W.B.S.C.T.E.

TEACHING AND EXAMINATION SCHEME FOR DIPLOMA COURSES

COURSE NAME: ELECTRICAL ENGINEERING

COURSE CODE : EE

DURATION OF COURSE : 6 SEMESTERS

SEMESTER: FIFTH SEMESTER **SCHEME : C**

Sr.No	SUBJECT	PERIODS			EVALUATION SCHEME							Credits
	THEORY				SESSIONSAL EXAM				PR(INT.)	PR (EXT.)		
		L	T	P	TA	CT	Total	ESE				
1	Power Electronics and Drives	03		02	10	20	30	70	25	25		4
2	Microprocessor & Microcontroller	03	--	02	10	20	30	70	25	25		4
3	Switchgear & Protection	03		02	10	20	30	70	25	50		4
4	Industrial Project & Entrepreneurship Development	01	--	03					25	50		3
5	Utilization, Traction , Heating and drives	03		02	10	20	30	70	25	25		4
6	Elective I (Any One)	03	--	02	10	20	30	70	25	25		4
	Illumination Engineering											
	Heating , Ventilation and Air conditioning											
	Energy Conservation & Audit											
	Electric Traction											
7	Professional Practice -III			03					25	25		2
	Total	**16**		**16**	**50**	**100**	**150**	**350**	**175**	**225**		**25**

STUDENT CONTACT HOURS PER WEEK: **32 HRS**
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, T - Tutorial, PR (INT.) – Practical (Internal) PR(EXT.)- Practical(External), ESE - End Semester Exam

TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.

Total Marks : 900

Minimum passing for sessional marks is 40%, and for theory subject 40%.

Name of the Subject : Power Electronics & Drives	
Subject Code: EE/S5/PED	**Semester : Fifth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit: 04	

Aim:

Sl. No.	
1.	The field of Electrical Engineering is generally segmented into three major areas – Electronics, Power & Control.
2.	This subject is the combination of these three areas. Nowadays all the industrial drives to run a machine and to control it as per requirement are based on Power Electronics.
2.	Understanding of the subject will provide skill to the students for trouble shooting & testing of Power semiconductor devices, Solid state DC & AC motor drives.

Objective:

Sl. No.	Student will be able to:
1.	Describe the Power semiconductor devices & draw their characteristics.
2.	Describe the Inverter, Converter & Chopper circuits.
3.	Explain the operation of the DC motor & AC motor drives

Pre-Requisite:

1.	Knowledge of Applied Electronics.
2.	Knowledge of DC & AC Motor operation to run their drives.

Contents (Theory):		Hrs./Unit	Marks
Unit : 1	**1. POWER SEMICONDUCTOR DEVICES:** **1.1 THYRISTOR (SCR)** 1.1.1 Construction, operation & symbol. 1.1.2 V-I characteristics of SCR (Holding current, Latching current, Breakover voltage). 1.1.3 Turn on methods - Voltage triggering, Gate triggering, dv/dt triggering. 1.1.4 Turn off methods – Current reduction, AC line commutation, Forced commutation. 1.1.5 Thyristor specifications – voltage rating, current rating, power rating, dv/dt, di/dt, Gate current, temperature. 1.1.6 Utility of Snubber circuit , Freewheeling diode. 1.1.7 DIAC, TRIAC, SCS – Principle of operation, characteristics & application. 1.1.8 IGBT - Principle of operation, characteristics & application.	**10**	**14**
Unit : 2	**2. Switching & Timer Circuits :** 2.1 Simple transistor timer using R-C as timing element. 2.2 Classification of multi-vibrators. 2.3 Study of Astable, Monostable & Bistable multivibrator	**10**	**14**

	circuits using OPAMP. 2.4 Internal block diagram, Pin diagram and operating of IC 555. 2.5 Study of Astable, Monostable & Bistable multivibrator circuits using IC 555 timer.		
Unit : 3	**3. Converter and Inverter:** **3.1 AC to DC Converter :** 3.1.1 Single phase fully controlled Half Wave Converter - with resistive load, - with R-L load 3.1.2 Single phase fully controlled Full Wave Converter - with resistive load, - with R-L load 3.1.3 Three phase fully controlled Bridge Converter - with RL load 3.1.4 **Cycloconverter –** Principle of operation of Single phase & Three phase cycloconverter, Basic circuit diagram, Input & Output waveforms. **3.2 Inverter :** 3.2.1 Classification of Single phase & Three phase Inverter – Line commutated & Forced commutated Inverters, Series, Parallel, Bridge Inverter 3.2.2 Operation of basic Series Inverter. 3.2.3 Operation of basic Parallel Inverter. 3.2.4 Operation of Single phase Bridge Inverter - a) Half Bridge Inverter b) Full Bridge Inverter 3.2.5 Pulse Width Modulated Inverter – a) Single pulse width Modulated Inverter. b) Multiple pulse width Modulated Inverter. c) Sinusoidal pulse width Modulated Inverter.	**10**	**16**
Unit : 4	**4. DC Chopper:** 4.1 Principles of chopper. 4.2 Classification – a) Step-up & Step-down chopper b) Second quadrant, Two quadrant & Four quadrant operation. 4.3 Type-A, B, C, D chopper – Operating Principle. 4.4 Commutations methods for choppers – Auxiliary commutation, Load commutation. 4.5 Jones chopper.	**08**	**12**
Unit : 5	**5. DC & AC Drives :** 5.1 Speed control of separately excited DC motor by single phase fully controlled converter. 5.2 Speed control of separately excited DC motor with three phase fully controlled converter. 5.3 Speed control of DC series motor with chopper control. 5.4 Speed control of DC servomotor. 5.5 Speed control of Three phase Induction motor with variable frequency PWM VSI. 5.6 Speed control of Three phase Induction motor with variable voltage variable frequency control. 5.7 Speed control of AC servomotor. 5.8 Static VAR compensation system - Principle of operation &	**10**	**14**

