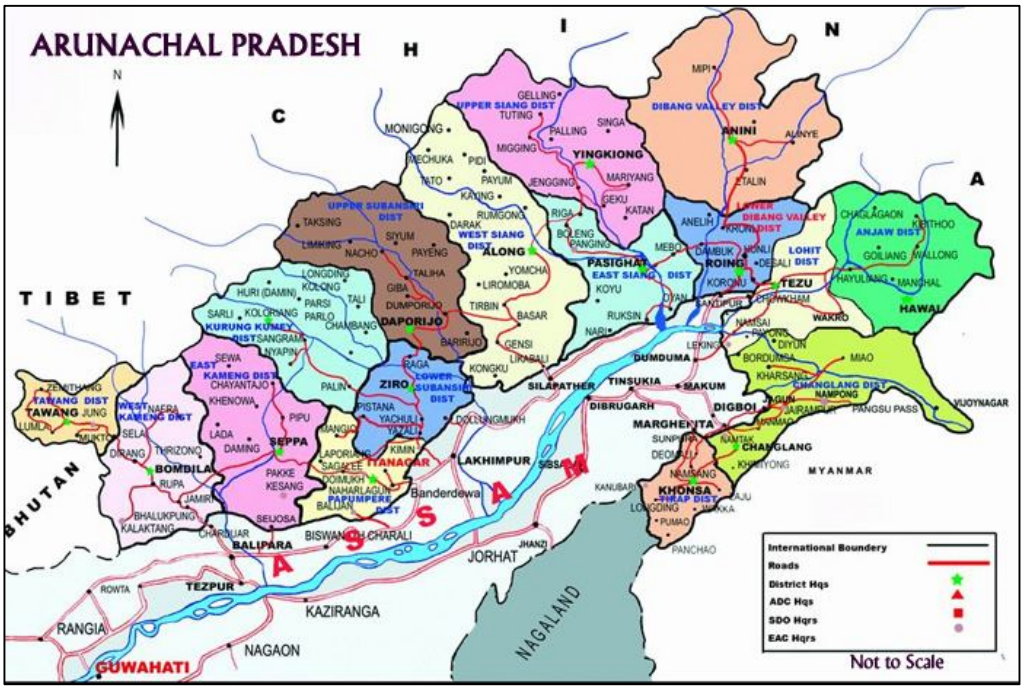
February 2013

REVISED CURRICULUM OF

ELECTRICAL & ELECTRONICS ENGINEERING DIPLOMA PROGRAM

IN

MULTI POINT ENTRY & CREDIT SYSTEM



For the State of Arunachal Pradesh

PART – II

National Institute of Technical Teachers' Training & Research
Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106
http://www.nitttrkol.ac.in

REVISED CURRICULUM OF PART – II

ELECTRICAL & ELECTRONICS ENGINEERING DIPLOMA PROGRAMME

IN MULTI POINT ENTRY & CREDIT SYSTEM

NATIONAL INSTITUTE OF TECHNICAL TEACHERS' TRAINING AND RESEARCH
Block – FC, Sector – III, Salt Lake City, Kolkata – 700106

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Foreword

Government of Arunachal Pradesh has entrusted NITTTR, Kolkata for revising the existing course curricula in eight subject areas and for developing the new course curricula in the two areas.

Revised Course Curricula:

1. Herbal Technology
2. Garment and Fashion Technology
3. Hotel Management and Catering Technology
4. Travel and Tourism Management
5. Electrical and Electronics Engineering
6. Civil Engineering
7. Computer Science and Engineering
8. Automobile Engineering

New Course Curricula:

1. Electronics and Communication Engineering
2. Electrical Engineering
3. Mechanical Engineering

The Institute conducted a series of workshop involving experts in different subject areas for development of the course curricula. An effort has also been made to ensure that the revised course curricula do not deviate significantly from the existing course curricula and at the same time reflect the recent trends in a particular subject area.

The Institute welcomes any meaningful suggestions which can be incorporated in the final versions of the above said document.

Sd/-
(Prof. S. K. Bhattacharyya)
Director
NITTTR, Kolkata

Table of Contents

Scheme of Studies and Evaluation (MPECS)

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING

1. FOUNDATION COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment*		Sessional	Viva		
1	G101	Communication Skill-I		3	0	0	75	10	15	0	0	0	100	3
2	G102	Communication Skill-II	G 101	2	1	2	50	0	0	25	25	0	100	4
3	G103	Mathematics-I		3	1	0	75	10	15	0	0	0	100	4
4	G104	Mathematics-II		3	1	0	75	10	15	0	0	0	100	4
5	G105	Physics -I		3	0	2	75	10	15	25	25	0	150	4
6	G106	Physics-II	G 105	3	0	2	75	10	15	25	25	0	150	4
7	G107	Chemistry - I		3	0	2	75	10	15	25	25	0	150	4
8	G108	Chemistry - II	G 107	3	0	2	75	10	15	25	25	0	150	4
9	G109	NCC I/NSS I		0	0	2	0	0	0	25	25	0	50	1
10	G110	NCC II/NSS II		0	0	2	0	0	0	25	25	0	50	1
TOTAL				**23**	**3**	**14**	**575**	**70**	**105**	**175**	**175**	**0**	**1100**	**33**

*** The marks for assignment (15) should include five (5) marks for attendance.**

2. HARD CORE COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
9	G201	Engineering Drawing-I		1	0	3	50	0	0	0	50	0	100	3
10	G202	Engineering Drawing-II	G201	1	0	3	50	0	0	0	50	0	100	3
11	G203	Workshop Practice-I		1	0	3	0	0	0	50	50	0	100	3
12	G204	Workshop Practice-II	G203	1	0	3	0	0	0	50	50	0	100	3
13	G205	Engineering Mechanics		3	0	0	75	10	15	0	0	0	100	3
14*	G206A	Introduction to Computer Programming		2	1	2	50	0	0	25	25	0	100	4
	G206B	Introduction to Information Technology												
	CSE206	Introduction to C-Programming		3	1	4	75	10	15	50	50	0	200	6
15	G207	Fundamentals of Electrical & Electronics Engineering		3	0	2	75	10	15	25	25	0	150	4
TOTAL				12/13	1	16/18	300/325	20/30	30/45	150/175	250/275	0	750/850	23/25

*G206A-Only for Civil Engg. ,Mechanical Engg. and Automobile Engg.and CSE206 for Computer Science&Engg.

3. SOFT CORE COURSES: ***(Two to be taken, 301 [Environmental Education] is compulsory, any One from the rest)***

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
18	G301	Environmental Education		3	0	0	75	10	15	0	0	0	100	3
19	G302A	Engineering Economics & Accountancy		3	0	0	75	10	15	0	0	0	100	3
20	G302B	Principles of Management		3	0	0	75	10	15	0	0	0	100	3
21	G302C	Entrepreneurship Development		3	0	0	75	10	15	0	0	0	100	3
22	G302D	Organizational Behaviour		3	0	0	75	10	15	0	0	0	100	3
23	G302E	Elements of Electronics		3	0	0	75	10	15	0	0	0	100	3
24	G302F	Materials Science	G105, G106, G107, G108	3	0	0	75	10	15	0	0	0	100	3
TOTAL				**6**	**0**	**0**	**150**	**20**	**30**	**0**	**0**	**0**	**200**	**6**

4. BASIC TECHNOLOGY COURSES FOR ELECTRICAL & ELECTRONICS ENGINEERING:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assign ment		Sessional	Viva		
25	EEE 401	Circuits & Networks		3	1	2	75	10	15	25	25	0	150	5
26	EEE 402	Electrical & Electronic Measurement		3	1	2	75	10	15	25	25	0	150	5
27	EEE 403	Electrical Machine I		3	1	2	75	10	15	25	25	0	150	5
28	EEE 404	Electrical Power System I		3	0	0	75	10	15	0	0	0	100	3
29	EEE 405	Electrical Drawing & Estimation		0	2	2	0	0	0	50	50	0	100	3
30	EEE 406	Electronic Devices & Circuits		3	1	2	75	10	15	25	25	0	150	5
31	EEE 407	Electrical Machine II	EEE 403	3	1	2	75	10	15	25	25	0	150	5
32	EEE 408	Electrical Power System II	EEE 404	3	0	0	75	10	15	0	0	0	100	3
33	EEE 409	Power Electronics	EEE 406	3	1	2	75	10	15	25	25	0	150	5
34	EEE 410	Electrical & Electronic Workshop		0	2	4	0	0	0	50	50	0	100	4
35	EEE 411	Heat Engine		3	0	0	75	10	15	0	0	0	100	3
TOTAL				**27**	**10**	**18**	**675**	**90**	**135**	**250**	**250**	**0**	**1400**	**46**

5. APPLIED TECHNOLOGY COURSES FOR ELECTRICAL & ELECTRONICS ENGINEERING:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assign ment		Sessional	Viva		
36	EEE 501	Analog Electronics	EEE 406	3	1	2	75	10	15	25	25	0	150	5
37	EEE 502	Digital Electronics	EEE 406,501	3	1	2	75	10	15	25	25	0	150	5
38	EEE 503	Switch Gear & Protection		3	0	0	75	10	15	0	0	0	100	3
39	EEE 504	Microprocessor, Microcontroller & its Applications	EEE 406, 501, 502	3	1	2	75	10	15	25	25	0	150	5
40	EEE 505	Instrumentation & Control		3	1	2	75	10	15	25	25	0	150	5
41	EEE 506	Consumer Electronics		3	1	2	75	10	15	25	25	0	150	5
42	EEE 507	Maintenance of Electrical & Electronic Equipment		3	1	2	75	10	15	0	25	25	150	5
43	EEE 508	C Programming		0	2	4	0	0	0	50	50	0	100	4
44	EEE 509	Technical Seminar		0	0	6	0	0	0	0	50	50	100	3
45	EEE 510	Projects		0	0	8	0	0	0	0	100	50	150	4
TOTAL				**21**	**8**	**30**	**525**	**70**	**105**	**175**	**350**	**125**	**1350**	**44**

6. ELECTIVE COURSES FOR ELECTRICAL & ELECTRONICS ENGINEERING: (Any TWO to be taken)

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assign ment		Sessional	Viva		
46	EEE 601	Communication Engineering		3	1	0	75	10	15	0	0	0	100	4
47	EEE 602	Medical Electronics		3	1	0	75	10	15	0	0	0	100	4
48	EEE 603	Utilization of Electrical Power		3	1	0	75	10	15	0	0	0	100	4
49	EEE 604	Bio Medical Instrumentation		3	1	0	75	10	15	0	0	0	100	4
50	EEE 605	Computer System Trouble Shooting & Maintenance		3	1	0	75	10	15	0	0	0	100	4
51	EEE 606	Digital Signal Processing		3	1	0	75	10	15	0	0	0	100	4
52	EEE 607	Renewable Energy Sources		3	1	0	75	10	15	0	0	0	100	4
53	EEE 608	Computer Aided Design & Drawing		3	1	0	75	10	15	0	0	0	100	4
TOTAL OF TWO COURSES				**6**	**2**	**0**	**150**	**20**	**30**	**0**	**0**	**0**	**200**	**8**

Industrial/Field Training

Pre-requisite – Students must be either in 4th Term or higher.

Course Code	***Name of Course***	*Teaching Scheme*					**Examination Scheme**				**Total Marks**
		Pre-requisite	**L**	**T**	**P**	**C**	**Theory**		**Practical**		
							End Exam	**PA**	**End Exam**	**PA**	
EEE511	Industrial Training (1 week orientation + 3 weeks OJT)		-	-		10	-	-	100	100	200

BASIC TECHNOLOGY COURSES

CIRCUITS & NETWORKS

L	T	P	**Code .: EEE 401**
3	1	2	

Total Contact hrs.:
Theory: 45
Tutorial:15
Practical: 30
Credit: 5

Total marks: 150

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: 25
P.A.: 25

RATIONALE:

The concept of electrical circuit is very essential for the study of the other subjects in Electrical & Electronics Engineering. This subject covers the basic electrical principles both on d.c. and a.c. circuits. The fundamental principles of magnetic circuits have also been covered. The concept of transient response has been included here.

DETAILED COURSE CONTENT

Unit	Topic / Sub Topic	HRS
1.	**Magnetic Circuits**	**8**
	1.1 Magnetising force	
	1.2 Magnetic intensity	
	1.3 Magnetomotive force	
	1.4 Magnetic flux	
	1.5 Relation between Magnetic flux and magnetic intensity	
	1.6 Magnetic Cycle of magnetisation	
	1.7 Magnetic hysteresis	
	1.8 Hysteresis loop	
	1.9 Permeability	
	1.10 Permeance	
	1.11 Reluctance	
	1.12 Magnetic circuit & comparison with electric circuit	
	1.13 Series, Parallel and Composite magnetic circuit	
	1.14 Enumerate the energy stored in a magnetic field	
	1.15 Pulling force by an electromagnet	
	1.16 Magnetic circuit in relay	
	1.17 Simple problems on magnetic circuit	
2.	**Passive Circuit Elements**	**6**
	2.1 Resistance	
	2.1.1 Equation relating voltage, current and resistance	
	2.1.2 Unit of resistance	
	2.1.3 Expression relating resistance, resistivity, length of conductor and area	
	2.1.4 Expression for the energy dissipated in a resistance	
	2.1.5 Specification of resistance	
	2.1.6 Colour code of resistance	
	2.1.7 Simple problems on resistance	
	2.2 Capacitor	

2.2.1 Definition of Capacitor
2.2.2 Types of Capacitors
2.2.3 Simple equation relating
(a) Capacitance, charge and voltage
(b) Capacitance current and voltage
(c) Energy stored in terms of capacitance and voltage
(d) Capacitance, Area of the plate & distance between plate
2.2.4 Construction of capacitor
2.2.5 Specification of capacitor
2.2.6 Simple problems on capacitor

2.3 Inductor
2.3.1 Define inductor
2.3.2 Write simple equations relating to voltage, current and inductance
2.3.3 Describe the construction of inductor
2.3.4 Define self and mutual inductance
2.3.5 Define co-efficient of coupling
2.3.6 Describe dot convention
2.3.7 State the unit of inductance
2.3.8 Write the expression for energy stored in inductance
2.3.9 Name different type of inductors and their field of application
2.3.10 Write the equation of inductor relating to its physical dimensions
2.3.11 Solve simple problems on inductor

3. D.C. Circuit Analysis **8**

3.1 Definition of voltage and current source
3.2 Graphical representation of the ideal current & voltage source
3.3 Graphical representation of the practical voltage and current source
3.4 Series parallel combination and the equivalent resistance
3.5 The conversion formulae for Delta to Star and vice-versa
3.6 Kirchhofff's current law and voltage law
3.7 Superposition theorem
3.8 Norton's theorem and Thevenin's Theory
3.9 Maximum power transfer theorem
3.10 D.C network problems using above theorems and laws

4. A. C. Circuit Analysis **8**

4.1 Difference between A.C and D.C
4.2 The principle of generation of sinusoidal voltage and its waveform
4.3 Definition of
(a) Cycles (b) Frequency (d) Time Period (d) amplitude
(e) Phase difference
4.4 Average and RMS value of simple waves
4.5 R.M.S. and average value of sinusoidal quantity
4.6 Form factor and peak factor
4.7 Sinusoidal wave by phases
4.8 Sinusoidal quantities in
(a) Exponential form (b) Complex form (c) Polar form

4.9 The effect of A.C. quantity through
(a) Resistance (b) Inductance (c) Capacitance
4.10 Simple R-L, R-C, & R-L-C series circuit and relation between voltages and current
4.11 The expression for power and power factor
4.12 Impedance triangle, power triangle and the concept of Active reactive and apparent power

5. Series and parallel Resonating Circuits **7**

5.1 The condition for series resonance
5.2 The expression of frequency at resonance condition
5.3 Quality factor (Q Factor)
5.4 Band width (BW)
5.5 The condition for parallel resonance
5.6 The resonance frequency for parallel L-C Circuit
5.7 Problems on series and parallel resonance

6. Transient **6**

6.1 Transient in RC circuits
6.1.1 The voltage equation across the capacitor being charged through resistor
6.1.2 The curves for charging capacitor
6.1.3 The curves for discharging capacitor
6.1.4 Time constant
6.2 Transient in R-L circuit
6.2.1 The current equation in R-L Circuit
6.2.2 Transient curves in R-L circuit
6.2.3 Time constant in R-L circuit
6.2.4 Problems on series and parallel resonance

7. Class Test **2**

LIST OF EXPERIMENTS

1. Identify of Passive Components
2. Perform the good bad test of Passive Components
3. Verify Kirchhoff's Current Law and Kirchhoff's Voltage Law
4. Verify Superposition Theorem
5. Verify Thevenin's Theorem
6. Verify maximum power transfer theorem (DC only)
7. Develop the charging and discharging curve of voltage across the capacitor connected in series with a resister
8. Measure the voltages across R, L, C in a series and parallel RLC circuit. Develop phaser diagram.
9. Determine the resonance frequency, Q-factor and Bandwidth in a series RLC circuit
10. Determine the resonance frequency, Q-factor and Bandwidth in a parallel RLC circuit

REFERENCE BOOKS :

1. Electronics and Electrical Engineering by Lionel Warnes (Macmillan)
2. Circuits & Networks, Analysis and Synthesis by A. Sudhakar, Tata McGraw-Hill Education
3. Circuit Theory, Analysis and Synthesis by Abhijit Chakrabarti, Dhanpat Rai Publications

ELECTRICAL & ELECTRONIC MEASUREMENT

L	T	P	**Code : EEE 402**
3	1	2	

Total Contact hrs.:
Theory: 45
Tutorial:15
Practical: 30
Credit: 5

Total marks: 150

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: 25
P.A.: 25

RATIONALE:

Measurement provides us with a means of describing various phenomena in quantitative terms and plays an important role in all branches of engineering and science. This course intends to teach the students facts, concepts, principles and procedure of electrical and electronic measuring instrument and the measurement techniques for the measurement of various electrical & electronics quantities, so that he/she can use this knowledge in acquiring supervision skills, prototype testing and investigation skills which in turn, will help to discharge his/her role as a supervisor in related technology areas and to assist in carrying out the work required by the industry/community.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	HRS
1.	**Basic Concepts of Electrical & Electronic Measuring Systems**	**10**
	1.1 Measuring systems and requirement	
	1.2 Necessity of different torques & arrangement of torque producing system	
	1.3 General description of PMMC, moving iron, dynamometers type instruments.	
	1.4 Calibration of instruments and standard of calibration	
	1.5 Block diagram of electronic measuring system.	
	1.6 Various types of electronic instruments	
	1.7 Basic characteristics of measuring devices	
	1.7.1 Accuracy, Precision, Error	
	1.7.2 Intrinsic, absolute and relative error	
	1.7.3 Uncertainty and random error	
	1.7.4 Systematic and instrumental error	
	1.7.5 Interference error	
	1.7.6 Installation errors (application errors)	
	1.7.7 Operational errors (human errors)	
	1.7.8 Zero drift	
	1.7.9 Error due to sensitivity changes	
	1.7.10 Statistical errors	
	1.7.11 Weighting of errors	
	1.7.12 Linearity, Hysteresis, Threshold, Repeatability, Reliability & maintainability, Span, Dynamic accuracy, Response time	
	1.8 First-order system, Second-order system	

2. Current Measurement **4**

2.1 Galvanometer
2.2 Ammeter (Moving Coil and Moving Iron type only)
2.3 Extension of current range
2.4 Calibration of ammeter
2.5 High Current Measurement using CT

3. **Voltage Measurement**
4

3.1 Voltmeters (Moving Coil and Moving Iron type only)
3.2 Extension of voltage range
3.3 Calibration of voltmeter
3.4 High Voltage Measurement using PT

4. **Power & Energy Measurement**
8

4.1 Principle of power measurement (use of Dynamometer type Instruments)
4.2 Wattmeter (Construction)
4.3 Extension of wattmeter range
4.4 Three phase power measurement using wattmeter
4.5 KVAR meter
4.6 Principle of energy measurement (Induction type only)
4.7 Energy meter (Construction)
4.8 Extension of range
4.9 Errors & their correction

5. **Measurement of other Electrical Quantities and Parameters**
10

5.1 P.F. meter
5.2 Frequency meter
5.3 Phase sequence and maximum demand indicator
5.4 Synchroscope
5.5 Megger
5.6 Measurement of resistance bridge type system
5.7 Measurement of insulation resistance
5.8 Measurement of earth resistance (low resistance measurement)
5.9 Measurement of inductance by Anderson & Maxwell bridge circuit
5.10 Measurement of unknown capacitance by Schering bridge
5.11 Potentiometer AC & DC, principles, operations, standard of calibration

6. Electronic Instruments : **7**

6.1 Working Principles of Digital Voltmeter (DVM)
6.2 Working Principle of Digital Multimeter.
6.3 Working Principles of function generator – Sine Wave, Square wave & Triangular wave.
6.4 Working principles of CRO with its construction and operating principles with applications.
6.5 Digital IC tester.

