	1
4000	4000	4000								
		mixer and record player, Wow %								
		Flutter % mixer having inputs								
		for tuner, microphones, Cry-								
		stal and Magnetic cartridges								
500	15.	Speaker Column (8" speakers)	-	-	2	2	2	2	2	2
1000	1000	1000								
16000	* 16.	Video Cassette Recorder (VHS)	-	-	1	1	1	1	1	1
16000	16000	16000								
		with 8 channel electronic								
		tuner, audio-video and VHF								
		output and cordless remote								
		control								
10000	* 17.	Video Cassette Players (VHS)	-	-	1	1	1	1	1	1
10000	10000	10000								
		With audio & video and VHF								
		output								
6000	18.	Single Trace Oscilloscope	1	2	1	2	2	4	2	3
12000	12000	18000								
		with component Tester 10 MHz								
		and 5 mv sensitivity								
12000	19.	Dual Trace Oscilloscope 15 MHz	1	2	-	-	2	4	2	3
24000	24000	36000								
		5 MV sensitivity								
3000	* 20.	Black and White 51 cm. TV sets	-	-	-	-	2	2	2	2
6000	6000	6000								

		electronics tuner							
3000	23. 3000	Servicing Quality Pattern Generator with VHF output and colour/B & W patterns	-	-	1	1	1	1	1
12000	24. 24000	Standard RF signal generator (AM/FM) Frequency range upto 36000 110 MHz and output at least 10 MV with external modulation facility % modulation and deviation variable.	2	3	-	-	2	3	2
2000	25. 6000	Regulated power supply 0-30 v, 8000 0-1 Amp. 0.1% regulation short circuit and overload protected	1	2	2	3	3	5	3
1000	26. 5000	R.F Signal generator (AM), 7000 30 MHz, 10 MHz, External Mod. variable modulation	5	7	-	-	5	7	5
300	27. 600	Transistor Radio Receiver 2 900 band portable, battery cum mains	2	3	-	-	2	3	2
600	28. 1200	Transistor Radio Table Model 1800 battery cum mains	2	3	-	-	2	3	2

500	1000	29. Antenna simulator as per speci- 1000 fications given by T.T.T.I., Chandigarh.	2	3	-	-	2	3	2	2
500	500	30. TV Antenna, 3 element and yagi 500 (1 each) Set	-	-	1	1	1	1	1	1
200	200	31. Radio Antenna Directional 200 and Omnidirectional	1	1	-	-	1	1	1	1
10000	10000	32. RF Signal Distribution equip- 10000 ment alongwith associated conn- ectors and cables	-	-	1	1	1	1	1	1

S.No.	Name of the Equipment/ Total Cost Board/Kit Etc.	Principles of comm. Engg. Lab.	Audio & Video Sys. & T.V. Engg Lab	Total	Total Recommen- ded
In Rs.	Intake	Intake	Intake	Intake	Intake
30	45	30 45	30 45	30 45	30 45

10000	33.	Sweep Generator	-	-	1	1	1	1	1	1
10000	10000	10000								
35000	34.	Wobbuloscope	-	-	1	1	1	1	1	1
35000	35000	35000								
20000	35.	Colour Video Camera	-	-	1	1	1	1	1	1
10000	36.	VCD Writer and Player	-	-	1	1	1	1	1	1
10000	37.	DVD Writer and Player	-	-	1	1	1	1	1	1
LS25000	38.	Diff. Types of Antenna-MF,HF	-	-	LS	-	-	-	-	-
		VHF, UHF & Microwave								
LS50000	39.	Experimental Kits demonstrating	-	-	LS	-	-	-	-	-
		ASK, PSK, FSK								
LS10000	40.	Diff. Types of Microphones	-	-	LS	-	-	1	1	
5000	41.	Audio CD Player	-	-	1	-	-	-	-	LS

* - These items may preferably be purchased in the form of board mounted training modules instead of commercial sets.