	Block diagram. 5.9 Uninterrupted power supply – Principle of operation & Block diagram of On load & Off load type UPS.		
	Total	**48**	**70**

Practical:

Skills to be developed:

Intellectual Skills:

1. Ability to select appropriate devices & instruments.
2. Ability to test & troubleshoot.

Motor Skills:

1. Ability to draw the circuit diagrams.
2. Ability to interpret the circuits and waveforms.

List of Practical: (At least Eight Experiments are to be performed)

1. To fabricate an op-amp integrator, determine its amplitude, phase relation with input, duration of output pulse compared to input for a square wave input.
2. To fabricate an op-amp differentiator, determine its amplitude, phase relation with input duration of output pulse compared to input for a triangular input.
3. To identify the terminals of Thyristor and plot V-I characteristics of Thyristor.
4. To fabricate with IC-555 -

   (a) Astable multivibrator & to determine duration of high pulse, low pulse and duty cycle.

   (b) Monostable multivibrator & to determine the duration of high and low pulses triggered condition with different R-C values.

   (c) A Pulse Width Modulation circuit to observe the variation of duration of high pulse with the various values of control voltage at control input terminal of IC-555.
5. To study fully controlled full wave rectifier using SCR.
6. To study DC chopper circuit using SCR.
7. To study series inverter using SCR.
8. To perform speed control of DC series motor using SCR.
9. To perform speed control of 3-phase Induction motor using PWM inverter. Interpret speed-torque characteristics. Use variable voltage variable frequency drive.
10. To study the operation and circuit diagram of Uninterrupted Power Supply unit.

List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	M.D.Singh, K.B.Kanchandani	Power Electronics	T.M.Hill.
2.	Mohan, Undeland, Riobbins	Power Electronics	Wiley India
3.	S.N.Singh	Power Electronics	Dhanpat Rai & Co.
4.	V. Subrahmanyam	Electric Drives – concepts & applications	T.M.Hill
5.	Albert Malvino & D.J.Bates	Electronic Principles	T.M.Hill
6.	V.R.Moorthi	Power Electronics	Oxford
7.	G.K.Dubey	Fundamentals of Electric drives	Narosa Publishing House
8.	M.H.Rashid	Power Electronics	P.H.I. Ltd
9.	K.Haribabu	Power Electronics	Scitech Publisher

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2	11	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	3,4,5	12				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Subject: Microprocessor and microcontroller	
Subject Code : EE/S5/MPMC	**Semester: FIFTH**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs/Week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical: 2 Hrs/Week	End Semester Exam.: 70 Marks
Credit: 04	Practical : 50 Marks

Aim:

Sl. No.	
1.	Today microprocessors and microcontrollers have become an integral part of all automatic and semi automatic machines. Therefore there is a growing need of engineers / technicians in this field. Hence, it is necessary to study microcontroller basics, hardware and its programming.
2.	This subject covers microprocessor 8085 and microcontroller 8051 architecture, its instruction set, programming and applications. After completing this subject the student can write and execute programs for microcontroller and microprocessor based applications.

Objective:

Sl. No.	The student will be able to
1.	Describe architecture and operation of microprocessor 8085
2.	Develop assembly language programs using instruction set of 8085
3.	Describe architecture and operation of microcontroller 8051
4.	Develop assembly language programs using instruction set of 8051
5.	Design and develop microcontroller based systems
6.	Explain various applications of microcontrollers

Pre-Requisite:

Sl. No.	
1.	Knowledge of digital electronics

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Microprocessor Basics** 1.1 Generation and evolution of 4 bit microprocessor to latest microprocessor 1.2 Basic Architecture of 8-bit Microprocessor 1.2.1 Hardware features of Intel – 8085 functional Blocks, bus structure. 1.2.2 Arithmetic Logic Unit 1.2.3 Registers (General purpose & Special Purpose) 1.2.4 Interrupts 1.2.5 Pin description. 1.3 Timing cycles of 8085 – Machine cycle, Opcode fetch cycle, execution cycle, instruction cycle.	8	12