7. Class Test **2**

LIST OF EXPERIMENTS

1. Dismantling and Assembly of indicating type instrument PMMC type, identification and drawing the following
   (a) Deflecting system
   (b) Controlling System
   (c) Damping System
2. Dismantling and assembly of indicating type instrument eg. Electrodynamic Wattmeter, identification and drawing of (a) deflecting System (b) Controlling System (c) Damping System (d) current coil (e) potential coil (f) voltage multiplier
3. Dismantling and assembly of indicating type instrument e.g. Moving Iron Voltmeter and Ammeter, identification and drawing of (a) deflecting system (b) Controlling System and damping system.
4. Dismantling and assembly of Single phase energy meter, identification and drawing of (a) deflecting system (b) braking system (c) current coil (d) potential coil (e) creep adjustment (f) Pf adjustment (g) speed adjustment
5. Measurement of power by three Voltmeter methods
6. Measurement of power and power factor by three-ammeter method
7. Measurement of three phase power & power factor by 2 wattmeter method
8. Extension of Range of a PMMC voltmeter
9. Connection of CT and PT for measurement of high current and high voltage and determination of trans ratio of current and potential transformer
10. Measurement of resistance by Wheatstone Bridge (and Kelvin's Double Bridge)
11. Measurement of Medium Value resistance by Ammeter Voltmeter method
12. Study of Digital Multimeter.
13. Study of CRO
14. Study of P. F. Meter, Frequency Meter and Synchroscope.

REFERENCE BOOKS:

1. Electrical Measurement and Measuring Instruments; Golding

2. Electron Instrumentation; H.S. Kalsi, T.M.H

3. Electrical Measurements and Measuring Instruments; E.Handscombe (The Wykeham Technologies Service)

4. Electrical Measurement and Measuring Instruments; By S.R. Paul (Rukamari Book House Calcutta

5. Electrical Measuring Instruments; S.R.Paul (Concept Publications 6/2/H D.Gupta Lane 700 050)

6. Electrical measurements by Forest Klaire Harris

7. Electrical and Electronics Measurements and Instrumentation by A.K. Sawhney, Puneet Sawhney, Dhanpat Rai & Company.

ELECTRICAL MACHINE - I

L	T	P		**Code : EEE 403**
3	1	2		
Total Contact hrs.:			**Total marks: 150**	**Theory:**
Theory: 45				End Exam: 75
Tutorial:15				P.A.: 25
Practical: 30				**Practical:**
Credit: 5				End Exam: 25
				P.A.: 25

RATIONALE:

The application of D.C. Machine in modern industries are still in practice. The Electrical & Electronics Engineering Technicians has to look after the installation, operation and control of machines such as DC Motor, DC Generator, Transformer & Storage Battery. So the knowledge of Machine is very essential in this regard. As the field of Electrical machine is very vast, this subject is divided into two parts, Electrical Machine - I and Electrical Machine - II. The Electrical Machine - I deal with D.C. Machines, transformers and different type of batteries. The usage of transformers and batteries are very wide. For that reason these topics have been included in this subject.

DETAILED COURSE CONTENT

Unit	Topic / Sub Topic	Hours

1. Fundamental of D.C. Machine **6**

1.1 Working principle of D.C. Machines, Fleming's Right Hand and Left Hand Rule
1.2 Types of D.C. machines on the basis of connection of field Coil with armature.
1.3 Construction of a D.C Machine
  a) Geometrical axis and central axis.
  b) Armature Winding
  c) Brush positions
  d) Lap and wave winding
1.4 Function of equalizing ring and dummy coils

2. D.C. Generator. **7**

2.1 Type of D.C. Generator.
2.2 Working principle of D. C Generator.
2.3 Emf. Equation of D.C. Generator.
2.4 Characteristic of D.C. Generator (all types)
2.5 Condition for building emf. in self excited generator (Shunt).
2.6 Critical resistance and critical speed
2.7 Armature reaction
2.8 Method of reducing the effect of armature reaction
2.9 Application of D.C. Generator
2.10 Problems on D.C. Generator.
2.11 Method of testing, fault diagnosis and repair of D.C. Generator.

3. D. C. Motor **12**

3.1 Types of D.C Motor.
3.2 Working principle of D.C. Motor
3.3 Significance of back emf
3.4 Torque equation of D.C. Motor
3.5 Characteristics of
  a) Speed Vs. armature Current (for all types).
  b) Torque Vs. armature current (for all types).
  c) Speed Vs. torque characteristics (for all types).
  d) Speed Vs. field current characteristics (for all types).
3.6 Field of application of different type of D.C .Motor
3.7 Basic principle of starting of D.C. Motors with construction details.
3.8 Speed control of D.C. Motor -
  a) By varying field current
  b) By varying armature voltage
3.9 Speed reversal method and Breaking methods of D.C. Motor.
3.10 Method of testing, fault diagnosis and repair of D.C Motor.

4. Transformer : **10**

4.1 Transformer & state its basic principle
4.2 Classification of transformer based on
  4.2.1 Application
  4.2.2 Construction
4.3 Construction of transformer
  4.3.1 The list of components used
  4.3.2 Composition of the components
  4.3.3 Type and nature of cooling of transformers
4.4 Working principle of transformer.
4.5 Transformer on (a) no-load (b) full load
4.6 Emf equation of transformer
4.7 Equivalent resistance, reactance impedance referred to either side
4.8 Phasor diagrams on load at different pf's
4.9 Different type of losses in transformer
4.10 Calculation of the losses and efficiencies of transformer
4.11 Condition for maximum efficiency of transformer
4.12 Procedure for testing of transformer
4.13 Open circuit test and short circuit test
4.14 Voltage regulation of a transformer
4.15 Construction and working principle of Auto transformer
4.16 Three phase Transformers : Describe distribution transformer & Power Transformer

5. Storage Batteries : **8**

5.1 Types of storage batteries
5.2 Construction of Lead Acid battery
5.3 Working principle of Lead Acid Battery
5.4 Special feature of Maintenance free battery
5.5 Different method of battery charging
5.6 Different battery charging circuit for
  (a) constant voltage (b) constant current charging
5.7 Method of testing, fault diagnosis and repair of batteries
5.8 Safety procedure for battery

6. Class Test: **2**

LIST OF EXPERIMENTS

1. Dismantle a D.C. machine and study its different parts.
2. Determine No load characteristics / Draw OCC curve of D .C. Machine
3. Test Polarity on a single phase transformer
4. Determine the speed torque, speed armature current and torque armature current characteristics of a D.C. Motor (Shunt and Compound).
5. Control the speed of a D.C. Shunt Motor by
   (a) armature voltage Variation
   (b) field current variation.
6. Assemble and test the speed reversal circuit of a D.C. Shunt Motor
7. Determine the (a) no load loss (b) full load loss (c) efficiency and percentage regulation of a single phase transformer
8. Study the detail construction, assembly and installation of a lead Acid battery
9. Study the construction of Different battery chargers e.g.
   a) Taper charger/constant voltage charger
   b) Constant current charger
   c) Auto cut off battery charger
10. Study the construction of Maintenance free battery.

REFERENCE BOOKS :

a) Electrical Technology Vol-II (AC and DC Machines) by B. L. Thareja and A. K. Thareja, S. Chand Publication
b) Electrical Machines by Bimbhra, P.S.; Khanna Publishers, New Delhi, 1996
c) Electrical Machines by Bhattacharya, S.K., Tata McGraw-Hill, New Delhi, 2nd ,1997
d) Electrical Machines Nagrath & Kothari, Tata McGraw-Hill, New Delhi, 1995
e) Transformers & motors by Shultz; George patrick Howard W. Sams & Co. New York, latest
f) Elementary Electrical Engineering by Gupta, M.L., New Heights, New Delhi, 18th, 1992
g) Batteries and Energy System by Mantell, McGraw Hill
h) Storage Batteries by Vinal, John Willey & Sons

ELECTRICAL POWER SYSTEM - I

L	T	P	**Code : EEE 404**
3	0	0	

Total Contact hrs.:45 **Total marks: 100**

Theory: 45
Practical: Nil
Credit: 3

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: Nil
P.A.: Nil

RATIONALE:

The knowledge of power generation and substation are very essential in the field of Electrical Engineering. The role of the technician in maintaining a generating station and substation is vital. Some emphasis has been given on the maintenance aspects of power generating station and substation. As the power crisis in this country is increasing day by day with the increase in power demand, the utilisation of diesel-generating set is also increasing. Hence the detail study of diesel generating sets as a captive power-generating unit is to be studied here.

DETAILED COURSE CONTENT

Unit	Topic / Sub Topic	Hours

1 Generation of Electrical Power 15

- 1.1 Name of the sources of Energy
- 1.2 Factors on which the following generating systems are implemented
  - (a) Thermal Power station (b) Hydro Electric Power Station
  - (c) Atomic Power stations (d) Gas Turbine (e) Diesel generating systems
- 1.3 Thermal Power generation
  - 1.3.1 Detail layout of thermal power station
  - 1.3.2 Factors for site selection & furnish the list of thermal power plants
  - 1.3.3 Generating capacity of the thermal power station
  - 1.3.4 Working principle of the following(a) Coal handling Plant (b) Alternators (c) condensing plant (d)Water treatment plant (d)Ash handling system (f)Station auxiliaries (g) pulverising system (h) steam generation system (i) turbine system (i) Electrostatic Precipitator (ESP)
- 1.4 Hydro Electric Power generation
  - 1.4.1 Reasons for developing a Hydro Electric Project
  - 1.4.2 Different types of hydro electric project
  - 1.4.3 List of hydro electric projects and their capacities
  - 1.4.4 Detail layout of the hydro electric project
  - 1.4.5 Alternator, and turbine of the hydro electric projects
  - 1.4.6 Station auxiliaries of the hydro electric projects
- 1.5 Atomic Power Generation
  - 1.5.1 Reasons for selecting Atomic Power Station as a power-generating unit
  - 1.5.2 Factors on which the site is selected
  - 1.5.3 Different types of Atomic reactors used in Power generating system
  - 1.5.4 Detail layout of the Atomic Power generating system

1.5.5 Safety system needed for the running and maintenance of the Atomic Power generating system
1.5.6 Advantages and disadvantages of Atomic Power generating system

1.6 Diesel Generating Plants
1.6.1 Reason for selection of Diesel generating system as power generating unit
1.6.2 Capacities of the Diesel generating System
1.6.3 Schematic layout of the Diesel generating System
1.6.4 Starting procedure of a Diesel generating System
1.6.5 List of materials and components required for the operation and maintenance of Diesel generating Set
1.6.6 Relevant IE rules for connecting the Diesel generating set with the bus bar
1.6.7 Maintenance schedule
1.6.8 Testing schedule for the repair work during breakdown

1.7 Gas Turbine
1.7.1 Reason for selecting gas turbine stations
1.7.2 Layout of the gas turbine generating stations.
1.7.3 Working principle of the gas turbine
1.7.4 Advantages & disadvantages of gas turbine

1.8 Perform the comparative study of steam, Hydel, Atomic, Diesel generating and gas turbine plants

2. Planning of Economic and Tariff of Power System 10

2.1 Definition of
(a) Demand (b) Load Curve (c) Maximum Demand or Peak Load (d) Connected load (e) Demand factor (f) Load factor (g) Diversity factor (h) Plant Factor and problem solutions
2.2 Factors involved for determining cost of generation and problem solutions.
2.3 Method of determination of size of conductors and apply Kelvin's law and problem solutions
2.4 Method of (i) load survey (ii) Planning (iii) calculation for Tariff and problem solutions.
2.5 Method of power factor improvement of a plant and problem solutions.

3. Power Installations and Drives 8

3.1 Power installation
3.2 Factors on which a power installation is designed
3.3 Layout of an Industrial Power Distribution System
3.4 Methods for the selection of drive in an industrial system
3.5 Factors on which the motor is selected
3.6 Table stating the properties and application of different type of Motor.
3.7 Method for the choice of device for specific Industrial Utility
3.8 Designing a 400 V, three phase 4 wire bus bar system (Power derived from 3 phase 11 KV system) and methodologies to estimate the cost factor etc. for it.

4. Sub Station 10

4.1 Substation, types of substation.
4.2 Various equipments used for construction of various types of substations.
4.3 Layout of a transmitting sub-station

4.4 Layout of
(a) Primary distribution sub-station
(b) Secondary distribution sub-station

4.5 Method of Earthing the Substation
(a) Earthing systems as per Bureau of Indian Standard
(b) Relevant IE Rules for sub-station earthing
(c) Distinction between earthed versus Isolated neutral power system
(d) Reason for neutral point earthing

4.6 Method of Inspection and Maintenance of
(a) Switchgear (b) Transformer (c) Transformer oil (d) Bus bars (e) Power factor improvement devices

4.7 Method of transformer oil testing
(a) Effect of contamination
(b) Method of filtering and reconditioning of transformer oil
(c) Application of mineral oil
(d) Relevant code for the transformer oil testing

5. Class Test 2

REFERENCE BOOKS:

1. Electrical Power by S.R. Chakraborty (Venus Publishers 71/2B Bidhan Sarani, Kolkata – 700 006)
2. Generation of Electrical Energy by B. R. Gupta
3. Power System by V.K. Mehta
4. Power Plant Engineering by Nagpath & Kothari.

ELECTRICAL DRAWING & ESTIMATION

L	T	P	**Code : EEE 405**
0	2	2	

Total Contact hrs. : **Total marks: 100** **Theory:**
Theory: Nil End Exam: Nil
Tutorial:30 P.A.: Nil
Practical: 30 **Practical:**
Credit: 3 End Exam: 50
P.A.: 50

RATIONALE:

Drawing is the language of Engineers. Any job which is to be communicated for implementation is required to be done within an optimum time span and with efficacy. Since last century a lot of change has taken place in Drawing for representing job specification. Standardised symbols as prescribed by Bureau of Indian Specification are to be introduced while practicing the jobs on Drawing. The preparation of list of material along with the specification writing is also an important factor which is to be dealt in this subject. Students will also be able to develop basic estimating skills, which is very essential especially to become an entrepreneur.

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours
1	**Construction of Assembly drawing of the Electrical Item**	**2**
	1.1 List of Electrical Symbols as per IS 2032 (Part I to Part XI)	
2	**Drawings of Joints and Electrical Accessories**	**3**
	2.1 Different type of Cable Joint	
	2.2 Kit Kat fuse with its holder	
	2.3 SPST knife switch	
3	**Drawing of Electrical Instruments**	**8**
	3.1 Dial of (a) Moving Iron (b) Moving Coil (c) Dynamometer and (d) Induction Type Instruments	
	3.2 Diagrams of deflecting systems of (a) Moving Coil (b) Moving Iron (c) Dynamometer and (d) Induction Type Instruments	
	3.3 Diagrams on (a) Controlling system (b) Damping System	
4	**Drawing on Electrical Machine**	**6**
	4.1 Sectional Drawing of D.C. Motor	
	4.2 Drawing of three phase transformer with tank and bushing	
5	**Winding Diagram**	**6**
	5.1 Lap / Wave winding diagram of a 4 pole D.C. Machine	
6	**Transmission & Distribution Line Diagram**	**7**
	6.1 Single line diagram of a typical ac power supply system	
	6.1.1 Transmission line components : Line conductors, line insulators, line supports, guarding.	

6.2 Diagram of a 3 phase 4 wire Power Distribution system and show the arrangements for service connection and safety device over road crossing safety guard
6.3 Diagram for HT and LT insulation in detail

7 Plant and substation layout Diagram **10**

7.1 Diagram of Pole Mounted Sub-station
7.2 Diagram of Foundation mounted outdoor substation
7.3 Layout of 11KV substation

8 Elements of Estimation and Costing **4**

8.1 Types of estimation and estimation tools
8.2 Overhead and service charges

9 Domestic and Industrial Wiring **4**

10.1 Layout and estimation of residential wiring
10.2 Layout and estimation of industrial wiring
10.3 IE rules

10 Estimation and Costing of Electrical Products & Services **10**

11.1 Market survey for cost of given product like DOL. starter, small motor, MCBs, etc.
11.2 Market survey for availability of required materials, their cost and other requirements
11.3 Detailed estimation and preparation of cost schedule for repair and maintenance of electric fan, automatic electric iron, single-phase transformer, mixer, D.O.L. starter etc.