DIGITAL ELECTRONICS AND MICROPROCESSOR LAB

Principles of Digital Electronics Lab.

Communication System Lab.

Microprocessors And Applications Lab.

(Second Year)

(Third Year)

(Third Year)

S.No.		Name of the Equipment/ Total No. Rate per Total Cost Board/Kit Etc.		Principles of Digital Eltx. Lab.		Telecom- municat- ion Lab.		Micropro- cessors & Applicat- ion Lab.		Total		
Recommen- ded	Piece											
Intake	@ Rs.		Intake									
30	45		30	45	30	45	30	45	30	45		
2	25000	1.	CRO dual trace with delayed 50000 50000 time base, 25 MHz or higher band width.	1	1	1	1	-	-	2	2	2
2	15000	2.	CRO dual trace 15 MHz. 15000 30000	1	2	-	-	-	-	1	2	1
4	10000	3.	CRO dual trace 10 MHz. 30000 40000	2	2	1	2	1	2	4	6	3
4	2500	4.	Multimeter, 20 K Ohm/volt 7500 10000 sensitivity, 1% accuracy in D.C. voltage range, Max. D.C.	2	3	1	2	-	-	3	5	3

			voltage range 2500 V, A.C Curr-									
			ent.									
6	2000	5.	Multimeter, Digital hand held 8000 12000 3 1/2 digit, 0.3% accuracy	2	3	1	2	1	2	4	7	4
			1000 V D.C. and 20 m ohm res-									
			istance range protected									
			against transients.									
25	300	6.	Logic Probe 6000 7500	15	18	-	-	5	7	20	25	20
14	3500	7.	Logic board/trainer including 35000 49000 +5 Volt, 1Amp + 15 V, 0.3 Amp.	10	14	-	-	-	-	10	14	10
			power supply and bread board									
			and flexible leads.									
10	8000	8.	Microprocessor trainer kits 64000 80000 with 8085 system (EC 85 or similar).	-	-	-	-	8	10	8	10	8
3	5000	9.	Component rack 144 tray (small) 15000 15000 & 24 large tray.	2	2	-	-	1	1	3	3	3
LS	--	10.	Consumable material such as 50000 60000 components ICs, resistors transistors etc.	LS	LS	-	-	LS	LS	LS	LS	LS
LS	--	11.	Miscellaneous 40000 45000	LS	LS	LS	LS	LS	LS	LS	LS	LS

S.No.	Name of the Equipment/ Total No. Rate per Recommen- Piece ded	Total Cost Board/Kit Etc.	Principles of Digital Eltx. Lab.	Communi- cation Lab.	Micropro- cessors & Applicat- ion Lab.	Total Intake
	In Rs.	Intake	30 45	30 45	30 45	30 45
12.	Simple Telephone relay	2 100 100 200	- - 1 2	- - 1 2	- - 1 2	1 2 1
13.	Slugged relay	2 100 100 200	- - 1 2	- - 1 2	- - 1 2	1 2 1
14.	Fast operating relay	2 100 100 200	- - 1 2	- - 1 2	- - 1 2	1 2 1
15.	Auto telephone set	3 1000 1000 2000	- - 2 3	- - 2 3	- - 2 3	2 3 2
16.	Stop Watch	2 300 300 600	- - 1 2	- - 1 2	- - 1 2	1 2 1
17.	Telephone Relay	3 50 100 150	- - 2 3	- - 2 3	- - 2 3	2 3 2

3	250	18.	Voltmeter (0-50 v)	-	-	2	3	-	-	2	3	2
			500 750									
3	250	19.	Ammeter	-	-	2	3	-	-	2	3	2
			500 750									
3	3000	20.	Dual power supply (0-30v/.5amp)	-	-	2	3	-	-	2	3	2
			6000 9000									
1	35000	21.	Minimum 12 line electronic telephone exchange with teleph- one instrument sets and power supply.	-	-	1	1	-	-	1	1	1
			35000 35000									
4	4000	22.	Cordless telephone Set	-	-	4	4	-	-	4	4	4
			16000 16000									
1	50000	23.	Experimental Kits for demonstr- ating ASK, FSk, PSK circuits	-	-	1	1	-	-	1	1	1
LS	75000	24.	Experimental Kits for Optical Fibre Communication	-	-	LS		-	-	LS		
1	LS 10000	25.	Mobiles Phones	-	-	2	2	-	-	2	2	1
1	50000	26.	Computers System with Internet Connection	-	-	1	1	-	-	1	1	1
LS	50000	27.	Microprocessor Training Kit of 8086	-	-			8	10			