SUGGESTED PRACTICAL EXPERIENCES (Marks – 50)

The following list of workshop experiences could be enriched further.

a) Assembly of single point house wiring for incandescent wiring, fans with electro-mechanical and electronics regulators.
b) Assembly of single and double fluorescent tube wiring circuit
c) Staircase wiring using two-way switches
d) Godown wiring circuit
e) Panel board wiring using MCBs, ELCBs.
f) Panel board wiring using phase changing devices
g) Using coil-winding machines to build small transformers.
h) Dismantling and assembling of fractional horse power motors.
i) Dismantling and assembling of home appliances like:
    i. Electric food processors
    ii. Electric iron
    iii. Electric toasters
    iv. Electric room heaters
j) Performance of domestic appliances
    i. Water heaters of various types immersion water heater, instant geyser, storage heaters
    ii. Different types of lamps like fluorescent tube, CFL, halogen lamps etc.
    iii. Burglar alarms
    iv. Electric bells, fans and fan regulators of various types

REFERENCE BOOKS:

1. House Wiring by Arora, B.D., R.B. Publications, New Delhi, latest
2. Electrical Estimating & Costing by Bajpai, M.N., Saroj Publication, New Delhi, 1995
3. Geometrical and Machine Drawing by Bhatt, N.D,: Charoter Pub., Anand Gujarat, 28th, 1993
4. Electrical Costing, Estimating and contracting by Bhattacharya, S.K., TTTI, Chandigarh, 1994
5. Electrical Engineering Drawing by Bhattacharya, S.K., Wiley Eastern, New Delhi, 1992
6. The electricity act; 2003 or latest
7. Electrical Engineering Drawing by Nagpal, G.R., Khanna Publications, New Delhi, 1991
8. Schedule of Rates by P.W.D. Govt. Deptt., latest
9. Electrical Appliances by R.B. Publications, New Delhi
10. A workbook of Engineering Drawing by Somiaya Publications, Mumbai
11. Electrical wiring, estimating and costing by Uppal, S.L., Khanna Publisher, New Delhi

ELECTRONIC DEVICES AND CIRCUITS

L	T	P	**Code : EEE 406**
3	1	2	

Total Contact hrs : **Total marks: 150** **Theory:**
Theory: 45 End Exam: 75
Tutorial:15 P.A.: 25
Practical: 30 **Practical:**
Credit: 5 End Exam:: 25
P.A.: 25

RATIONALE:

Electrical & Electronics Engineering can not stand alone without the study of Electronic Devices & Circuits. The modern Electrical Equipments are mostly controlled by electronic circuits where both the circuits are mostly designed on the basis of linear and binary operation of the solid state devices. This subject provides the facility for the study of basic knowledge of the solid state devices and their application. The study of the practical circuits is included in this subject rather than theoretical approach. Some problems on designing of simple electronic circuits have also been included here.

DETAILED COURSE CONTENTS

Unit	**Topic/Sub Topic**	**Hours**
1	***Semiconductor Diodes***	**10**
	1.1 Semiconductor Physics	
	1.2 Types and properties of semiconductor	
	1.3 Doping	
	1.4 Diodes	
	a) Principle of operation b) Types and c) Specifications	
	1.4 Forward and reverse biased diode	
	1.6 Volt – amps, characteristics of diode	
	1.7 Practical diode	
	1.8 Important specifications of semiconductor diode	
	1.9 Half wave and full wave rectifier circuits using Diodes.	
	1.10 Efficiency of rectifier circuit, concept of ripple factor.	
	1.11 Construction of different filter circuits used with rectifiers & its applications.	
	1.12 Diode clipping, clamping circuits & voltage doubler circuits.	
	1.13 Special purpose diodes	
	1.14 Characteristics and field of application of (a) zener diode (b) Light emitting diode (c) photo diode (d) schottky diode (e) tunnel diode (f) PIN diode (g) gun diode (h) Varactor diode	
2	***Transistor***	**12**
	2.1. Construction of transistor	
	2.2. Working principle of transistor	
	2.3. Types and configuration of transistor, circuits (CB, CE, CC)	
	2.4. Characteristics of transistor and method of drawing characteristics curves	

2.5. Amplifying characteristics
2.6. Application area of (a) common base (b) common emitter (c) common collector configuration transistors.
2.7. Definition of (a) current amplification factor (b) leakage current (c) input resistance (d) output resistance.
2.8. Relation between α and β
2.9. Load line of a transistor (both for dc and ac)
2.10. Function of the heat sink of a transistor.
2.12. Specification of a transistor.
2.13. Transistor biasing and essential requirement of different Biasing circuit with comparison and stability factor.
2.14. Function of a small single stage amplifier, and calculate its voltage and power gain.
2.15 Multistage amplifiers and different type of coupling.
2.16 Different types of power amplifiers
2.17 Different stages of an amplifier used in PA system.
2.18 Feedback system in transistors (concept of feedback, gain in feedback, advantage and disadvantage in feedback amplifiers).

3. ***Multistage Amplifier :*** **5**

3.1 General Block diagram of multi-stage amplifier
3.2 Different coupling methods – working, frequently response, applications and comparison of
(a) RC coupled (b) LC coupled (c) Direct Couples (d) Transformer coupled amplifiers.

4. ***FET:*** **8**

4.1 Working principle and characteristics of JFET, MOSFET,
4.2 Types of MOSFET and their characteristics
4.3 Construction of MOS transistors and its advantages and disadvantages.
4.4 Comparison between BJT & FET.

5. ***Sinusoidal Oscillators:*** **8**

5.1 Condition of Oscillator circuits (Barkhausen criteria)
5.2 Conditions of oscillation
5.3 Different types of oscillators like Hartley, Colpitt, Phase-shift, Wein Bridge and Crystal oscillators and their applications.

6. ***Class Test:*** **2**

LIST OF EXPERIMENTS:

1. Identify the active and passive components
2. Determine the forward and reverse characteristics of PN junction diode
3. Determine half wave rectifier circuit wave form with filter and without filter.
4. Determine full wave rectifier circuit wave form with filter and without filter.
5. Determine the input and output characteristics of Junction transistor
6. Determine the characteristics of a zener diode

7. Connect the (a) common base (b) common emitter (c) common collector Amplifiers and to compare their gain
8. Assemble (a) two stage R.C. coupled amplifier and (b) Check the amplification of the input signal
9. Connect a single stage amplifier and check the cut off, saturation and normal biasing conditions on input signal by varying the biasing.
10. Determine the (a) current amplification factor in common base configuration (b) base current amplification factor in common emitter configuration
11. Determine the input and output characteristics of transistor, (a) draw the D.C. load line (b) draw the collector dissipation curve
12. Construct a multistage amplifier with (a) power Amplifier and check the amplification of input signal with and without negative feedback
13. Construct a phase shift Oscillator and adjust its gain to obtain sinusoidal output. Determine (a) gain and (b) frequency of oscillation during Oscillation
14. Construct the diode clipping and clamping circuit and observe the clipping level with change in biasing voltage

REFERENCE BOOKS :

1. Electronics Fundamentals and Applications by D. Chottopadhyay and Rakshit.
2. Electronic Principles; Sahdev (Dhanpat Rai & Sons)
3. Electronic Devices and circuits; Mothershead (TMH)
4. Electronic Devices; Floyd
5. Electronic Principles; Malvino; (TMH)
6. Basic Electronics by S. K. Mandal.
7. Electronics Devices by G.K.Mithal.
8. Electronics Devices & Circuit theory by Robert Boyelstad.

ELECTRICAL MACHINE - II

L	T	P	**Code : EEE 407**
3	1	2	

Total Contact hrs.:
Theory: 45
Tutorial:15
Practical: 30
Credit: 5

Total marks: 150

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: 25
P.A.: 25

RATIONALE:

The subject Electrical Machine - II is a subject, which deals with the induction machine, synchronous machine and special purpose motors. In this subject the construction, working principles, starting principles are to be studied. The testing of the machines and the brief design ideas have also been included here. In addition to the theoretical study of the topics as mentioned above care has been taken for including the practical aspects of the topics. A few problems have also been included here, so that the student can develop the problem solving attitude during their service career.

DETAIL OF COURSE CONTENT

Unit	Topic / Sub Topic	hrs
1.	**Three phase induction motor**	**15**
	1.1 Types of Induction Motor	
	1.2 Comparison between slip ring and cage type induction motor.	
	1.3 Working principle of an three phase induction motor	
	1.4 Expression for torque in three phase induction Motor	
	1.5 Torque speed characteristics of a three phase induction motor	
	1.6 Explanation of (a) the effect of variation of applied voltage on torque speed characteristics (b) the effect of variation of rotor resistance on torque speed characteristics	
	1.7 Method of achieving high starting torque of an three phase induction motor	
	1.8 Various methods for starting induction Motor	
	1.9 Different method of speed control in three phase induction motor (conventional Method)	
	1.10 Enumerate different losses in three phase induction motor	
	1.11 Efficiency of three phase induction motor considering the losses in the motor	
	1.12 Electrical equivalent circuit of three phase induction motor	
	1.13 Calculation of the torque developed, current drawn, power factor, motor speed of three phase induction motor (usage of standard equation) and data	
	1.14 Testing of three phase induction motor : no load test, block rotor test and load test.	
	1.15 Circle diagram of three phase induction motor.	

2 ***Single Phase Induction Motor*** **8**

2.1 Basic operating principle and types of single phase induction motor.
2.2 Constructional details
2.3 Various methods of starting of single phase induction motor
2.4 Torque – Speed characteristics of single phase induction motor
2.5 Application areas of different types of single phase induction motor.

3. ***Synchronous Machines*** **5**

3.1 Operating principle and types of Synchronous Machines.
3.2 Construction of three phase Synchronous Machines.

4. ***Three Phase Synchronous Generator*** **5**

4.1 Constructional detail and working principle of three phase synchronous Generator.
4.2 Different type of excitation method of synchronous generator
4.3 Synchronization of synchronous generator.
4.4 Study of V Curve.

5. ***Three Phase Synchronous Motor*** **5**

5.1 Starting methods of synchronous motors.
5.2 Effect of excitations on armature current.
5.3 Power factor improvement using synchronous motors.

6. **Special Purpose Motors** **5**

6.1 Linear Induction Motor
6.2 Universal Motor
6.3 Stepper Motor
6.4 Servomotor

7. ***Class Test*** **2**

List of Experiments

1. Determine the slip of an induction motor
2. Determine the insulation resistance test of three phase induction motor
3. Determine the high voltage test of the three-phase induction motor
4. Determine the open circuit test of the three phase induction motor
5. Determine the blocked rotor test of a three phase induction motor
6. Determine the Dynamometer method of testing the speed current and speed torque characteristics
7. Determine the pony brake method of the speed current and speed torque characteristics
8. Determine No load test and Blocked Rotor tool Drawing circle diagram for determining
    a) The true current and power factor at rated voltage
    b) The maximum output
    c) The maximum torque
    d) The full load efficiency
    e) Full load rotor speed
10. Determine the effect of rotor resistance on the torque speed curves of an induction motor.
11. Determine of Magnetisation characteristics of an alternator (a) at no load rated speed (b) at no load half rated speed (c) at full load (non-induction) rated speed

12. Determine excitation required to maintain constant voltage in an alternator
13. Determine of the relationship between terminal voltage and load current of an alternator, keeping excitation and speed comfort
14. Determine of regulation and efficiency of an alternator from open circuit and short circuit
15. Determine of the relationship between terminal voltage and load current of an alternator for varying power factor load, the speed and excitation remaining constant
16. Parallel operation of three-phase alternator and load sharing
17. Determine of the performance test of ceiling fan and preparation of test report as per Bureau of Indian Standard.

REFERENCE BOOKS :

1. Electrical Technology Vol-II (AC and DC Machines) by B. L. Thareja and A. K. Thareja, S. Chand Publication

2. Electrical Machines by Bimbhra, P.S.; Khanna Publishers, New Delhi.

3. Electrical Machines by Bhattacharya, S.K., Tata McGraw-Hill, New Delhi.

4. Electrical Machines Nagrath & Kothari, Tata McGraw-Hill, New Delhi.

5. A C Machine by M.G. Say.

ELECTRICAL POWERS SYSTEM - II

L	T	P	**Code : EEE 408**
3	0	0	

Total Contact hrs.:45 **Total marks: 100**

Theory: 45
Practical: Nil
Credit: 3

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: Nil
P.A.: Nil

RATIONALE :

The subject power system has different parts like Power Generation, Transmission & Distribution, and Switch gear & protection. Since the topics in the above sections covers very vast areas, it is required to divide the subjects into three different major parts e.g., (a) Power generation (b) Power transmission & Distribution (c) Switch Gear & protection. As the subject power Transmission and Distribution is more or less descriptive and based on the study of structures of transmission line, construction of lines, overhead safety devices, service connections, estimating work, these topics are included in power system - II. The related IE rules and Bureau of Indian Standard Specifications have also been included here.

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hour
1.	**Principles of Transmission and Distribution**	**4**
	1.1 Transmission System and Distribution System	
	1.2 Short & Medium Transmission line, current voltage relation, Performance of Short Transmission line.	
	1.3 Distribution systems eg a) Radial system b) ring main system	
	1.4 Description of (a) D.C. two wire system (b) D.C. three wire system (c) Single phase A.C (d) Three phase A.C. System	
	1.5 Copper efficiency of a) D.C. two wire & three wire system b) Single phase A.C c) Three phase d) Three phase 4 Wire system	
	1.6 Current loading in three phase 4 wire and three wire feeder system	
	1.7 Voltage drop in A.C Feeder (Single phase)	
	1.8 Voltage drop in three phase AC Feeder	
	1.9 A.C distributor and determining the sending end voltage	

2 Materials of Overhead Line **6**

2.1 Construction, characteristics & their applications of
- a) Line Conductor
- b) Poles
- c) Wooden poles and their Treatment
- d) Concrete Poles
- e) Steel tubular poles
- f) Rail Poles
- g) Steel towers with cross arms brackets
- h) Stays, struts and other line accessories like Arcing Horns etc. suspension clamp, strain clamp, snail clamp, tubular compression dead end, etc and binding wires dampers etc

2.2 Construction, characteristics & field of application of
- a) Shackle Insulators
- b) Pin Insulators
- c) Post Insulators
- d) Disc Insulator
- e) String Insulators

3. Mechanical Design of Overhead line **7**

3.1 Main components of over head lines
3.2 Line conductors
3.3 Line supports
3.4 Line insulators and supporting structure
3.5 String insulation and efficiency
3.6 Method of improving string efficiency
3.7 Sag in overhead lines
3.8 Calculation of sag
3.9 Corona – phenomena
- 3.9.1 Causes
- 3.9.2 Methods of reducing corona

4. Electrical Design of Overhead line **5**

4.1 Line parameters : Resistance, Inductance and capacitance
4.2 Skin effect
4.3 Proximity effect
4.4 Inductance of 1-Phase overhead line and 3-phase overhead lines
4.5 Capacitance of 1-phase overhead line and 3-phase overhead lines
4.6 Transposition of conductance
4.7 Concept of self GMD and mutual GMD

5. Performance of Transmission lines **6**

5.1 Classification of transmission lines
5.2 Voltage regulation and line efficiency
5.3 Performance of short transmission lines
5.4 Performance of medium transmission lines
5.5 Performance of long transmission lines.

6. Underground cables **8**

6.1 Types of cables
6.2 Ionisation cables
6.3 Construction of Extra High voltage cables
6.4 Standard size of cables and their field of applications
  6.4.1 Specification of underground cable
6.5 Construction of (a) PILC Cable (b) XLPE Cable (c) PVC Cable
6.6 Testing of cables (as per IS Specification)
6.7 Overhead and underground Distribution system.
6.8 Methods of cable laying
  6.8.1 Method of Cable joints for (a) PILC Cable (b) XLPE Cable (c) PVC Cable
  6.8.2 Cable end Boxes
  6.8.3 Type of Tests for commissioning of cables

7. HVDC Transmission line **3**

7.1 HVDC Transmission system
7.2 Comparison of HVDC Transmission system with HVAC Transmission system

8. IE Rules 1956 **4**

8.1 IE Rules related to
  a) Overhead lines
  b) Conductors at different voltages on same supports
  c) Erection of alteration to building structure, flood banks and elevation of roads
  d) Clearance
  e) Routes
  f) Maximum intervals between supports
  g) same structure carrying the Telecommunication lines
  h) Lines crossing or approaching each other
  i) Guarding
  j) Service from OH Line
  k) Earthing
  l) Metallic bearer wire used for supporting insulated cables
  m) Protection against lighting
  n) Unused overhead lines

9. ***Class Test*** **2**

REFERENCE BOOKS :

(a) Power Installation (Overhead lines) by S.R.Chakravorty, Venus publishers.
(b) Electrical Power by S.R.Chakravorty, Venus publishers.
(c) Principle of Power System by V. K. Metha
(d) IE Rules
(e) Relevant B.I.S. Spécifications

POWER ELECTRONICS

L	T	P	**Code.: EEE 409**
3	1	2	

Total Contact hrs.:
Theory: 45
Tutorial:15
Practical: 30
Credit: 5

Total marks: 150

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: 25
P.A.: 25

RATIONALE:

Power Electronics is an interdisciplinary area using the members of Thyristor family and control electronics to control the switch ON and switch OFF processes of the devices and principles of control theory. The field of control electronics also had a great change from analog control system to the digital integrated and microprocessor control. The area of power electronics had a two sided development (a) the semiconductor devices of improved performance and (b) control circuit of these devices. Thus the care has been taken to include the study of the characteristics of the power devices which are being used and also their control circuits.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hour
1.	Power Electronic Devices	10
	1.1 Construction, working principle, symbol, characteristics and application of Power Diodes, Power Transistors, SCR, UJT, DIAC, TRIAC, PUT, IGBT, GTO.	
	1.2 Control characteristic of power devices.	
2.	Thyristors	3
	2.1 Terminal characteristics of Thyristors.	
	2.2 Switching characteristics of Thyristors.	
	2.3 Thyristor protection.	
	a) Need of protection	
	b) Over voltage and over current protection	
	c) dv/dt and di/dt ratings of thyristor	
	d) Use of snubber circuit	
	e) Use of free wheeling diode	
	2.4 Heating, cooling and mounting of thyristors.	
	2.5 Series and parallel connection operation of thyristors.	
	2.6 Firing circuits for thyristors.	
3.	Thyristor Commutation Techniques	4
	3.1 Types of commutation	
	3.2 Natural commutation	
	3.3 Forced commutating method	
	3.4 Series resonance/current commutation	
	3.5 Voltage commutations	
	3.6 Auxiliary thyristor for commutation	
	3.7 External pulse commutation	
4	Phase Controlled Rectifiers	5
	4.1 Principle of phase control (Single phase Half-wave circuit with RL Load and free	

willing diode).
4.2 Full wave controlled converters (Single phase).
4.3 Three phase thyristor converters.

5 Choppers 5
5.1 Principle of operation of choppers
5.2 Types of chopper circuits (A type to E-type)
5.3 Thyristor choppers circuits

6 Inverters and UPS
6
6.1 Working principle of inverter
6.2 Inverter circuits using transistor and thyristor and their comparison
6.3 Series and parallel inverter using thyristor
6.4 Pulse width modulation (PWM) circuit
6.5 Block diagram of UPS

7 Cyclo-converter 5
7.1 Operating principle of cyclo-converter
7.2 Types of cyclo-converters
7.3 Single phase to single phase and Single phase to bridge cyclo-converter

8 Industrial Applications 5
8.1 Speed control of D.C. motor using armature voltage control and chopper circuit.
8.2 Different types of speed control methods for induction motor such as stator voltage control, frequency control
8.3 Electronic Heating
8.4 Power regulation using SCR and TRIAC.

9 Class Test 2

List of Experiments

1. Use relevant instruments to determine the performance of Thyristor, TRIAC & DIAC.
2. Use relevant instruments to determine the time delay relay circuit in UJT relaxation oscillator
3. Use TRIAC as AC load control
4. Use relevant instruments to determine the performance of IGBT & GTO
5. Use a PUT to develop Relaxation oscillator circuit
6. Assemble a snubber circuit and comment on its performance
7. Assemble a SCR commutating circuits and comment on its performance
8. Assemble a Chopper circuit using SCR and comment on its performance
9. Use chopper circuits to control Speeds of DC motor
10. Assemble a parallel inverter using two thyristors
11. Assemble a cyclo-converter circuit using thyristors and comment on its performance
12. Use thyristor -UJT circuit to control speeds of a universal motor.
13. Use computer simulations for the above lab experiences

REFERENCES BOOKS

1. Thyristor Engineering by Berde, M.S., Khanna Pub. New Delhi, latest
2. Power Electronics by Bimbhra, P.S., Khanna Pub. New Delhi, 1996
3. Laboratory Manual on power electronics by Earnest, Joshua, Mathew, Susan S., Walkey, A.S., Soni, Shyamoli, TTTI, Bhopal, 2002
4. Power Electronics by Rashid, M.H., Prentice Hall of India, New Delhi, latest
5. Power Electronics by Sen P.C., Tata McGraw Hill New Delhi, 1999
6. Power Electronics by Vithayathil, Joseph, McGraw Hill, New York, 1994

ELECTRICAL & ELECTRONIC WORKSHOP

L	T	P	**Code : EEE 410**
0	2	4	

Total Contact hrs.:
Theory: Nil
Tutorial: 30
Practical: 60
Credit: **4**

Total marks: 100

Theory:
End Exam: Nil
P.A.: Nil
Practical:
End Exam: 50
P.A.: 50

RATIONALE:

The role of the subject Electrical & Electronics Workshop is very important in building up the career of a technician. It is necessary to learn the concepts, skill, process/technique and develop attitude to work. The concept can be learned in the lecture classes, but for developing skill, learning the process or technique or to develop the attitude to work can be acquired by attending the workshop. In this curriculum, case has been taken to include such type of the job which are encountered frequently in the day to day life of an electrical & electronics technician. The jobs are arranged in such a manner that the technicians will learn the technique of solving problems and importance of the IE rules and IS specifications.

DETAILED COURSE CONTENT

ELECTRICAL WORKSHOP (Any Ten)

Unit	Topic / Sub Topic	Hour
1.	Identify different type of tools and accessories used in electrical work shop and prepare a list with diagram.	
2.	Study the safety practices in Electrical workshop and prepare a brief Instructional manual.	
3.	Dismantle a ceiling fan using screw driver, wrenches, bearing puller etc and prepare a list of components.	
4.	Dismantle and assemble single phase and three phase pump motor using screw drivers, wrenches, bearing puller and prepare the list of components.	
5.	Perform the preventive maintenance operation of a three phase induction motor along with the servicing of star/delta starter and single phase preventor circuit (Maintenance schedule and maintenance log book must be prepared as per bureau of Indian Standard	
6.	Perform the connection of a wiring installation for (a) incandescent lamp Controlled by a reed switch (b) 5 amp. 230v. 3 pin socket controlled by a Reed switch (c) a ceiling fan controlled from a reed switch through a miniature Circuit breaker with neon indicator must be used.	
7.	Perform the wiring connection of twin fluorescent lamp (Stroboscopic effect elimination and power factor improvement methods must be practiced.	
8.	Assemble a Semi Automatic star Delta starter using contactors and time delay and thermal over load unit.	
9.	Assemble a Direct on line starter using contactor, thermal over load and Single phase preventer circuit.	
10.	Practice the winding of coils for small transformers, and assemble it in stamping	

	of cares finally perform the testing.	
11.	Perform the Megger testing of a wiring installation and fill in the test report form of the Electric Supply authorities. (The conventions stipulated in IE Rules and IS specifications must be practiced)	
12.	Perform the resistance measurement of an earth installation using earth Megger testing equipment (The convention stipulated in IE Rules and IS Specification must be practiced).	
13.	Assemble the coils of stator Rotor of an induction motor after using different type of insulating materials and locking wedges.	
14.	Perform the testing of insulation resistance of the stator and rotor of 3 phase 400v wound rotor induction motor.	
15.	Perform the good and bad test of (a) Diode (b) transistor (c) resistor (d)inductor (e) capacitor by digital Multimeter.	
16.	Solder the joints of (a) 12 SWG solid copper conductor using 65 watt 230 V. soldering Iron (b) Six numbers of 10 amp. 1000 V. Diode with heat sink and connecting lugs by 35 watt 230 V. soldering iron. (c) a 8 pin DIP base on printed circuit vero board by 18 watt 230V. leakage free soldering iron using of tweeters, nippers, pliers are to be practiced. De-soldering of above job.	
17.	Perform the installation work of a 5 KW 400 v. motor. The work Should be completed with (a) foundation detail (b)layout of the system (c)list of connection (d) testing method.	
18.	Study and trace wiring installation of building and prepare the single layout diagram with full specification of the accessories and control gears used.	
19.	Practice the fixing of porcelain insulators, safety devices on the arm Steel pole (uses of the specification of Bureau of Indian Standard Specification).	
20.	Assemble the string insulator.	
21.	Assemble a 400 V. Distribution panel using (a) Miniature circuit Breakers (b) MCCB (c) CT with ammeter and selecting switch (d) Voltmeter with selecting switch.	

ELECTRONIC WORKSHOP

1 Electronic Components Identification

1.1 Identify & compare of the following components:
Resistors (carbon, wire wound and metal film), potentiometer
Capacitors (electrolytic, ceramic, mica, silver mica, paper, polystyrene, metalized polystyrenes) Active devices (transistor, diode and IC's)

2 Soldering

2.1 Identify solder materials fluxes and soldering iron
2.2 Study method of soldering
2.3 Discuss defects in soldering and precautions
2.4 Practice component soldering and earthing
2.5 Familiarize different types of soldering irons, mains operated, battery operated, high and low leakage, adjustable bit types
2.6 Identify different grades of soldering materials
2.7 Discuss precautionary measures for soldering semiconductors and ICs

3 PCB Testing

3.1 Design the Printed Circuit Board (PCB) layout for simple electronic circuit
3.2 Make of PCB, given the artwork
3.3 Practice fitting of components and completing the above circuit
3.4 Test the circuit and corrections if any for proper functioning

4 Cables & Connectors

4.1 Identify various types of cables:
Co-axial cable, Twisted pair cable, Flat ribbon cable, Fibre optic cable
4.2 Identify and use various types of connectors:
BNC connector, Banana connector, Crocodile connector, Male and female D type connector, Flat cable connector, Printed circuit connector, UTP connector

5 Other Accessories and Instruments

5.1 Use tools and accessories in manufacturing of electronic circuits.
a) Different types of cutters, Nose pliers, Wire strippers, Screw drivers, Lead strengtheners, Extractors,
b) Soldering station, Desoldering pump
5.2 Study functions, setting and use of Display devices/ indicators and recorders in Panels
5.3 Identify and use different types of switches
5.4 Study setting and use of Common Measuring Instruments and equipments used in electronic applications : Multimeter, AC voltmeter, AC and DC ammeter, LCR meter, Regulated power supply, CRO, Function Generator

6 Assembling of Simple Electronic Circuits

6.1 Assemble and test few simple circuits like
a) Battery eliminator
b) IC regulator circuits
c) IC timer circuit
d) IC operational amplifier circuit

List of Experiments (Any Six)

1. Identification and use of different tools and accessories used in manufacturing of electronic circuits.
   a) Different types of cutters.
   b) Nose pliers
   c) Wire strippers
   d) Screw drivers
   e) Lead strengtheners
   f) Extractors
   g) Soldering iron
   h) Desoldering pump
   i) Crimping tool
2. Use of regulated power supply. Font panel controls and their functions.
3. Use of DC and AC voltmeter and ammeter to measure DC and AC voltage current.
4. Use of analog multi-meter to measure.
   a) AC and DC voltage
   b) AC and DC current
   c) Different resistor
   d) Continuity testing.
5. Use of digital multi meter to measure:
   a) AC and DC voltage
   b) AC and DC current
   c) Different resistor
   d) Continuity testing.
6. Use of different switches
   b) Toggle switches – SPST, SPDT, DPST, DPDT
   b) Thumb-wheel switches
   c) Rotary switches
   d) Push on/Push off switches
   e) Keyboard switches – mechanical, capacitive, membrane
   f) DIP switches
7. Use of different display devices
   a) LED display
   b) Seven segment display
   c) LCD display
8. Prepare computer network cable (use different type of cable and connector)
9. Use of breadboards to implement simple electronic circuits using resistors/ capacitors/diodes/transistors/switches/display devices.
10. Prepare two simple electronic circuits using general purpose PCBs.
11. Prepare two PCBs for simple electronic circuits.
12. Circuit assembly on breadboards and PCBs (rectifiers, oscillators, amplifiers).

REFERENCE BOOKS :

1. Electrical Installation Work by TG Francis (Sixth Edition) ELBS
2. Electrical Equipment Testing & Maintenance by AS Gill (Rusteen Publishing Company, PHC)
3. Printed circuit board : Design & technology by William Bosschart, Tata McGraw Hill, New Delhi.

4. Electronic Drafting & Drawing by Y.I. Shah, Jeevandeep Prakashan, Ramdeet, Mumbai.
5. Basic Electronics & Linear circuits by Bhargava & Gupta, Tata McGraw Hill; New Delhi.
6. Practical Semiconductor Data manuals by BPB Publications; New Delhi.
7. Transistor selector data manual by Towers International, BPB Publications; New Delhi.

HEAT ENGINE

L	T	P	Code : EEE 411
3	0	0	

Total Contact hrs.: 45 **Total marks: 100**
Theory: 45
Practical: Nil;
Credit: 3

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: Nil
P.A.: Nil

RATIONALE:

Heat Engine which is an important subject in Mechanical Engineering is also very essential for Electrical & Electronics Engineering students. This subject covers the concepts on properties of steam, steam boilers, working principles of reciprocating steam engine, steam turbine, condenser and internal combination engine.

DETAILED COURSE CONTENT

Unit	Topic / Sub Topic	Hours
1.0	**Properties of Steam**	**7**
	1.1 Difference between gas and vapour	
	1.2 Phase diagram for formation of steam from ice	
	1.3 Definition of saturated temperature and pressure, sensible heat, total heat, dry ness fraction, entropy of vapour.	
	1.4 Types of steam e.g., wet, dry saturated steam, superheated steam, and degree of superheat	
	1.5 Dryness fraction of steam by separating & throttling calorimeters.	
	1.6 Non-flow process of vapour and their representation on P-V, T-S and H-S diagrams	
	1.7 Flow process of vapours	
2.0	**Steam Boilers**	**6**
	2.1 Functions and working principles of boilers	
	2.2 Construction, mountings accessories, pressure parts and pipe fittings of modern type of boilers	
	2.3 Quality of boiler fuel	
	2.4 Burning equipment and ash handling mechanism	
	2.5 Chimney draught and state its measurements	
	2.6 Process of feed water treatment	
3.0	**Reciprocating Engine**	**6**
	3.1 Working principle of steam engine and its field of use	
	3.2 Rankine cycle	
	3.3 Types of engines	
	3.4 List the components of engine & state their functions	
	3.5 Speed governing system of steam engine	
	3.6 Describe the indicator diagram	

3.7 Definition of (a) mean effective pressure (b) indicated horse power (c) brake horse power (d) Thermal efficiency (e) mechanical efficiency

4.0 Steam Turbine **8**

4.1 Function and working principle of steam turbine
4.2 Difference between steam engine and steam turbine
4.3 Functions of (a) nozzles (b) blades (c) casing (d) wheels (e) rotors (f) diaphragm and glands
4.4 Impulse and reaction, simple and compound, single and multistage turbine
4.5 Compounded impulse turbine e.g., (a) pressure compounded (b) velocity compounded (c) pressure velocity compounded
4.6 Pressure and velocity diagram of all above turbines
4.7 Losses of turbine
4.8 Velocity diagram of single stage impulse turbine
4.9 Work done, output and efficiency
4.10 Speed governing system of the turbine

5.0 Condenser **6**

5.1 Function and classification of surface and jet condensers and air pumps
5.2 Effect of vacuum in condenser
5.3 Vacuum efficiency and condenser efficiency
5.4 Amount of cooling water required and the mixture of vapour & air
5.5 Source of air in condensers

6.0 Internal Combustion Engine **10**

6.1 Difference between internal and external combustion engine
6.2 Classification of IC engine
6.3 Working principles of two stroke cycle and four stroke cycle of petrol and diesel engine
6.4 Definition of (a) cycle of operation of four stroke otto (b) diesel and dual combustion cycle (c) cycle efficiency (d) comparison between otto and diesel cycle (e) two stroke otto (f) diesel cycles (g) scavenging
6.5 Petrol engines, engine parts cylinder, piston, piston ring, connecting rod, crank and crank case, cam and crank-shaft
6.8 Diesel engine and its parts.
6.8.1 Description of (a) fuel injection system (b) cooling system (c) exhaust system (d) governing system (e) lubricating system both for CI and SI engine

7.0 Class Test **2**

REFERENCE BOOKS:

1. Heat Engine; TP Mukherjee, M Dutta & Co.
2. Thermal Engineering; PL Ballaney; Khanna Publishers
3. Thermal Engineering; BK Sarkar, Tata Mc Graw Hill Publishing Company

APPLIED TECHNOLOGY COURSES

ANALOG ELECTRONICS

L	T	P	**Code : EEE 501**
3	1	2	

Total Contact hrs : *Total Marks: 150* **Theory: 100**
Theory: 45 End Exam: 75
Tutorial:15 P.A.: 25
Practical: 30 **Practical:**
Credit: 5 End Exam: 25
P.A.: 25

RATIONALE :

This course is included so that the students learn the facts, concepts, principles and procedure of linear analog integrated circuits and their applications in Electronics, so that he/she can use this knowledge in acquiring the supervision skill, proto type testing skill and investigation skill which in turn, will help in discharging his/her role as a supervisor in the industry or as an entrepreneur.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours

1. Concept of Integrator Circuits: **2**

1.1 Definition of the term IC and its uses.
1.2 Different types of ICs.
1.3 Merits and demerits of ICs.
1.4 Classification of the packages of ICs .
1.5 Difference between digital & linear ICs. (Explain the three basic temperature. Grades of IC).

2 Differential Amplifiers **5**

2.1 Circuit diagram and operating principle of differential amplifier using BJT & FET.
2.2 Comparison with single transistor based CE amplifier.

3 Operational Amplifiers **7**

3.1 Introduction to OPAMP: electrical properties, transfer characteristics and parameters of ideal OPAMP and real OPAMP, block diagram and operating principles of OPAMP, OPAMP configuration – open & closed loop, necessity of feedback in OPAMP and applications.
3.2 OPAMP ICs : Circuit, block schematic, symbol, pin diagram, specification, rating, operating principle & field of applications of IC 741, inverting and non-inverting modes, assumptions for ideal OPAMP, virtual ground concept.
3.3 Compensation techniques: Offset error voltage & current in real OPAMP compensation techniques.
3.4 DC characteristics of OPAMP, input bias current, input offset current, input offset voltage and thermal drift rate, AC characteristics of OPAMP- frequency response, slew rate.
3.5 Differential gain, input & output resistances, CMRR and effect of negative feedback on OPAMP.

4 OPAMP Applications **7**

4.1 Amplifiers: Inverting & non-inverting, unity gain (voltage follower/buffer) and summing amplifier, scalar, adder, subtractor/ difference amplifier, Integrator and Differentiator, AC amplifier using OPAMP

4.2 Instrumentation Amplifier: Necessity & requirement, instrumentation amplifier with linear gain control using 2 & 3 OPAMP, field of applications

4.3 Voltage comparators: Ideal and real voltage comparators, schmitt trigger circuit, block schematic, pin diagram of IC 710, field of applications as peak detector, peak to peak detector, zero-crossing detector, window detector.

4.4 Phase locked loops (PLL): Necessity of PLL, block diagram and operation principle of PLL, transfer characteristics of PLL, definition of parameter – lock range, capture range and pull-in-time, field of applications, circuits, block schematic pin diagram specification, ratings, operating principle of PLL IC – 565.

5 Active Filters & Passive Filters **6**

5.1 Necessity, classification & application of filters

5.2 Passive filter circuits: High pass, low pass, band pass and band select filters using passive components (R,L,C), transfer characteristics and operating principle merits and demerits, field of applications

5.3 Necessity & classification of active filters

5.4 Active filter circuits low pass and high pass, notch filter circuits using OPAMP IC and operating principle, merit & demerit comparison of passive and active filters field of applications

6 Waveform Generators **6**

6.1 OPAMP as a square wave and triangular wave generator, Multivibrators, astable, monostable & bistable multivibrators, Schmitt trigger.

7 Electronic Timers **4**

7.1 Electronic timer : basic principle, classification, applications

7.2 Timer IC : Circuit, block schematic, pin diagram, salient features specifications, ratings & operating principles of IC's 555

7.3 Applications of IC 555

8 Voltage Regulators **6**

8.1 Voltage regulators: Linear & switching regulators Linear voltage regulators: Circuit, block schematic, Pin diagram, salient features

8.2 Specifications, ratings & operating principle of IC's voltage regulators circuits.

9 Class Test **2**

List of Experiments

Analyse the performance of following circuits:

a) DC voltage regulator circuit using IC 723 or IC 3085.
b) Single ended/Double ended BJT Difference amplifier.
c) Operational amplifier IC 741-calculations of OP-AMP Parameters.
d) OPAMP Inverting/non- Inverting amplifier.
e) OPAMP Adder/Subtractor.
f) OPAMP Instrumentation amplifier.
g) OPAMP Schmitt trigger

h) IC 710 voltage comparator (window detector)
i) PLL IC 565 as Frequency Synthesizer
j) Astable Multivibrator using OPAMP.
k) Monostable Multivibrator using OPAMP.
l) Bistable Multivibrator using OPAMP.
m) DC time relay using IC 555.
n) Astable, monostable, bistable multivibrators using IC 555.

REFERENCE BOOKS :

1. OP-AMPS & Linear IC's by Botkar, K.R.; Khanna publishers, New Delhi.
2. OP-AMPS by Clayton, G.B; Wiley Eastern Ltd., New York.
3. OP-AMPS & Linear Integrated Circuits by Gaikwad, R.; Prentice Hall India Ltd., New Delhi.
4. OP-AMPS Graeme & Toby, Wiley Eastern Ltd., New York.
5. Micro Electronics Millman, J. Tata McGraw Hill, New Delhi.
6. Principle of Electronics by V.K.Mehta.

DIGITAL ELECTRONICS

L	T	P		
3	1	2		**Code : EEE 502**
Total Contact hrs.:			**Total Marks: 150**	**Theory:**
Theory: 45				End Exam: 75
Tutorial:15				P.A.: 25
Practical: 30				**Practical:**
Credit: 5				End Exam: 25
				P.A.: 25

RATIONALE:

This course provides students a structured approach to learning the principles and practical applications of digital electronics used by computers, electronics & communications equipments, and control systems. Through a balanced series of lectures, computer-based exercises, and hands-on laboratory sessions, the student will acquire a solid foundation in digital logic including gates, binary numbers, flip-flops, registers, counters, display devices, and applications of Boolean algebra.