ELECTRONICS WORKSHOP AND PROJECT LABORATORY

Electronics Workshop

Electronics Instruments and Measurements

Project

(First Year & Second Year)

Lab. (Third Year)

(Third Year)

S.No.		Name of the Equipment/ Total Cost		Electron-	Electro-	Project	Total					
Total No.	Rate per	Board/Kit Etc.		ics Work-	ronics							
Recommen-	Piece			Shop	Inst. &							
ded					Measurem							
					ents Lab							
-----		-----		-----	-----	-----	-----					
Intake	In Rs.	Intake		Intake	Intake	Intake	Intake					
30	45	30	45	30	45	30	45	30	45			
-----		-----		-----	-----	-----	-----					
4	200	1. D C Voltmeter (1K/2K/10K/20K 800 800 Ohm per Volt)		-	-	4	4	-	-	4	4	4

5	2.	Gen.purpose multimeter	2	3	2	3	2	3	6	9	4
	1000	4000 5000									
6	3.	Electronic multimeter	2	3	3	4	2	3	7	10	5
	2500	12500 15000									
5	4.	IC regulated power supply	1	1	2	3	4	5	7	9	4
	1500	6000 7500									
		0-15 V; 1 A									
5	5.	Transistor power supply	1	1	1	2	4	5	6	8	4
	2000	8000 10000									
		0-30 V / 1 A variable.									
1	6.	Unregulated power supply	1	1	1	1	-	-	2	2	1
	1000	1000 1000									
		0-30 V; 1 A									
6	7.	A.F. signal generator.	2	3	4	5	2	3	8	11	5
	1500	7500 9000									
6	8.	RF signal generator	2	3	5	6	2	3	9	12	5
	2500	12500 15000									
3	9.	Function Generator	1	2	1	2	1	2	3	6	2
	3000	6000 9000									
3	10.	Std. Signal Generator	2	3	1	1	1	2	4	6	2
	5000	10000 15000									
4	11.	AC/DC Voltmeter (M.I.type)	-	-	2	4	-	-	2	4	2
	200	400 800									
2	12.	Sensitive multirange ammeter	-	-	1	2	-	-	1	2	1
	500	500 1000									
5	13.	Calibrated CRO (Single beam	-	-	1	2	4	5	5	7	4
	15000	60000 75000									
		10 MHz)									

4	20000	14.	Dual trace Cal. CRO 10 MHz	1	2	2	3	3	4	6	9	3
			60000 80000									
2	5000	15.	Q Meter	-	-	1	2	-	-	1	2	1
			5000 10000									
3	4000	16.	RLC/Universal Bridge	-	-	1	2	1	2	2	4	2
			8000 12000									
2	10000	17.	Universal Digital Freq. Counter	-	-	1	2	1	2	2	4	1
			10000 20000									
1	6000	18.	Distortion Factor Meter	-	-	1	1	-	-	1	1	1
			6000 6000									
3	1000	19.	Decade Resistance Box	-	-	1	2	1	2	2	4	2
			2000 3000									

S.No.	Name of the Equipment/ Total No. Rate per Total Cost Board/Kit Etc.	Electron- ics Work- Shop	Electro- nics Inst. & Measurem ents Lab	Project	Total							
Intake	In Rs.	Intake	Intake	Intake	Intake							
30 45		30 45	30 45	30 45	30 45							
3	1500	20.	Decade Cap. Box	-	-	1	2	1	2	2	4	2
			3000 4500									