DETAILED COURSE CONTENTS

Unit	Topic / Sub Topic	Hours

1. **Number System** **5**
   - 1.1 **B**inary number system, conversion of decimal number to binary number and vice versa, octal number system, hexadecimal number systems and their conversion.
2. **Binary Arithmetics** **5**
   - 2.1 **B**inary addition and subtraction, Negative number and compliment arithmetic, Binary multiplication and division
   - 2.2 Elements of logic and truth tables.
3. **Logic Gates** **6**
   - 3.1 OR and AND gates, NOT operation, NOR and NAND gates, AND, OR, INVERT Gate, EXOR, EX NOR gate.
4. **Boolean Algebra** **6**
   - 4.1 **T**heorems of Boolean algebra,
   - 4.2 Karnaugh map and entering the data in the map, minimization Tool (max variable)
   - 4.3 Minimization of Boolean Expression using above methodologies.
5. **Binary Code** **4**
   - 5.1 BCD - weighted EBCDIC, ASCII CODES ERROR detection and correction-alphanumeric codes,
   - 5.2 Decoders and display – Decimal Decoder, Seven segment decoders.
6. **Flip Flop** **6**
   - 6.1 RS clocked and R.S. flip flops, T and D-flip flops – J.K. flip flops, Construction details and operating principle.
7. **Types of Digital Circuits** **6**
   - **7**.1 Combinational circuit

a) Half-adder & subtractor
b) Full adder & subtractor
c) Decoder, Encoder, Multiplexer (4 :1, 8 :1) & Demultiplexer (1:4, 1:8)
d) Designing circuit for seven segment Display

7.2 Sequential circuits
a) Counter and registers
b) Synchronous and Asynchronous
c) Decade counter, series shift registers, shift counter, parallel shift register.

8. **Elements of ICs** **5**

8.1 Internal configuration TTL-RTL-ECL-IIL Logic- only description will be given. No analysis is required.

9. **Class Test** **2**

List of Experiments

A. Experiments by using Digital Trainer Kit
1. Verify truth Tables for AND, OR, NOT, Exclusive-OR gates
2. Develop exclusive-OR gate using basic building block
3. Develop the half adder and full adder circuit and verify the truth table
4. Connect a 4-bit parallel full adder circuit and verify the Truth Table
5. Connect four Flip Flop circuit to develop a four bit ripple counter
6. Connect a J.K. Flip Flop circuit and verify the truth table for various input of J and K
7. Connect 4 Flip Flop with "Pre" and "CLR" input terminal for developing different type of shift registers
8. Connect the 7492 counter chip to develop different module counter
9. Connect the 7490 decade counter with display decoder system for showing the counting operation
10. Connect the XOR circuit to develop parity bit checker

B. Experiments by using bread board and IC chips
1. Develop a 3 to 8 decoder circuit
2. Develop a set-reset Flip Flop by using 7400 (NAND Gate) chip
3. Develop a two digit counter by using 7490, 7448 & seven segment Display
4. Develop a 4 to 1 multiplexer circuit by using discrete chips
5. Develop a up down counter circuit by using Flip Flops and AOI (And OR Invert) circuits
6. Connect the DAC chip MC1408 L or 0800 in the circuit to check the conversion process
7. Connect the ADC 7109 on the circuit to check the conversion process

REFERENCE BOOKS :

1. Switching Theory & Digital Electronics by V. K. Jain
2. Digital Electronics and computer by R.K. Gaur.
3. Digital Circuits and Design by S Salivahanan, Vikas Publishing House

SWITCH GEAR AND PROTECTION

L	T	P	**Code.: EEE 503**
3	0	0	

Total Contact hrs.:45 **Total marks: 100** **Theory:**
Theory: 45 End Exam: 75
Practical: Nil P.A.: 25
Credit: 3 **Practical:**
End Exam: Nil
P.A.: Nil

RATIONALE :

Switch gear and protection plays an important role in the Electrical power system. Since the demand of Electrical power is increasing, the job of generation, transmission and distribution of Electrical Energy is becoming very complicated. The modern technique of efficient generation, transmission and distribution is coming up regularly. The uses of inter connected bus (National power grid) is increasing day by day. For the job of operation, maintenance and repair work, the service of electrical technicians are very essential. In this subject a lot of information is provided so that the updated knowledge can be given to the student of Diploma in Electrical & Electronics Engineering.

DETAILED COURSE CONTENT

Unit	Topic / Sub Topic	Hours

1. **Protective Relays** **4**
1.1 Causes of faults
1.2 Relay protection : construction and working principles
1.3 Zones of protections
1.4 Primary and back up protection

2. **Relay Application and characteristics** **4**
2.1 Functions and operating principle of
(a) over current relays (b) instantaneous over current relay (c) directional relays (d) directional over current relays and their connections (e) distance relays (f) Impedance relay (g) differential relays

3. Feeder Protection **10**
3.1 Protection and their selection
3.2 Principle of over current protection in respect of
(a) non-directional time and current grading (b) directional time and current grading (c) over current earth fault protection (d) directional earth fault relays
(e) Earth-fault detection in systems earth through A.C. suppression oil
3.3 Principle of distance protection in respect of
(a) effect of the ratio source Impedance to line impedance (Zs / Zv) (b) time grading of distance relays (c) fault resistance (d) distance protection by impedance relays (e) MHO distance protection.
3.4 Pilot protection in respect of (a) wire pilot protection (b) carrier and Microwave pilot protections
3.5 Apparatus protection
3.5.1 Transformer protection
3.5.2 Description of (a) the nature of transformer faults (b) Faults in Auxiliary equipment (c) winding faults (d) overloads and external start-circuits (e)

differential protection of transformers (f) earth leakage protection (g) Gas actuated relays (h) transformer feeder protection

4. Generator Protection **6**

4.1 Type of generator faults e.g.
(a) stator fault (b) Rotor fault (c) Abnormal running conditions

4.2 Description of (a) the stator protection systems (b) the rotor protection systems (c) over load protection (d) prime mover protection (e) over voltage protection

4.3 Protective scheme for a direct connected generator

4.4 Protection of generator transformer unit and relay tripping functions

5. Motor protection **3**

5.1 Describe different type of motor faults

5.2 Describe the protection systems of (a) stator (b) rotor (c) over load

6. Bus Zone protection **3**

6.1 Different type of Bus Zone faults

6.2 Explanation of (a) Bus backup protection (b) differential scheme of Bus Bar protection.

7. Lighting Arrestors **4**

7.1 Construction and functions of the following

(a) Ground wire (b) Horn gap arrestors (c) Pellet type oxide film arrestors

(d) Thyrite arrestor (e) Auto valve arrestor (f) Location of the connection of lighting arrestors from transformer.

8. Static Relays **3**

8.1 Basic principle for the development of static Relay

8.2 Principle of operation of

(a) Electronic relay (b) transductor relay (c) Rectifier bridge relays (d) transistor relays (e) Hall – effect relays (f) gauss effect relays

9. Circuit Breakers **3**

9.1 Theory of circuit interruption

9.2 Types of Circuit Breakers

9.3 Working principle of OCB, ACB, SF_6 and Vacum Circuit Breakers

9.4 Rating of a circuit Breaker

10. Fuse **3**

10.1 Types of Fuse

10.2 Construction and working principle of different types of fuses.

11 Class Test **2**

REFERENCE BOOKS :

(a) Power system protection and switch gear by B Ravindranath E-M- chamder; (New Age (p) Ltd. Publishers)

(b) Switchgear and Protection by Sawhney

(c) Switchgear and Protection by Dr R.S.Jha

MICROPROCESSOR, MICROCONTROLLER & ITS APPLICATIONS

L	T	P	**Code : EEE 504**
3	1	2	

Total Contact hrs.:
Theory: 45
Tutorial:15
Practical: 30
Credit: 5

Total marks: 150

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: 25
P.A.: 25

RATIONAL:

Though the progress and advancement in the area of microprocessor and microcontroller is very fast, the study of the basic principles e.g. the study of digital building blocks and 8085A system is still continuing. Though the field is very vast, the whole subject covers 8085 microprocessors & interfacing devices, 8051 Microcontroller and applications of microprocessor and microcontroller. A lot of laboratory exercises have been included for better understand of the subject.

DETAIL COURSE CONTENT

Unit	Topic Sub-Topic	Hours
1.	**Micro Computer System and hardware** 1.1 Structure of a micro computer 1.2 Explanation of (i) Programme (ii) Memory (iii) Input / output (iv) CPU 1.3 Micro computer organization and the function of a micro processor 1.4 Generic architecture of a microprocessor with its functional components (e.g. registers ALU, timing & control unit and control signals) 1.4.1 Description of (a) various registers (general purpose register and special purpose register) (b) general capability of ALU (c) various control signals (d) functions of internal and external buses. 1.5 Various functional components of 8085 Microprocessor	6
2.	**Memory and Memory Organization** 2.1 Memory organization with reference to microprocessor 2.2. Static and dynamic RAM 2.3. Description of (a) ROM, PROM, EPROM (b) memory address decoding (c) various forms of storage in microprocessor	5
3.	**Elements of Programming** 3.1 Binary and Hexadecimal number systems 3.2 Description of (a) instruction code (b) the need for assembly language (c) role of assembler 3.3 Merit and demerit of instruction length 3.4 Field of instruction 3.5 Role of flags 3.6 Op-code fetching modes 3.7 Time requirements of instructions	5

4. ***Instruction Set*** **5**

4.1 Data Transfer & Arithmetic group of Instruction of 8085 A

4.1.1 Data transfer and arithmetic group of instructions

4.1.2 a) Number of T states, machine cycles, addressing modes associated with each instruction (b) the effect of the instruction on flags if any

4.1.3 Small programs using these instructions

4.2 Logical group & Branch group of Introduction for 8085 A

4.2.1 Explain the logic and branch group of restriction

4.2.2. Number of T states, machine cycles, addressing modes associated with each instruction.

4.2.3 Instruction to illustrate logic and branch operations.

5. **Interfacing of INPUT/OUTPUT Devices** **5**

5.1 Decoding the address assigned to an Input/Output part

5.2 Process of interfacing.

5.3 Comparison between I/O mapped I/O and memory mapped I/O interfacing with microprocessor

6. **Interfacing Peripherals** **6**

6.1 Interfacing of 8 bit ADC/DAC with microprocessor

6.2 Interrupts and basic techniques of data transfer

6.3 Internal structure of Programmable Peripheral Interface 8255A and method of interfacing,

6.4 Internal architecture of Programmable interval Timer / Counter 8253.

6.5 Direct Memory Access operation.

6.6 Introduction to serial I/O and data Communication.

7. **Microcontroller** **6**

7.1 Introduction

7.2 Comparison between the Microcontroller 8051 with 8-bit microprocessor

7.3 8051 Microcontroller hardware

7.4 Description of (a) the Input/Output Pins, Ports and Circuits (b) external memory (c) counters and Timers (d) Serial Data Input/Output (e) Interrupts

7.5 PIC Microcontroller with instruction set.

8. **Applications of Microprocessor and Microcontroller** **5**

8.1 Microprocessor based stepper motor control

8.2 Temperature controllers

8.3 Liquid level controller

8.4 Data acquisition systems

9. **Class Test** **2**

List of Experiments:

1) Examine the 8085A training Kit, identify the microprocessor, Keyboard interface chip, Input Output Interface Chip, Programmable timer/counter chip, serial communication chip, interrupt controller chip, RAM and ROM area.

2) Move a data (a) by immediate addressing (b) from register to register (c) register to memory (d) memory to registers
3) Add two hexadecimal numbers
4) Subtract one hexadecimal number from other
5) Add five hexadecimal numbers which are stored in 5 successive memory location
6) Arrange five random hexadecimal numbers in memory locations in a sequential order (Starting from highest to lowest)
7) Divide two hexadecimal numbers and convert the result from hexadecimal to decimal value
8) (a) Develop a time delay subroutine (b) To convert 5 hexadecimal number into its corresponding Analog Value and display it on CRO screen using the time delay subroutine.
9) Convert the analog values into its corresponding digital value and display it in the address and data field
10) Develop a Programme for driving a stepper motor
11) Develop a Programme for a Running display of HELP US in Address and Data field
12) Develop a Programme for Traffic Control System
13) Develop a Programme to display the second and Minute of a clock
14) Develop a Programme to control a Coffee Vending Machine
15) Develop a Programme for the operation of a counter

REFERENCE:

1. Microprocessor, Architecture, Programming and Application with the 8085/8080A by Rames S.Gaonkar (PHI)
2. Introduction to Microprocessor by A.P. Mathur (TMH)
3. Microprocessor by Rafiquazzaman
4. Microprocessor & Microcomputer by Malvino

INSTRUMENTATION AND CONTROL

L	T	P	**Code : EEE 505**
3	1	2	

Total Contact hrs.: **Total marks: 150** **Theory:**
Theory: 45 End Exam: 75
Tutorial:15 P.A.: 25
Practical: 30 **Practical:**
Credit: 5 End Exam: 25
P.A.: 25

RATIONALE:

Due to widespread of automation in Industry, the study of instrumentation and control has become very essential. Since the whole system is a combination of analog and digital system, so the topics on both the systems have been included as the course of studies. Along with the topics of sensors & its characteristics and its interfacing techniques with both analog and digital system will be discussed under this subject. The first hand knowledge on Data Acquisition System has also been included.

DETAIL COURSE CONTENT

Unit	*Topic / Sub Topic*	Hour

1. Basic Concepts of Instrumentation **6**

1.1 Introduction to Sensors and Transducers.

1.2 Explanation of

a) static characteristics of instruments - accuracy, sensitivity, reproducibility, drift, static calibration, static error and dead zone.

b) dynamic characteristics of instruments - speed of response, fidelity, and dynamic error.

1.3 Dynamic response of zero order, first order second Order instruments.

2. Displacement, Strain, Load and Torque Measurement **6**

2.1 Basic principle of operation and Characteristics of -

(a) Linear Variable Differential Transformer (LVDT) (b) Capacitive Transducer (c) Strain gauge (d) Load Cell (e) Torque Measuring Transducer (f) Piezoelectric Transducer

3. Temperature Measurement **6**

3.1 Relation between the three scales of temperature. (C, F, K)

3.2 Operating principle of different temperature transducer

(a) Thermistors (b) Resistance Temperature Detector (RTD)

(c) Thermocouple (d) IC temperature sensor (h) Radiation Pyrometer (total radiation)

4. Pressure Measurement **6**

4.1 Principle of operation of different pressure measuring devices

(a) Manometer (b) Bourdon Gauge (c) Bellow gauge

(d) Diaphram pressure gauge

4.2 Principle of operation of low pressure measuring Devices

(a) McLeod Gauge (b) Pirani Gauge (c) Ionization Gauge (d) Knudsen Gauge

5. Flow and Level Measurement **7**

5.1 Principle of operation of
(a) Orifice Meter (b) Venturi Meter (c) Pitot tube (d) Rotameter
(b) Ultrasonic flow meter

5.2 Principle of operation of
(a) Capacitive level sensor (b) Ultrasonic level sensor

6. **Signal Conditioning** **5**

6.1 Basic principle of
(a) D.C. and A.C. signal conditioning

6.2 Instrumentation Amplifier

6.3 Use of filter circuit

6.4 Principle of Data Acquisition and conversion system

7. **Basic concepts of Control system** **7**

7.1 Difference between open loop and closed loop systems.

7.2 Transfer function and block diagram algebra

7.3 Time response of 1st order and 2nd order system to unit step input.

7.4 Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion.

7.5 Root locus concepts, rules for construction of root loci, determination of root locus, root contours.

7.6 Proportional, derivative and integral control actions, P, PI and PID controllers.

8. Class Test 2

List of Experiments:

1. Measure displacement using LVDT
2. Measure weight using strain gauge bridge
3. Measure speed of motor using photo electric pickup
4. Measure temperature using thermocouple
5. Measure temperature using Resistance Temperature Detector (RTD)
6. Measure temperature using thermistor
7. Study performance of piezo electric transducers
8. Measure displacement with help of capacitive transducer
9. Measure pressure using load cell
10. Measure liquid level using capacitive type transducer
11. Study proportional mode of control
12. Study proportional - integral type control
13. Study proportional – integral - derivative control
14. Study performance of data acquisition system

REFERENCE BOOKS:

1. Intelligent Instrumentation by George c. Barney (PHI)
2. Electronic Instrumentation by H.S. Kalsi (TMH)
3. Principles of Industrial Instrumentation by D. Paranobis (TMH)
4. Modern Control Engineering by D.Roy Choudhury, PHI
5. Modem Control Engineering by K. Ogata , PHI
6. Control Systems Engineering by L.J. Nagrath, M. Gopal, Third Edition, New Age International Publishers.

CONSUMER ELECTRONICS

L	T	P	**Code : EEE 506**
3	1	2	

Total Contact hrs : *Total Marks: 150* **Theory:**
Theory: 45 End Exam: 75
Tutorial:15 P.A.: 25
Practical: 30 **Practical :**
Credit: 5 End Exam:25
P.A.: 25

RATIONALE:

This course is designed to provide required knowledge and skills in the communication systems such as microphone and loudspeakers. The students will also be acquainted with the systems like tape recorder, audio CD player, B/W TV, colour TV, VCR, etc. Some of the home appliances like washing machine, electronic oven, electronic heater cooker etc. are also covered in this course.

DETAIL COURSE CONTENT:

Unit	Topic/Sub Topic	**Hours**

1. Microphones 4
   - 1.1 Construction, working principle and frequency response of (a) Carbon Microphone (b) Variable Reactance Microphone (c) Capacitance Microphone (d) Piezo-Electric Microphone e) Moving Coil Microphone

2. Loudspeakers 4
   - 2.1 Constructions and working principles of Moving Coil Loudspeaker
   - 2.2 Impedance and Power Level of loudspeaker
   - 2.3 Frequency characteristics of Practical Loudspeakers : Woofer, Tweeter, Squawker – Loudspeaker Enclosure

3. Tape Recorders 4
   - 3.1 Principle of magnetic recording and playback, Requirement of bias.
   - 3.2 Working principle with block schematic diagram of a tape recorder system

4. Black and White TV System 10
   - 4.1 Working principle with block diagram of TV transmitter and receiver
   - 4.2 Circuit diagram: TV Tuner, Video IF stage, Sound stage, Picture tube & its associated circuit, Synchronizing circuits, Automatic Gain Control (AGC), Horizontal & vertical deflection circuits, EHT section, Remote control of a TV receiver.

5. Colour TV System 4
   - 5.1 Working principle of Color TV with block diagram.

6. CD Player 4
   6.1 Working principle of CD recording and CD playing

7. Cable TV System 3
   7.1 Working principle of Cable TV System.

8. Video Cassette Recorder 4
   8.1 Principle of operation of tape transport mechanism, Servo system, Time base connection.
   8.2 Block schematic description of a VCR, Control switches of VCR

9. Home Appliances 6
   9.1 Principle of washing machine, electronic oven, electronic heater with block diagram

10. Class Test 2

List of Experiments:

1. Study the internal layout of black and white TV receiver.
2. Study the Internal adjustment, control and fault finding procedure of Black & White TV.
3. Study the internal layout of colour television.
4. Study the internal adjustments control and simple troubleshooting techniques of Colour TV.
5. Study the electronic parts, internal switching and control of Videocassette recorder.
6. Study simple trouble shooting techniques of VCR.
7. Study of internal switching and controls of CD player and its simple troubleshooting techniques.
8. Study simple trouble shooting techniques of Mobile telephone Handset
9. Study simple trouble-shooting techniques of PHOTO COPYING machine.