6	200	21.	Std. Inductance (Diff. Value)	-	-	4	6	-	-	4	6	4
			800 1200									
LS	--	22.	Charts, Models, displays for	LS	LS	-	-	-	-	LS	LS	LS
			2000 2000									
			safety/rules etc.									
4	4000	23.	Digital Multimeter	1	2	3	3	2	3	6	8	3
			12000 16000									
6	1500	24.	Single Phase Variac 5 Amp,	4	5	1	2	4	5	9	12	5
			7500 9000									
	av.		15 Amp (Oil/Air cool)									
3	10000	25.	Gen. Purpose CRO; 5 MHz.	1	2	-	-	2	3	3	5	2
			20000 30000									
20	500	26.	Tools Kit	10	15	-	-	10	15	20	30	15
			7500 10000									
	SET			SET	SET			SET	SET	SET	SET	
LS	--	27.	Misc. Active Components	LS	LS	-	-	LS	LS	LS	LS	LS
			8000 10000									
LS	--	28.	Misc. Accessories as per req.	LS	LS	-	-	LS	LS	LS	LS	LS
			2000 3000									
LS	--	29.	Misc. Passive components.	LS	LS	-	-	LS	LS	LS	LS	LS
			3000 4000									
LS	--	30.	Working Models of analog and	LS	LS	-	-	-	-	LS	LS	LS
			5000 8000									
			digital equipment									
LS	--	31.	Dark room with Camera, Enlarger,	LS	LS	-	-	LS	LS	LS	LS	LS
			50000 50000									
			Developing setup, Fixing &									
			Printing setup etc.									

LS		32.		Manual Etching Setup		LS	LS		-	-		LS	LS		LS	LS		LS
		--		3000 4000														
LS		33.		Mechanised Etching Setup		LS	LS		-	-		LS	LS		LS	LS		LS
		--		5000 5000														
LS		34.		Silk-Screen Printing Setup		LS	LS		-	-		LS	LS		LS	LS		LS
		--		5000 5000														
3		35.		Drill Machine with stand		1	2		-	-		2	3		3	5		2
		2000		4000 6000														
LS		36.		Misc. Items		LS	LS		-	-		LS	LS		LS	LS		LS
		--		40000 60000														
LS		37.		Consumable(Not specified above)		LS	LS		LS	LS		LS	LS		LS	LS		LS
		--		15000 25000														

LEARNING RESOURCE MATERIALS

1.	Overhead Projector with screen	1	--	20000
2.	35 m.m. Slide cum Film Projector	1	--	50000
3.	Audio Cassette Recorder	1	--	15000
4.	V.C.R. with Monitor & Accessories	1	--	35000
5.	Photography Camera for Production of slide and film strips, 35 mm still camera dark room equipment.	1		100000
6.	Mathematical Typewriter	1	--	50000
7.	Cutting, Binding & Stitching equipment.	1	--	30000

ANNEXURE-1 QUESTIONNAIRE

INSTITUTE OF RESEARCH,DEVELOPMENT AND TRAINING U.P.KANPUR -208024

SUBJECT: Questionnaire for ascertaining the job potential and activities of diploma holder in Electronics Engg.

PURPOSE: To design and develop Three Year diploma curriculum in Electronics Engg.

NOTE: 1.Please answer the questions to the points given in the questionnaire.
2.Any other point or suggestion not covered in this questionnaire may be written on a separate paper and enclosed with the questionnaire.

1.Name of the organisation: _____

2.Name & Designation of the officer _____
filling the questionnaire _____

3.Name of the department/section/ _____
shop _____

4.Importent functions of the _____
department/section/shop _____

5.Number of diploma holder employees _____
under your charge in the area of _____
Electronics Engg.

6.Please give names of modern equipments/machines handled by a diploma holder in Electronics Engg.

- | | | |
|----|----|----|
| 1. | 2. | 3. |
| 4. | 5. | 6. |

7.What proficiencies are expected from a diploma holder in Electronics Engg.