REFERENCE BOOKS:

1. Audio and Video Systems by R. G. Gupta : Tata McGraw-Hill
2. Monochrome and Colour TV by Gulati : New Age International
3. Book Video by Newness : BPB
4. VCR-Principle Maintenance and Repair by S. P. Sharma : Tata McGraw-Hill
5. Cable TV Technology and Operation by Bartlett : Tata McGraw-Hill
6. Electronic Instruments and Systems by R.G. Gupta : Tata McGraw-Hill
7. Electronic Communication by Ruddy and Coolen : Prentice Hall of India, N. Delhi.

MAINTENANCE OF ELECTRICAL & ELECTRONIC EQUIPMENT

L	T	P	**Code : EEE 507**
3	1	2	

Total Contact hrs : *Total Marks: 150* **Theory:**
Theory: 45 End Exam: 75
Tutorial:15 P.A.: 25
Practical: 30 **Practical:**
Credit: 5 End Exam:25
P.A.: 25

RATIONALE:

The modern houses are highly mechanised. The modern housewife prefers electrical and electronically controlled gadgets rather than the conventional systems. In most cases there is no proper scope of repairing these gadget when malfunctioning starts. Our technicians also have been embarrassed when they are asked to attend the fault and suggest the remedy. Since the construction and working principles are not properly exposed to the Electrical & Electronics Diploma Holder so they are scared to open those gadget. The subject will describe the constructional detail of those gadgets and the probable causes of failure, so that the necessary repair work can be carried out either by himself or by any workmen under the guidance of the Electrical & Electronics Diploma Holders.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	**Hours**

1 **Types of Maintenance** **6**

1.1 Routine, preventive, breakdown and corrective maintenance.

1.2 Advantages of preventive maintenance and importance of planning of preventive maintenance schedule, Factors affecting the preventive maintenance schedule.

2 Principles of Testing of Electrical & Electronics Equipment **7**

2.1 Distinction between routine type and special tests

2.2 Comparison between various methods of testing such as –

a) Direct testing

b) Indirect testing and regenerative testing for efficiency and temperature rise

2.3 Equipment test and tolerances

2.4 Mechanical tests before commissioning of equipment

2.5 Electrical tests/inspections before commissioning of equipment.

2.6 Principles of testing microprocessor-based equipment

2.7 Principles of testing computer controlled electronic and electrical equipment

3 **Maintenance of Power Supply Units** **6**

3.1 Maintenance of (a) voltage Stabilisers (b) Constant Voltage Transformer (c) Uninterrupted Power Supply (d) Switch Mode Power Supply (e) Inverters

4 **Insulation Testing** **7**

4.1 Classification of insulating materials as per IS-1271

4.2 Measurement of insulating resistance and interpret from it the conditions of

insulation under different working environments

4.3 Properties of good insulation oil

4.4 The agents, which contaminate the insulating oil

4.5 Procedure for test of oil as insulator as per IS 1992
(a) Dielectric strength test (b) Acidity test (c) Sludge test (d) Crackle test
(e) Flash point test

4.6 Interpretation of results of above test and draw conclusions

5 **Maintenance of Insulation** **6**

5.1 Factors affecting the life of the insulating materials

5.2 Methods of cleaning the insulation covered with loose dry dust, sticky dirt and oily.

5.3 Cleaning, washing and drying insulation and re-varnishing procedure

5.4 Methods of external heating, internal heating and vacuum impregnation

5.5 Methods of measuring temperature of internal part of winding/machine and applying correction to measured values insulation resistance when the machine is hot

5.6 Procedure for the purification of used insulating oil

6 Trouble Shooting in Case of Breakdown 5

6.1 Significance of trouble shooting,

6.2 Need and type for trouble shooting chart

6.3 Internal/external causes for failure/abnormal operations of equipment

6.4 Reasons for occurrence of the mechanical, electrical and magnetic faults

7 Safety Regulations 6

7.1 IE ACT – statutory regulation for safety of persons and equipments

7.2 Do's and Don'ts listed in I.S. for substation operation

7.3 Understanding meaning and causes of electrical accidents

7.4 Factors on which severity of shock depends

7.5 Procedure to be followed for shut down of substation and power line

7.6 Understanding the procedure for rescuing a person who has received an electric shock

7.7 Methods of providing artificial respiration

7.8 Precautions to be taken to avoid the fire due to electrical reasons

8 Class Test 2

LIST OF EXPERIMENTS:

a) Dismantle and assemble different types of electric motors.

b) Undertake preventive maintenance schedules.

c) Develop preventive maintenance schedules.

d) Develop troubleshooting charts for each type of electrical equipment

e) Perform the following tests on insulation oil as per the latest IS specifications to interpret and draw conclusions

i) Dielectric strength test

ii) Acidity test

iii) Sludge test

iv) Crackle test

v) Flash point test

f) Inspect Visually & undertake preventive maintenance of CRO
g) Inspect Visually & clean the following measuring instruments
   i) Function generator
   ii) Multimeter
   iii) Frequency meter
   iv) LCR meter
   v) Clamp on meter etc.
h) Perform test on semiconductor devices.

REFERENCE BOOKS :

1. Operation and maintenance of electrical equipments by B.V.S. Rao, Wheeler Publishing.
2. I.S. Code on IS-1271-1958; Bureau of Indian Standards, New Delhi,
3. Indian Electricity Rules by Central Law Agency, Allahabad
4. Preventing Electrical Fires & Failures by Hattangadi, A.A. Tata McGraw-Hill.
5. Operation and Maintenance of Electrical Equipment, Vol I & II by Rao, B.V.S.; Wheeler Publishing.
6. Modern Electronic Equipment - troubleshooting, repair & maintenance by Khandpur R.S.; Tata McGraw-Hill.
7. Practical Electronic Fault Finding & Troubleshooting by Pain Robin, BH Newness, Oxford.
8. Testing, commissioning, operation and maintenance of electrical equipments by Rao, S. Khanna Publishers.

C PROGRAMMING

L	T	P	Code : EEE 508
0	2	4	

Total Contact hrs.: 90
Theory (Tutorial): 30
Practical: 60
Credit: 4

Total marks: 100

Theory:
End Exam: Nil
P.A.: Nil
Practical:
End Exam: 50
P.A: 50

RATIONALE:

This course is an introduction to the C programming language. The student will learn to write programs containing the following C language features: simple data types, one-dimensional arrays, conditional and control statements, and functions. The student will also develop programs to handle different files.

DETAIL COURSE CONTENT:

Unit	Topic/Sub Topic	**Hours**

1. Introduction to Problem Solving: **3**
Flow charts, Tracing flow charts, Problem solving methods, Need for computer Languages, Sample Programs written in C

2. C Language preliminaries: **3**
C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants

3. Input-Output: **1**
getchar, putchar, scanf, printf, gets, puts, functions.

4. Pre-processor commands: **1**
#include, #define, #ifdef

5. Operators and expressions: **2**
Arithmetic, unary, logical, bit-wise, assignment and conditional operators

6. Control statements: **2**
While, do-while, for statements, nested loops, if else, switch, break, Continue, and goto statements, comma operators

8. Storage types: **2**
Automatic, external, register and static variables.

9. Functions: **3**
Passing arguments, Function prototypes, Recursion, Library functions, Static functions

10. Arrays: **3**
Passing arrays to a function, Multi dimensional arrays.

11. Strings: **2**
Operations on strings.

12. Pointers: **3**

Declarations, Passing pointers to a function, Operations on pointers, Pointer Arithmetic, Pointers and arrays, Arrays of pointers function pointers.

13. Structures: **2**

Passing to a function, Unions, typedef, array of structure, and pointer to structure

14. File structures: **2**

Concept of record, file operations: Storing, creating, retrieving, updating
Sequential, relative, indexed and random access mode, Files with binary mode(Low level), performance of Sequential Files, Direct mapping techniques: Absolute, relative and indexed sequential files (ISAM) concept of index, levels of index, overflow of handling.

15. File Handling: **1**

File operation: creation, copy, delete, update, text file, binary file.

LIST OF EXPERIMENTS:

1. Write a program to output the following multiplication table:

   7 x 1 = 7
   7 x 2 = 14
   7 x 3 = 21
   …
   …
   …
   7 x 25 = 175

2. Write a programme to calculate the average of a set of N numbers.

3. Write a program to determine and print the sum of the following harmonic series for a given value of n:

   $$1+\frac{1}{2}+\frac{1}{3}+\ldots\ldots\ldots+\frac{1}{n}$$

   The value of n should be given interactively through the terminal.

4. The total distance traveled by a vehicle in t seconds is given by

   distance = $ut + (at^2)/2$

   Where u is the initial velocity, (meters per second), a is the acceleration (meters per second^2). Write a program to evaluate the distance traveled at regular intervals of time, given the values of u and a. The programme should provide the flexibility ot the user to select his own time intervals and repeat the calculations for different values of u and a.

5. Write a programme to read the following numbers, round them off to the nearest integers and print out the results in integer form:

   29.72 301.21 -76.73 -46.46

6. Admission to a professional course is subject to the following conditions:

a. Marks in Mathematics >=60
b. Marks in Physics >=50
c. Marks in Chemistry >=40
d. Total in all three subjects >>200

Total in mathematics and physics >=150

Given the marks in the three subjects, write a programme to process the applications to list the eligible candidates.

7. Floyd's triangle is given as follows:

```
1
2       3
4       5       6
7       8       9       10
11      12      13      14      15
…
…
…
79                                      91
```

Write a programme to print the triangle and modify it to produce the following triangle

```
1
0       1
1       0       1
0       1       0       1
1       0       1       0       1
```

8. Write a programme that will read a positive integer and determine and print its binary, octal, hexadecimal equivalents. The programme should obtain the option from the user interactively.

9. Write a programme to calculate the standard deviation of a number of data stored in an array.

10. Consider two arrays A and B containing a sorted list of data items in ascending order. Write a programme to merge them into a single sorted array C that contains every item from arrays A and B, in ascending order.

11. Write a programme which will read a string and rewrite it in the alphabetical order. For example, the word "INDIA" should be written as "ADIIN".

12. Write a programme, using recursive functions, to evaluate

$$f(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$$

Write a programme to write some integer data into a file named DATA. Then open the

file DATA to read the data items from it and store them into the files ODD and EVEN depending on whether they are odd or even respectively. Finally, the contents of the files DATA, ODD and EVEN should be printed with appropriate headings.

REFERENCE BOOKS:

1. Mastering C by Venugopal, Prasad – TMH
2. C – programming by E.Balagurusamy Tata McGray Hill
3. How to solve it by Computer : Dromey, PHI
4. Schaums outline of Theory and Problems of programming with C : Gottfried
5. The C programming language : Kerninghan and Ritchie
6. Programming in ANSI C : Ramkumar Agarwal
7. Mastering C by Venugopal, Prasad – TMH
8. Let Us C by kanetkar
9. An introduction to data structures with applications, Jean-Paul Trembly and Paul Sorenson, (2nd edition), 1884

ELECTIVE COURSES

COMMUNICATION ENGINEERING

L	T	P	**Code : EEE 601**
3	1	0	

Total Contact hrs : *Total Marks: 100* **Theory:** 100
Theory: 45 End Exam: 75
Tutorial:15 P.A.: 25
Practical: Nil **Practical:** Nil
Credit: 4 End Exam: Nil
P.A.: Nil

RATIONALE:

The knowledge of the Communication Engineering is very essential for transmitting the information for one to other. As the type of messages and information are different for different field of applications, different types of Communication Media are used. The type of modulation, transmission frequencies and media are also changed. For this reason, the study of Analogue and Digital Communication have been included in this subject.

DETAIL COURSE CONTENT:

Unit	Topic/Sub Topic	**Hours**

1. **Introduction** 5

1.1 Communication System.
- 1.2 Analog & Digital Signal
- 1.3 Concept of SNR (Signal to noise Ratio), Channel Bandwidth (BW) and rate of Communication
- 1.4 Modulation & Demodulation
- 1.5 Definition of Noise, Coding

2. Signal Analysis **5**
- 2.1 Periodic signal analysis using Fourier Series.
- 2.2 Aperiodic signal analysis using Fourier Transform.
- 2.3 Some properties of Fourier Transform.

3. Modulation (AM) **5**
- 3.1 Amplitude Modulation : Basic Concept.
- 3.2 Virtues, Limitations and Modification of Amplitude Modulation (AM).
- 3.3 Concepts of Double side Band suppressed carrier (DSB – SC), Single – Side Band, Suppressed carrier (SSB – SC) & vestigial side band suppressed carrier (VSB – SC) modulation.
- 3.4 Concept of Synchronous & Asynchronous Demodulation.
- 3.5 Design of various AM, DSB – SC, Modulator's & Demodulators.
- 3.6 Superheterodyne Receiver.

4. Angle Modulation **5**
- 4.1 The concept of generalized Angle Modulation with its types – FM (Frequency Modulation) and PM (Phase Modulation) & interconversion.
- 4.2 Types of FM with Bandwidth requirement for each of them.
- 4.3 Modulation & Demodulators of FM.

4.3.1. Indirect FM Generation (Block diagram only)
4.3.2. Direct FM Generation (Block diagram only)
4.3.3 Concept of PLL and its use as a FM demodulation (Concept only)
4.3.4 Stereo FM Transmitter & Receiver (circuit diagram only)
4.3.5 Concept of 'Pre-emphasis' & 'De-emphasis' circuits

5. Pulse Modulation **5**

5.1 Concept of PAM, PPM, PWM, PCM Modulation.

6. Digital Communication System **5**

6.1 Virtues, Limitation and modification of PCM.
6.2 Conversion of analog signal to digital signal, Pulse code, Delta Modulation and Differential Pulse code Modulation.
6.3 Concept of TDM (Time Division Multiplexing)

7. Base Band Pulse Transmission **4**

7.1 Concept of 'Matched Filter', 'Inter-symbol Interference'.
7.2 Concept of 'Nyquist's criterion' for distortionless Binary transmission.
7.3 Concept of 'Tapped – Delay – Line Equaliser'.
7.4 Concept of 'Eye pattern'.

8. Digital Passband Transmission **5**

8.1 Concept of ASK, FSK, PSK with probability of error (Formula only)
8.2 Design of Receivers & Transmitters for the ASK, FSK & PSK.

9. Concept of Spread Spectrum modulation **4**

9.1 Concept of CDMA (Code Division Multiplexing).

Class Test **2**

REFERENCE BOOKS :

1. Modern Digital and Analog Communication System by B. P. Lathi (Oxford University Press).
2. Communication System by Simon Hagkin (Wiley) (John Wiley & Sons)

MEDICAL ELECTRONICS

L	T	P	**Code : EEE 602**
3	1	0	

Total Contact hrs : *Total Marks: 100* **Theory:** 100
Theory: 45 End Exam: 75
Tutorial:15 P.A.: 25
Practical: Nil **Practical:** Nil
Credit: 4 End Exam: Nil
P.A.: Nil

RATIONALE :

The aim of this course under the 'specialised course' category is to develop some level of specialization in students of electrical & electronics engineering. In order to work in the area of medical electronics, students need to have basic knowledge about various systems of human body. Hence anatomy and physiology of some important systems are covered in brief in this subject along with electronic processing units of medical instruments. Most of the medical instruments incorporate transducers to convert biophysical parameters into electrical signals for electronic processing unit. The electronic processing unit mainly consists of signal conditional circuits, steady power supply and microprocessor-based control and measurement circuits. Therefore, this course is intended to develop understanding of various systems of human body and skills to use and troubleshoot basic electronic instruments used in the medical field.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	**Hours**
1	**Medical Terminology**	**6**
	1.1 Cell Physiology-Cell and its organelles	
	1.2 Cell electro physiology-Resting potential	
	1.3 Membrane potential and action potential, depolarization and repolarization	
	1.4 Cellular response to environment	
	1.5 Cell specialization – Nerve cell, skeletal muscle, smooth muscle, cardiac muscle	
2	**Blood and Cardio-Vascular System**	**6**
	2.1 Functions and properties of Blood	
	2.2 Determination of blood Groups	
	2.3 Anatomy of the Heart	
	2.4 Electrical activity of the heart	
	2.5 Blood pressure	
	2.6 Arterial and venous system	
3	**Respiratory, Digestive and Excretory system**	**8**
	3.1 Anatomy of the respiratory tract	
	3.2 Functions of its different tracts	
	3.3 Mechanism of respiration	
	3.4 Anatomy and functions of different parts of Gastro-intestinal tract	
	3.5 Anatomy and functions of Kidney, ureters, urinary bladder & uretra	
4	**Anatomy and Physiology of other important Human Biology Systems**	**8**
	4.1 Various endocrine glands, their secretions and functions	
	4.2 Central nervous system in brief	
	4.3 Bones and joints in short	

4.4 Anatomy and functions different parts of eye and ear
4.5 Physiology of vision and hearing

5 **Bio Electric Amplifiers** **5**
5.1 Operational Amplifiers
5.2 Basic Amplifier configuration
5.3 Multiple input circuit
5.4 Differential Amplifiers
5.5 Signal processing circuits
5.6 Isolation amplifier
5.7 Input Guarding

6 Display Devices & power supply 5
6.1 X-Y recorder, working principle
6.2 Dot matrix analog recorder
6.3 Medical oscilloscope
6.4 Emergency power supply system

7. Medical Instruments 5
Operating Principle of the following medical electronics instruments
7.1 Electro Cardiograph
7.2 Electro enceplato graph
7.3 Blood flow meter
7.4 Blood pressure meter
7.5 X ray machine
7.6 Ultrasonography

7 Class Test 2

REFERENCES BOOKS :

1 Digital Electronics : Bignell, James & Donovan Robert; Delmar, Thomson Learning, Singapore.
2 The Human Machine : Bijlani, R.L., Manchanda, S.K., National Book Trust, New Delhi
3 OPAMPS & Linear ICs : Botkar, K.R.; Khanna pub., New Delhi
4 Biomedical Instrumentation and Measurements : Cromwell L., Weibell F. J. and Pfeiffer E.A.,PHI, New Delhi
5. Linear Integrated circuits & OPAMPS : Gaikwad, Ramakant; Prentice Hall, New Delhi
6. Digital Electronics Practical : Jain, R. P.; Tata-McGraw-Hill, N. Delhi.
7. Modern Digital Electronics : Jain, R.P.; Tata-McGraw-Hill, New Delhi.
8. Handbook of Bio-Medical Instrumentation : Khandpur, R.S.; Tata McGraw-Hill, New Delhi.
9. Electronic Devices & Circuit. Vol. 1 : Mithal, G.K.; Khanna Publishers; New Delhi.
10. Electronic Devices & Circuits : Mottershed, A.; Prentice Hall, New Delhi.
11. OPAMPS & Linear Integrated Circuits : TTTI, Chandigarh; Prentice Hill, New Delhi.

UTILIZATION OF ELECTRICAL POWER

L	T	P	**Code : EEE 603**
3	1	0	

Total Contact hrs : *Total Marks: 100* **Theory: 100**
Theory: 45 End Exam: 75
Tutorial:15 P.A.: 25
Practical: Nil **Practical:** Nil
Credit: 4 End Exam: Nil
P.A.: Nil

RATIONALE :

This course is under 'specialised courses' group is intended to enable the student understand the facts, concepts, principles and procedures related to the utilisation of electric power so that student can able to acquire supervisory skills and to work as a supervisor in the industry.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	**Hours**
1.	Economics of Electric Power Utilisation 1.1 Classification of cost 1.2 Interest and depreciation 1.3 Economics of generation 1.4 Significance of diversity factor and load factor	5
2.	Electric Heating System **2.1 Introduction to electric heating system** **2.2 Modes of transfer of heat** **2.3 Principle of the resistance, induction and dielectric heating** **2.4 Principle of heat conversion in resistance, induction, dielectric heating** **2.5 Procedure to select electric furnace, oven** **2.6 Procedure to operate and control electric heating system (including the instrumentation and control system)**	8
3.	Electric Welding System 3.1 Concepts of the resistance, induction, arc metallic & carbon welding. 3.2 Principles of welding. 3.3 Principle of TIG and MIG welding.	4
4.	Selection, Operation and Control of Electric Welding System 4.1 Procedure to select the welding systems 4.2 Procedure to operate & control welding systems	4
5.	Overview of Electrical Traction System in India 5.1 Electric Drive – strengths and limitations 5.2 Choice of traction system in India	4
6.	Systems of Track Electrification	6

6.1 Description of various systems: D.C. 1-phase low frequency, A.C. 1-phase, high frequency at 3-phase A.C. and composite system
6.2 25 kV, A.C. 50 Hz system – strengths and limitations
6.3 Problems associated with A.C. traction system: Current & voltage unbalance, production of harmonics and induction effects
6.4 Comparison between A.C. and D.C. systems

7. Principles of Operation and Control of Electric Traction System 4
7.1 Remote control system
7.2 Remote control system equipment and network
7.3 General principle of operation
7.4 Supervisory and alarm facilities
7.5 Frequency allocation.

8. **Illumination scheme** **8**
8.1 Defining the important terminology's related to illumination
8.2 Laws of illumination
8.3 Standard formulae for determining the required lumen output
8.4 Determining the number of luminaries
8.5 Different illumination levels for different purpose
8.6 Defining, Describing the different type of luminaries like fluorescent lamp, Incandescent lamp, Sodium vapour lamp etc.
8.7 Designing a practical lighting scheme for a) Domestic installations b) Drawing office c) courtyard lighting d) street lighting

9. Class Test 2

REFERENCE BOOKS:

1. Electrical power by J. B. Gupta, Kataria & Sons Pub., New Delhi.
2. Utilisation of electrical energy & Electric Traction by J. B. Gupta, Katson Pub., New Delhi.
3. A Course in Electrical power by M. L. Soni, Dhanpat Rai & Sons, New Delhi.
4. Generation, Distribution & Utilisation of electrical energy by C. L. Wadhwa, Wiley Eastern Ltd., New Delhi.

BIO-MEDICAL INSTRUMENTATION

L	T	P	**Code : EEE 604**
3	1	0	

Total Contact hrs : 45
Theory: 45
Tutorial:15
Practical: nil
Credit: 4

Total Marks: 100

Theory: 100
End Exam: 75
P.A.: 25
Practical:
End Exam: Nil
P.A.: Nil

RATIONALE :

The aim of this course under the 'specialised course' category is to develop some level of specialization in students of electrical and electronics engineering. Most of the hospitals use conventional and state-of-the-art biomedical equipments for diagnosing and treatment of illnesses and diseases. Many a time, an electrical and electronics diploma engineer is also called upon to maintain them. Therefore, a general understanding will be very helpful to the student for troubleshooting minor faults of such equipment. As a service engineer and as an entrepreneur, this course will be highly beneficial.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	**Hours**
1.	**Introduction to Biomedical Instrumentation** 1.1 Man-instrument System 1.2 Problems encountered in measuring a living system 1.3 Body system and measurement variables 1.4 Specialist doctors, related variable and instruments 1.5 Field work and report	**5**
2.	Electrodes, Sensors and Transducers 2.1 Sources of bio-electric potential; electrode theory 2.2 Bio-potential and Biochemical electrodes, Electrodes for biophysical 2.3 Active and passive transducers 2.4 Micro electrodes 2.5 Sensor error sources 2.6 Sensing Bio-transducers	6
3.	Measuring and Recording Instruments 3.1 Electrocardiograph 3.2 Electroencephalograph 3.3 Electromyograph 3.4 Heart rate meter 3.5 Respiration rate meter 3.6 Blood flow meter 3.7 Blood pressure meter 3.8 Plethysmograph 3.9 Echocardiograph 3.10 Audiometer 3.11 Temperature meter	8

3.12 Sugar measurement meter

4. Intensive Care and Surgical Instruments **8**
   - 4.1 Artificial respirator
   - 4.2 Patient monitor
   - 4.3 Multi-channel monitor
   - 4.4 Central monitor system
   - 4.5 DC defibrillator
   - 4.6 External pacemaker
   - 4.7 Baby incubator
   - 4.8 Intra-aortic balloon pump
   - 4.9 Heart lung machine
   - 4.10 Surgical diathermy
   - 4.11 Pulse Oxymeter
   - 4.12 Cardiac cathaterization laboratory
   - 4.13 Stress test machine

5. **Bio-Telemetry** **6**
   - 5.1 Introduction to bio-telemetry
   - 5.2 Types of telemetry
   - 5.3 Physiological parameter adaptable to bio-telemetry
   - 5.4 Components of bio-telemetry
   - 5.5 Inplantable units
   - 5.6 Applications of telemetry in patient care

6. **Radiology and Microscopy Instruments** **10**
   - 6.1 X-ray machine
   - 6.2 CT scanners
   - 6.3 Image intensifier
   - 6.4 Ultrasonic scanner
   - 6.5 Ultrasonography
   - 6.6 Endoscope

7. **Class Test** **2**

REFERENCE BOOKS :

1. Introduction to Biomedical Equipment Technology : Carr and Brown, McGraw Hill, New York. Latest
2. Biomedical Instrumentation and Measurements : Cromwell L., Weibell F. J. and Pfeiffer E.A., PHI, New Delhi.
3. Handbook of Biomedical Instrumentation and Measurement : Harry E. Thomas, Latest
4. Handbook of Biomedical Instrumentation : Khandpur, R.S.; Tata McGraw-Hill, New Delhi.
5. Operating and Service Manual of Medical Instruments : Manufacturers/Suppliers, Latest

COMPUTER SYSTEM TROUBLE SHOOTING & MAINTENANCE

L	T	P
3	1	0

Code : EEE 605

Total Contact hrs : 45
Theory: 45
Tutorial:15
Practical: Nil
Credit: 4

Total Marks: 100

Theory: 100
End Exam: 75
P.A.: 25
Practical:
End Exam: Nil
P.A.: Nil

RATIONALE :

PCs are special type of electronic machine. They have some moving parts and some parts functioning electronically. The development of computer technology is very fast and the shelf value is not more than six months. Today, large number of students, people in the industry, government sectors etc are purchasing computers for different purposes. But there are only few entrepreneurs in the market who are capable to maintain computer systems like the way TV sets are repaired. Keeping this scenario in mind, if the size of the industry where the student gets employed is small or the student himself is an entrepreneur who has just started a business, then he should be aware of the different parts of computer system and their functions such as motherboard, floppy disk, hard disk drive, display units etc. This course will help the students to develop basic trouble shooting skills.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	**Hours**

1. **Elements of Computer Systems** **4**
   - 1.1 Motherboard, memory, Add-on cards, Disk drives, Input devices, Output devices

2. **General Troubleshooting** **6**
   - 2.1 Definition: Troubleshooting, diagnosis
   - 2.2 Classification of faults
     - 2.2.1 Hardware faults: Static faults, dynamic faults
     - 2.2.2 Software faults: System software fault, application software faults
   - 2.3 General troubleshooting rules
   - 2.4 Study of abnormal behaviour of PC system for faultfinding.
   - 2.5 Steps of troubleshooting success

3. **Motherboard TROUBLESHOOTING** **6**
   - 3.1 Motherboard Troubleshooting (Rectification in case of following probable symptoms)
   - 3.2 RAM error
     - 3.2.1 Not enough memory or out of memory
     - 3.2.2 Expanded memory unavailable
     - 3.2.3 This program has performed an illegal operating and will be shut down.
     - 3.2.4 Fatal exception error
     - 3.2.5 CMOS checksum error

3.2.6 A motherboard failure is reported but goes away when the PC's outer cover is removed.

4. Daughter Boards **5**

4.1 Display Cards – Types – VGA, SVGA, video accelerator card, AGP slot, TV tuner card, specifications of display cards, installation of display card, video accelerator card, TV tuner card; diagnosis of common faults in display card & VDU

4.2 Troubleshooting a monitor

4.3 Functions and installation of simple I/ O card, fax modem card, sound & video blaster card

5. Disk Drives **4**

5.1 Hard disk drives - IDE, SCSI, jumper setting, configuration as primary; slave

5.2 Installation, partitioning and formatting

5.3 CD-ROM drives - Types, speed, and installation

5.4 DVD – Recording formats, working principle, installation

5.5 Zip drives: - Function, working principle

5.6 CD writers: - Specifications, working principle

5.7 Drive testing and troubleshooting

5.7.1 Error codes and beep codes

5.7.2 Rectification in case of various simple faults

6. Installation and Configuration **6**

6.1 Assembly steps for complete computer systems with input; output devices and multimedia

6.2 System configuration – Jumper setting, CMOS setup, hard disc drive partitioning

6.3 Installation of operating system, configuring desktop

7. Servicing Techniques **5**

Preventive maintenance of computer system-need, schedule and procedure

Software debugging techniques – diagnostic softwares and utilities

Compression utilities, data recovery software

Hardware debugging techniques – common symptoms and step-by-step procedure for hardware debugging

Upgradation of computer system – CPU upgradation, memory upgradation, video card upgradation

8. Viruses **6**

8.1 Types of viruses

8.1.1 Command processor infection

8.1.2 Boot sector infection

8.1.3 Executable file infection

8.1.4 File-specific infection

8.1.5 Memory resident infection

8.1.6 Macro viruses

8.2 Protecting the PC from viruses

8.3 Recognizing an infection

8.4 Dealing with an infection

9. Class Test **2**

REFERENCE BOOKS :

1. Troubleshooting, Maintaining & repairing PCs by Stephen J. Bigelow, Tata McGraw-Hill Ltd., New Delhi.
2. How multimedia computer works by BPB Publication, New Delhi.
3. Assemble Your Own Computer by G. K. Gupta, G.T. Publication, Jaipur.
4. IBM PC and C.K. Jones by B. Govindrajalu, Tata McGraw-Hill, Ltd., New Delhi.
5. The Complete PC upgrade & Maintenance guide by Manish Jain, BPB, New Delhi.
6. Modern -All About Monitors by Lotia Nair, BPB Publication, New Delhi.
7. All about Keyboard and mouse by Lotia, BPB Publication, New Delhi.
8. Complete PC upgrade & Maintenance guide by Minasi Mark, BPB Publication, New Delhi.
9. Upgrading and repairing PCs by Scott Mueller, Prentice-Hall of India, New Delhi.
10. A Complete Guide to SMPS for PC by Upadhyay, BPB Publication, New Delhi.

DIGITAL SIGNAL PROCESSING

L	T	P	**Code : EEE 606**
3	1	0	

Total Contact hrs : 60
Theory: 45
Tutorial:15
Practical: 0
Credit: 4

Total Marks: 100

Theory: 100
End Exam: 75
P.A.: 25
Practical:
End Exam: Nil
P.A.: Nil

RATIONALE:

Digital signal processing is a technology driven field which dates its growth when Computers and Digital Circuitry became fast enough to process large amount of data efficiently. This subject deals with processing discrete – time signal or data sequences and covers the background and fundamental materials on discrete time system, digital signal processing technique, design procedures of digital filters and discrete Fourier transform.

DETAIL COURSE CONTENT:

Unit	Topic/Sub Topic	Hours
1.	**Introduction**	**5**
1.1	Concept of Signal & Systems	
1.2	Concept of Signal processing	
1.3	Concept of Frequency domain Analysis of time Domain Signal : for continuous time & Discrete-time signal.	
2.	**Signal**	**8**
2.1	Definition and classification : Continuous, Discrete & Digital	
2.2	Elementary signals : Unit Step Signal, Impulse, Ramp & Sinusoidal Signal	
2.3	Representation of Discrete - time signals.	
	2.3.1. Graphical representation	
	2.3.2. Tabular representation	
	2.3.3 Sequence representation	
2.4	Classification of Discrete-time-signals	
	2.4.1 Energy & Power Signal	
	2.4.2 Causal & Non Causal Signal	
2.5	Operations on signals.	
	2.5.1 Shifting	
	2.5.2 Time reversal	
	2.5.3 Time Scaling	
	2.5.4 Addition operation	
3.	**System**	**6**
3.1	Definition, Classification of Discrete-time Systems	
3.1.1	Static & Dynamic System	
3.1.2	Causal & Non-Linear System	
3.1.3	Time-variant & Time invariant system	
3.2	Representation of Arbitrary Sequence : Convolution technique.	
4.	**Frequency Analysis of Discrete time Signals**	**6**
4.1	Discrete – time Fourier Series	

4.2 Discrete – time Fourier Transform.

5. **Z – Transform** **6**

5.1 Definition of Z-Transform and ROC (Region of Convergence)

5.2 Z-Transform Finite – Impulse Sequence & Infinite – Impulse Sequence.

5.3 Properties of Z-transform

5.4.1 Long division Method.

5.4.2 Partial fraction expansion method.

5.4.3 Convolution method.

6. **Discrete Fourier Transform :** (Concept & Formula only) **3**

7. **Fast Fourier Transform (FFT) :** Decimation-in-time algorithm **4**

8. **Design of Digital Filters.** **8**

8.1 IIR filter design techniques.

8.1.1 Butterworth Filter design

8.1.2 Chebysheve Filter design

8.2 Realization of Digital filters.

8.2.1 Direct form – I realization

8.2.2 Direct form – II realization

9. **FIR Filter design** **8**

9.1 Rectangular window

9.2 Hanning window

9.3 Hamming window

9.4 Bartlett window

10 **Applications of Digital signal processing** **4**

11 **Class Test** **2**

REFERENCE BOOKS :

1. A Practical Approach to Digital Signal Processing by K. Padmanabhan, S. Ananthi, R. Vijayarajeswaran, New Age International Publications.
2. Signals and Systems by M. J. Roberts, Tata McGraw-Hill.
3. Digital Signal Processing by Sanjit K Mitra, Tata McGraw-Hill.
4. Signal processing and Linear Systems by Lathi, B., Carmichael, CA, Berkley-Cambridge.
5. Linear Systems and Digital signal Processing by Young, T., Englewood Cliffs, NJ, Prentice Hall.

RENEWABLE ENERGY SOURCES

L	T	P	**Code : EEE 607**
3	1	0	

Total Contact hrs : 60
Theory: 45
Tutorial:15
Practical: 0
Credit: 4

Total Marks: 100

Theory: 100
End Exam: 75
P.A.: 25
Practical:
End Exam: Nil
P.A.: Nil

RATIONALE:

In view of the fast depleting resources of conventional energy, it has become imperative to search for alternative sources of energy, which are not only renewable, but environment friendly and economically viable also. Solar energy, wind energy, biomass energy and hydropower energy etc. are some of the alternatives, which could be banked upon to meet the energy crisis. This course is intended to provide the requisite knowledge and skills of different aspects of these technologies to cope up with the present energy crisis and challenges of the future.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours

1. INTRODUCTION 12

1.1 *Overview of renewable energy sources*
- 1.1.1 *Need & importance*
- 1.1.2 *Scope & limitations of their use*

1.2 Types of renewable energy sources
- 1.2.1 Wind energy
- 1.2.2 Solar energy
- 1.2.3 Ocean Energy
- 1.2.4 Mini & Micro-hydro energy
- 1.2.5 Bio mass energy
- 1.2.6 Geo-thermal Energy

1.3 Government support & incentive for budget in North-Eastern states
- 1.3.1 Types of incentive
- 1.3.2 Product range covered

1.4 Advantages and disadvantages of renewable energy sources

2. WIND ENERGY SYSTEMS 12

- 2.1 Concept of wind energy
- 2.2 Wind resource assessment of India and Arunachal Pradesh
- 2.3 Wind turbines:
- 2.4 Types, basic terminology like mean wind speed, power coefficient, cut-in speed, cut-out speed, torque and torque coefficient, solidity ratio, swept area, air mass density, velocity index, roughness index of terrain, power curve of wind turbine
- 2.5 Various components of horizontal and vertical axis wind turbines
- 2.6 Maximum power in the wind- Betz coefficient
- 2.7 Basic statistics- Weibull distribution

2.8 Local effects on wind flow
2.9 Small wind turbine – Construction & Working
2.10 Electric generators in small wind turbines
2.11 Electric generators in large wind turbines
2.12 Operation and maintenance of horizontal and vertical axis wind turbines
2.13 Selection of site for sitting of wind turbines
2.14 Planning the layout of a wind farm in the hilly terrain of Arunachal Pradesh

3. **SOLAR ENERGY** 10

3.1 Basic principles of harnessing solar energy
3.2 Solar energy for heating water
3.3 Consideration and installation
- 3.3.1 Specification and list of materials required
- 3.3.2 Repair and maintenance

3.4 Solar energy systems and its application
- 3.4.1 Street lights
- 3.4.2 Solar pumps
- 3.4.3 Solar lanterns
- 3.4.4 Calculation of energy consumption

3.5 Installation, operation and maintenance of solar PV modules

4. BIO-MASS ENERGY 12

4.1 Concept of Bio-mass energy : Classification of Bio –mass; Sources of Bio-mass; Energy content in Bio-mass
4.2 Energy Plantation
4.3 Chemical process of converting biomass into useful energy
- 4.3.1 Anaerobic fermentation,
- 4.3.2 Pyrolysis,
- 4.3.3 Gasification

4.4 Mechanical process of converting biomass into useful energy
- 4.4.1 Biomass briquetting, Mixing of biomass with coal

4.5 Basics of anaerobic fermentation
4.6 Types of Bio-gas plant based on
- 4.6.1 Construction,
- 4.6.2 Feed materials,
- 4.6.3 Use pattern

4.7 Factors affecting Bio-gas yield
- 4.7.1 Temperature, C.N ratio, pH value, total dissolved solid, Moisture content

4.8 Commonly used feed stock
4.9 Properties & application of Bio gas
4.10 Construction details with sketches
- 4.11 Fixed-Dome bio-gas plant
- 4.12 Floating-Drum bio-gas plant

4.11 Specification and quantity of construction materials required for bio-gas plant.
4.12 Advantages and disadvantages of each type of bio-gas plant
4.13 Overall operation and maintenance of plant, gas appliances and fittings; Charging feed materials, disposal of slurry, cleaning of gas digester
4.14 List of safety precautions at bio-gas plant and for end users of bio-gas
4.15 Cost analysis of overall construction and operation of bio-gas plant