- | | | |
|----|----|----|
| 1. | 2. | 3. |
| 4. | 5. | 6. |

8.Mention the approximate percentage of the following desired in

Diploma teaching.

- 1. Theoretical knowledge -----%
- 2. Practical knowledge -----%
- 3. Skill Development -----%

9. Do you think " on the job training" / Industrial training should form a part of curriculum. (Yes/ No)

if yes then

- (a) Duration of training -----
- (b) Mode of training
 - 1. Spread over different semesters
 - 2. After completion of course
 - 3. Any other mode

10. What mode of recruitment is followed by your organisation.

- 1. Academic merit
- 2. Written test
- 3. Group discussion
- 4. Interview
- 5. On the job test.

11. Mention the capabilities/ Qualities looked for while recruiting diploma holder in Electronics Engg.

- (a) Technical knowledge -----
- (b) Practical skill -----
- (c) Etiquettes and behaviour -----
- (d) Aptitude -----
- (e) Health, habit and social background -----
- (f) Institution where trained -----

12. Does your organisation have any system for the survey of Home articles of different countries/States. Yes/No

13. Does your organisation conduct field survey to know users views regarding. Yes/No

- 1. Home Articles for different age groups and sex.
 - 2. Effect of climatic conditions
 - 3. Any other
- If yes ; Please give brief account of each.

14. Which type of assignment do you suggest for an entrepreneur in Electronics Engg.

15. In which types of organisations can a diploma holder in Electronics Engg. can work or serve.

- | | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |

16. Job prospects for the diploma holder in Electronics Engg. the next ten years in the state / country.

17. In your opinion what should be the subjects to be taught to a diploma student in Electronics Engg.

Theory

Practical

18. Kindly mention particulars regarding topics/areas which should be given more emphasis in the curriculum .

Theory

Practical

19. Kindly state whether your organisation can contribute towards improvement of curriculum in above field. Yes/ No
If yes : Please give names of experts in your organisation to whom contact.

20. Kindly give your valuable suggestions for being considered at the time of finalisation of curriculum.

21. What changes in technologies are to be incorporated in the development of curriculum in Electronics Engg.

(Signature)

Kindly mail the above questionnaire duly filled to:-

Shri R. P. Alam
Assistant Professor
Institute of Research, Development & Training, U.P.
(Govt. Polytechnic Campus)
Kanpur-208024

(Please note that all information in this survey is confidential for the use of curriculum design only)

ANNEXURE- 2 FIELD EXPOSURE SCHEDULE

Just after the end of second year examination all the students will go for an industrial training for 4 weeks. It will be organised and supervised by the institution staff. Preferably govt. organisations like Doordarshan, AIR, Telephone, Post & Telegraph departments & Govt. undertakings e.g. UPTRON, I.T.I., B.E.L., H.A.L., C.E.L., be chosen for the training. Medium & small scale private industries may also be adopted for the training.

Training unit should in no way be less than a small scale industry so that the student may get training on different stages of production, testing quality control and assurance.

The training report submitted by the student should contain the following points applicable according to industry.

1. Name & Address of the organisation
2. Nature of the industry and its activity.
3. Date of
 - i. Joining
 - ii. Leaving
4. Details of the sections of the industry visited.
 - i. Name of tools, equipments instruments in use.
 - ii. Activities of the section
 - iii. Study of the components, devices used in complete assemblies.
 - iv. Soldering and de-soldering techniques used in circuit fabrication.
 - v. Study of PCB Lay out developing and preparation.
 - vi. Checking and testing of the components used.

- vii. Final checking of the product.
 - viii. Discription of quality control measures taken in industry.
5. Study and aquaintance with transmission unit used in AIR, Doordarshan and other service organisation.
- i. Discription of faults occuring usually and their remedies.
 - ii. Periodic maintenance schedule.
 - iii. Major maintenance points in the unit.
 - iv. Preventive Maintenance steps taken.