5. OVERVIEW OF OTHER RENEWABLE ENERGY SOURCES 12

- 5.1 Mini and Micro-hydro power plant
  - 5.1.1 Advantages of Mini and Micro-hydro power plants
  - 5.1.2 Construction and working with sketches of the micro hydro power plants
  - 5.1.3 Operation of Mini and Micro-hydro power plants
- 5.2 Tidal and Ocean energy
  - 5.2.1 Working principle of tidal and ocean energy power plant
  - 5.2.2 Advantages and disadvantages of tidal and ocean energy power plant
- 5.3 Scope of tidal and ocean energy development in India
- 5.4 Incineration power plant
  - 5.4.1 Working principle of Incineration power plant
  - 5.4.2 Sources of feed materials for this plant
  - 5.4.3 Advantages of Incineration power plant
- 5.5 Geo-thermal energy systems
  - 5.5.1 Working principle of geothermal power plant
  - 5.5.2 Advantages of geothermal energy systems
  - 5.5.3 Geothermal energy systems being used in India
- 5.6 Hydrogen energy
  - 5.6.1 Hydrogen energy as sustainable future fuel
  - 5.6.2 Advantages and disadvantages of hydrogen energy
  - 5.6.3 Present applications of hydrogen energy in India and abroad

6 **Class Test** **2**

REFERENCE BOOKS:

1. Biogas Energy in India.: Academic book centre Ahmedabad.
2. Renewable energy: power for a sustainable future : Boyle G, Oxford University Press, New Delhi.
3. Renewable energy: Environment & Development Dayal M. Konark Publisher Pvt. Ltd., New Delhi.
4. Solar Energy System utilization G.D Rai / R.K KhannaPublishers, New Delhi
5. Solar energy fundamentals and applications H.P.Garg& J.Prakash Tata Mcgraw Hill; New Delhi
6. Renewable Energy Island Press Earthscan Kogan Page
7. Bio gas Technology, A practical hand book Khandelwal K.C.& Mehdiss Tata Mc Graw Hill; New Delhi
8. Bio gas systems: Principles and application Mittal K.M. New age International Ltd. New Delhi
9. Renewable energy sources and conversion technology N.K Bansal, Manfred Kleemann, Michael Maliss Tata Mcgraw Hill; New Delhi

COMPUTER –AIDED DESIGN & DRAWING

L	T	P	**Code : EEE 608**
3	1	0	

Total Contact hrs : 60
Theory: 45
Tutorial: 15
Practical: 0
Credit: 4

Total Marks: 100

Theory:
End Exam: 75
P.A.: 25
Practical:
End Exam: 0
P.A.: 0

RATIONALE :

In order to develop and produce electronic and electric circuits, many skills are required. Drawing is also a skill, which intends to equip students with ability to read and sketch circuit diagram from PCB artwork and assembly of unit. The advent of computers has also touched the area of design and drawing of electronic circuits. Therefore, a technician need to learn to use computers and take its' aid in drawing, designing and enhancing the quality of electronic circuits. This course is design to develop the skills and to build and test electrical circuits, analog & digital electronic circuits using electronics workbench-like software on a computer. This subject will also help to provide necessary knowledge & skills for the project work in third year of this diploma programme.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
1	Basic Circuit Drawing	8
1.1	Symbols	
1.2	Draw symbols & components	
1.3	Draw common electrical and electronic instruments	
1.4	Draw rectifier, amplifier & oscillator circuit	
1.5	Electronic circuit layout	
1.6	Sketch front panel diagrams	
1.7	Preparing the layout for the printed circuit boards	
2	**PCB Design**	**6**
2.1	*Awareness of software for PCB design*	
2.2	*PCB layout of rectifier, amplifier & oscillator circuit*	
3	**Introduction to CAD**	**8**
3.1	CAD concepts	
3.2	CAD hardware in brief	
3.3	Auto CAD 2000 menu	
3.4	Creating simple objects using Auto CAD	
4	**Commands and Functions of AutoCAD**	**10**
4.1	Using basic commands	
4.2	Facilitating commands	
4.3	Editing and informative commands	
4.4	Using line types, line weight and text annotation	

5 **CAD Applications in Electronics & Electrical Circuits 8**

5.1 Using examples from electronics & electrical engineering discipline
5.2 Organizing, drawing in different layers
5.3 Dimensioning drawings
5.4 3D visualization, working with surfaces
5.5 Solid modeling and solid editing

6 **Design & Drawing of electrical installation of residential & industrial complexes 8**

6.1 Electrical installation of three bed-room house
6.2 Electrical installation & wiring of a small factory unit in an industrial estate

7 Using Electronics Workbench like software 10

7.1 Overview of Electronics Workbench like Software
7.2 Building & Testing Analog Circuits
7.3 Analog Instruments
7.4 Building & Testing Digital Circuits
7.5 Digital Instruments
7.6 Simulation
7.7 Awareness about use of other software, like
- Pspice
- PCB maker
- CASPOC
- PROTEUS PCB
- MULTISIM
- Matlab

8 Class Test 2

SUGGESTED TUTORIAL

Use various computer software to develop circuits on the computer and test each of them

a. Principles of Engineering Drawing
b. Draw block diagram of monochrome TV receiver.
c. Draw circuit diagram of radio receiver.
d. Draw circuit diagram, PCB component layout diagram and PCB artwork for discrete series regulated power supply using IC for +5 volts output.
e. Draw front panel layout diagrams of typical Dual Cathode Ray Oscilloscope.
f. Draw orthographic and isometric views for power transformer.
g. Draw orthographic and isometric views for loudspeakers & microphones.
h. Sketch wiring diagram of residential & industrial complexes.

REFERENCES BOOKS :

1. Electrical wiring, estimating and costing by B. D. Arora, R.B. Publications, New Delhi.
2. AutoCAD 2000 by Frey David, BPB Publications, New Delhi.
3. Using AutoCAD 2000 by Ron House, Prentice Hall, New Delhi.
4. AutoCAD 14 For Engineering Drawing Made Easy by P. Rao Nageswara, Tata McGraw Hill, New Delhi.
6. AutoCAD 2000 by Sham Tickoo, Galgotia Publications, New Delhi.
7. Electrical wiring estimating and costing by S. L. Uppal, Khanna Publishers New Delhi.

8. An Introduction to AutoCAD 2000 by Yarwood , A. Longman, New Delhi.
9. IS: 696-1972, Code of practice for General Engineering Drawing.: BIS, New Delhi.
10. Printed Circuit Board Design & Technology by William Bosschart, Tata McGraw Hill, New Delhi.
11. Electronic Drafting & Drawing by Y.I. Shah, Jeevandeep Prakashan, Ramdeet, Mumbai
12. Computer Aided Drafting and Design by Donald D. Voisinet, McGraw Hill, New Delhi, 1996

Annexure - I

LIST OF RESOURCE PERSONS

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Dr. P. Sarkar
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Dr. S. Chattopadhyay
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Associate Professor, Electrical Engineering NITTTR, Kolkata

Dr. S. Pal
Assistant Professor, Electrical Engineering NITTTR, Kolkata

Annexure – II

LIST OF EQUIPMENT
ELECTRICAL ENGINEERING LABORATORIES

SL. NO.	ITEM	Laboratory
1.	Moving Iron Voltmeter (portable)	Measurement & Machine Lab
2.	Moving Iron Ammeter portable)	Measurement & Machine Lab
3.	Wattmeter (single phase dynamo meter type)	Measurement & Machine Lab
4.	Megger (D.C.)	Electrical Workshop
5.	Earth Testing Set	Electrical Workshop
6.	Single phase energy meter	Measurement Lab
7.	Three phase energy meter	Measurement Lab
8.	Digital Ammeter DC.	Measurement & Machine Lab
9.	Digital Ammeter AC.	Measurement & Machine Lab
10.	Digital Voltmeter(D.C.)	Measurement & Machine Lab
11.	Digital Voltameter(A.C)	Measurement & Machine Lab
12.	Wattmeter	Measurement & Machine Lab
13.	Single phase Auto transformer (variac)	Measurement & Machine Lab
14.	Power Capacitor	Electrical Circuit Lab
15.	Variable Inductor (Iron cored)	Electrical Circuit Lab
16.	Fixed Value resistors	Electrical Circuit Lab
17.	Wire Wound Rheostat	Electrical Machine & Circuit Lab
18.	Digital LCR Meter Auto ranging	Electrical Measurement & Circuit Lab
19.	Auto Cut off Battery Charger	Electrical Workshop
20.	Lead Acid Battery	Electrical Workshop
21.	Tachometer	Electrical Machine Lab
22.	Electronic Stroboscope (Digital)	Electrical Machine Lab
23.	Digital Multimeter	Electrical Circuit, Machine, Measurement and Workshop
24.	DC. machine for dismantling and assemble practice	Electrical Workshop
25.	Tool Kit	Electrical Workshop
26.	DC. Shunt motor for direct loading test	Electrical Machine Lab
27.	Wound Rotor Induction motor (slipring induction motor)	Electrical Machine Lab
28.	Three phase induction Motor (squirrel cage type)	Electrical Machine Lab
29.	DC. machine with separately excited equipped with Tacho Generator	Electrical Control System Lab
30.	DC. Compound Machine	Electrical Machine Lab
31.	Slip ring synchronous/ Asynchronous Machine	Electrical Machine Lab
32.	Universal Motor	Electrical Machine Lab
33.	I-Phase Induction Motor with start and run capacitor	Electrical Machine Lab
34.	I-Phase Induction Motor with start capacitor	Electrical Machine Lab
35.	Split-phase Motor	Electrical Machine Lab
36.	Two speed Induction Motor Squirrel Cage	Electrical Machine Lab
37.	Dissectable Machines: Tutor	Electrical Machine Lab

SL. NO.	ITEM	Laboratory
38.	Microprocessor Training Kit	Digital Electronic Lab
39.	High Voltage oil testing set	Electrical Measurement Lab
40.	Automatic winding m/c	Electrical Workshop
41.	Hand operator winding m/c	Electrical Workshop
42.	Solid state converter	Electrical Machine Lab
43.	Capacitor load	Electrical Circuit & Machine Lab
44.	Inductive Load	Electronics Lab
45.	Digital Storage Oscilloscope	Electronics Lab
46.	Dual Trace Oscilloscope	Electronics Lab
47.	Function Generators	Electronics Lab
48.	Induction Heating Apparatus	Industrial / Power Electronics Lab
49.	Dielectric heating	Industrial / Power Electronics Lab
50.	Digital Tongue Tester	Electrical Workshop
51.	Digital insulation tester	Electrical Workshop
52.	Distance relay	Switch Gear and Protection Lab
53.	Electronic Trivector meter	Electrical Measurement Lab
54.	Electronic Energy meter	Electrical Measurement Lab
55.	CT & PT Test set	Electrical Measurement and Machine Lab
56.	Single phase and 3 phase power analyser	Electrical Measurement Lab
57.	D.G. Set	Emergency Power Supply in Electrical Lab
58.	P.C. based P.I.D. Temp controller	Control System Lab
59.	Electronic Component Trainer	Electronic Lab
60.	Analog Trainer	Electronic Lab
61.	Network Theorem Training Board	Electrical Circuit Lab
62.	AC fundamentals training board	Electrical Circuit Lab
63.	Digital Component Trainer	Digital Electronic Lab
64.	Thyristor Power Control Circuit	Power Electronic Lab
65.	Digital Circuit Study Board	Digital Electronic Lab
66.	Electrical Machine Testing System	Electronic Machine Lab
67.	Instrumentation Trainer	Instrumentation and Control Lab
68.	Study of Control System Kit	Control System Lab
69.	Decade resistance box	Circuit Lab
70.	Decade capacitance box	Circuit Lab
71.	Decade inductor box	Circuit Lab
72.	Shackle insulator box	Electrical Workshop
73.	Pin Insulator	Electrical Workshop
74.	Disc Insulator	Electrical Workshop
75.	Complete set of a overhead power distribution pole with arms insulators and safety devices	Electrical Workshop
76.	Over head service connection system complete set	Electrical Workshop
77.	Miniature circuit breaker single pole of different current rating (230V, SP and N0.5 - 2.5A)	Electrical Workshop
78.	Miniature circuit breaker four pole 650V, 6A	Electrical Workshop
79.	Single phase distribution board with box and miniature circuit breaker, 250V, 6 Amp, 8 way	Electrical Workshop

SL. NO.	ITEM	Laboratory
	(for wiring practice) with 650V, 20A moulded case breaker	
80.	Three phase with Neutral (3 phase 4 wire) distribution board with box, miniature circuit breaker, connectors and master control MCB (4 pole) (for wiring practice)	Electrical Workshop
81.	Standard wire gauge BSW and M.M.	Electrical Workshop
82.	Laminated cores (Transformer assembly practice) Type: 30, 6, 33; Grade: 51	Electrical Workshop
83.	Super enameled copper SWG-30,32,36,40	Electrical Workshop
84.	Leatheroid (10 mil and 20 mil thick)	Electrical Workshop
85.	Prepahan thick (10 mil and 20 mil)	Electrical Workshop
86.	Air drying varnish (Dr Brick's)	Electrical Workshop
87.	PVC insulated cable a) Single core single strand 230V, 18 SWG b) Single core Multi strand 230V, 7/200	Electrical Workshop
88.	PVC conduit 6mm, 12mm, 18mm	Electrical Workshop
89.	PVC casing 6mm, 12mm, 18mm	Electrical Workshop
90.	Current transformer	Electrical Measurement & Switch Gear Lab
91.	Potential Transformer	Electrical Measurement & Switch Gear Lab
92.	Decade capacitor box	Electrical Measurement & Switch Gear Lab
93.	Air cored Inductor	Electrical Measurement & Switch Gear Lab
94.	Decade Resistor box	Electrical Measurement & Switch Gear Lab
95.	Static speed control of AC motor (3φ inductor)	Control System / Power Electronic Lab
96.	Electric power system simulator	Power System Lab
97.	Single phase and three phase power analyser	Electrical Measurement Lab
98.	Microprocessor based temperature controller	Control System Lab
99.	Virtual instrumentation simulator	Instrumentation Lab
100.	Flux Meters	Electrical Measurement Lab
101.	Micro controller trainer kit	Digital Electronics Lab
102.	Starter kit for digital signal processing	Digital Electronics Lab

SAMPLE PATH

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

TERM -1

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	**P**	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	G 101	Communication Skill-I		3	0	0	75	10	15	0	0	0	100	3
2	G 103	Mathematics-I		3	1	0	75	10	15	0	0	0	100	4
3	G 105	Physics-I		3	0	2	75	10	15	25	25	0	150	4
4.	G 107	Chemistry-I		3	0	2	75	10	15	25	25	0	150	4
5	G 201	Engineering Drawing-I		1	0	3	50	0	0	0	50	0	100	3
6	G 203	Workshop Practice-I		1	0	3	0	0	0	50	50	0	100	3
7	G 207	Fundamentals of Electrical & Electronics Engineering		3	0	2	75	10	15	25	25	0	150	4
8	G 109	NCC1 / NSS1		0	0	2	0	0	0	25	25	0	50	1
TOTAL				**17**	**1**	**14**	**425**	**50**	**75**	**150**	**200**	**0**	**900**	**26**

TERM - 2

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	G 102	Communication Skill - II	G 101	2	1	2	50	-	-	25	25	-	100	4
2	G104	Mathematics-II		3	1	0	75	10	15	0	0	0	100	4
3	G106	Physics-II	G 105	3	0	2	75	10	15	25	25	0	150	4
4	G108	Chemistry-II	G 107	3	0	2	75	10	15	25	25	0	150	4
5	G202	Engineering Drawing-II	G 201	1	0	3	50	0	0	0	50	0	100	3
6	G204	Workshop Practice-II	G 203	1	0	3	0	0	0	50	50	0	100	3
7	G205	Engineering Mechanics		3	0	0	75	10	15	0	0	0	100	3
8	G110	NCC II / NSS II		0	0	2	0	0	0	25	25	0	50	1
TOTAL				**16**	**2**	**14**	**400**	**40**	**60**	**150**	**200**	**0**	**850**	**26**

TERM - 3

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	G 206B	Introduction to Information Technology		2	1	2	50	0	0	25	25	0	100	4
2	G 301	Environmental Education (Soft core-I)		3	0	0	75	10	15	0	0	0	100	3
3	EEE 401	Circuits & Networks		3	1	2	75	10	15	25	25	0	150	5
4	EEE 402	Electrical & Electronic Measurement		3	1	2	75	10	15	25	25	0	150	5
5	EEE 403	Electrical Machine I		3	1	2	75	10	15	25	25	0	150	5
6	EEE 411	Heat Engine		3	0	0	75	10	15	0	0	0	100	3
TOTAL				**17**	**4**	**8**	**425**	**50**	**75**	**100**	**100**	**0**	**750**	**25**

TERM - 4

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	**P**	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	EEE 404	Electrical Power System I		3	0	0	75	10	15	0	0	0	100	3
2	EEE 407	Electrical Machine II	EEE 403	3	1	2	75	10	15	25	25	0	150	5
3	EEE 406	Electronic Devices & Circuits		3	1	2	75	10	15	25	25	0	150	5
4	EEE 501	Analog Electronics	EEE 406	3	1	2	75	10	15	25	25	0	150	5
5	EEE 502	Digital Electronics	EEE 406, 501	3	1	2	75	10	15	25	25	0	150	5
6	EEE 508	C Programming		0	2	4	0	0	0	50	50	0	100	4
TOTAL				**15**	**6**	**12**	**375**	**50**	**75**	**150**	**150**	**0**	**800**	**27**

TERM - 5

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	EEE 408	Electrical Power System II	EEE 404	3	0	0	75	10	15	0	0	0	100	3
2	EEE 409	Power Electronics	EEE 406	3	1	2	75	10	15	25	25	0	150	5
3	EEE 405	Electrical Drawing & Estimation		0	2	2	0	0	0	50	50	0	100	3
4	EEE 410	Electrical & Electronic Workshop		0	2	4	0	0	0	50	50	0	100	4
5	EEE 504	Microprocessor, Microcontroller & its Applications	EEE 406, 501, 502	3	1	2	75	10	15	25	25	0	150	5
6	EEE 507	Maintenance of Electrical & Electronic Equipment		3	1	2	75	10	15	0	25	25	150	5
7	EEE 601-608	Elective I		3	1	0	75	10	15	0	0	0	100	4
TOTAL				**15**	**8**	**12**	**375**	**50**	**75**	**150**	**175**	**25**	**850**	**29**

TERM - 6

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	EEE 503	Switch Gear & Protection		3	0	0	75	10	15	0	0	0	100	3
2	EEE 505	Instrumentation & Control		3	1	2	75	10	15	25	25	0	150	5
3	EEE 506	Consumer Electronics		3	1	2	75	10	15	25	25	0	150	5
4	G 302A-G 302F	Soft Core II		3	0	0	75	10	15	0	0	0	100	3
5	EEE 509	Technical Seminar		0	0	6	0	0	0	0	50	50	100	3
6	EEE 510	Projects		0	0	8	0	0	0	0	100	50	150	4
7	EEE 601-608	Elective II		3	1	0	75	10	15	0	0	0	100	4
TOTAL				**15**	**3**	**18**	**375**	**50**	**75**	**50**	**200**	**100**	**850**	**27**

Industrial/Field Training

Pre-requisite – Students must be either in 4th Term or higher.

Course Code	*Name of Course*	*Teaching Scheme*					Examination Scheme				Total Marks
							Theory		Practical		
		Pre-requisite	L	T	P	C	End Exam	PA	End Exam	PA	
EEE511	Industrial Training (1 week orientation + 3 weeks OJT)		-	-		10	-	-	100	100	200