Unit: 2	**Microprocessor Programming** 2.1 Instruction set of Intel 8085 2.2 Addressing modes 2.3 Introducing to branch and subroutine 2.4 Simple Program such as Addition, Subtraction, Multi-byte addition, Multiplication of two numbers, BCD to Hex conversion, Hex to BCD conversion etc. 2.5 Interrupt & Interrupt Service Routine	8	13
Unit: 3	**Application of microprocessor** 3.1 Review of A/D and D/A converter 3.2 Interfacing – parallel (8255) 3.3 Measurement of voltage, current, frequency. 3.4 Generation of square, triangular and staircase waveform. 3.5 Over current Relay operation . 3.6 Speed control of D.C. motor	8	10
Unit : 4	**Microcontroller Basics** 4.1 Introduction and applications 4.2 Comparison between microcontrollers and microprocessors 4.3 Evolution of microcontrollers 4.4 Architecture of 8051 4.4.1 Block diagram of 8051 microcontroller 4.4.2 Registers in 8051 4.4.3 General purpose or working registers 4.4.4 Stack Pointer and Program counter 4.4.5 Special function registers (SFR) 4.4.6 Program Status word 4.4.7 Data pointer (DPTR) 4.4.8 Timer resisters 4.4.9 Ports 4.4.10 Control registers	7	10
Unit: 5	**8051 addressing modes and instructions** 5.1 8051 addressing modes 5.2 8051 instruction set 5.5 8051 Simple Program such as Addition, Subtraction, Multi-byte addition, Multiplication of two numbers, BCD to Hex conversion, Hex to BCD conversion, Hex to ASCII conversion etc.	6	10
Unit : 6	**8051 interrupts, timer/counters** 6.1 Interrupts in 8051 6.2 Initializing 8051 interrupts 6.3 Interrupt priorities 6.4 Timers and counters, timer counter modes	6	7
Unit: 7	**Application of microcontroller** 7.1 Measurement of voltage, current, frequency. 7.2 Generation of square, triangular and staircase waveform. 7.3 Over current Relay operation . 7.4 Speed control of D.C. motor.	5	8

Total		**48**	**70**

Text Books:

Sl. No.	Name of Authors	Title of the Book	Name of the Publisher
1.	Ramesh Gaonkar	Microprocessor Architecture, Programming, and Applications with the 8085	Wiley Eastern Ltd.
2.	B. Ram	Fundamentals of Microprocessor & Microcontroller	Danpat Rai Publication
3.	Kenneth J Ayala,	8051 microcontrollers architecture, Programming and Applications	Penram International Publishing (I) Pvt. Ltd.
4.	Nagoorkani	Microprocessor & Microcontroller	T.M.Hill ,India
5.	N. Senthil Kumar M.Sarvanan S.Jeevananthan	Microprocessors and Microcontrollers	OXFORD University Press
6.	Subhashis Maitra	Microprocessor and microcontroller	J.B. Books and Learning
7.	Naresh Grover	Microprocessor – Comprehensive studies	Dhanpat Rai & Co.
8.	Biju Azeez	Microprocessor interfacing & Microcontroller	Scitech Publication

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: i) Logical development ii) Programming skills
2.	Motor Skills: i) Data entry, Error Correction and Execution of assembly language programms ii) Connection Skills

Suggested list of Laboratory Experiments:

Sl. No.	Minimum 10 Experiments to be conducted from between Sl no. 1-17
I.	1. Introduction of 8085 Microprocessor and 8051Microcontroller Kit 2. To develop and execute the following using 8085 Microprocessor / 8051 Microcontroller **(At least Eight programs)** i) Addition, Subtraction of two numbers. ii) Multi-byte addition. iii) Multiplication of two numbers. iv) Finding the maximum value in an array. v) Arranging the given data in Ascending order. vi) BCD to Hex conversion. vii) Hex to BCD conversion. viii) Hex to ASCII conversion. ix) ASCII to Binary conversion. x) Square Root of a given data. xi) Least Common Multiple of two numbers. xii) Greatest Common Divisor of two numbers. xiii) Program using interrupt.
II.	To develop, Run & Test Program for the following using 8085 Microprocessor / 8051 microcontroller: **(At least Four applications)**
	1. Measurement of dc voltage and currents using suitable potential divider circuit and shunt along with an A/D converter.

	2. Measurement of ac voltage, current, frequency and phase angle difference (either between two voltages or between voltage and current) using suitable PT, CT, Zero crossing detectors, A/D converters etc. 3. Generation of square, triangular, staircase wave form using D/A converter. 4. Over voltage/under voltage or over current/under current relay circuit using suitable hardware circuit. 5. Control of a D.C. motor at different speed and to note speed vs. Load characteristics at open loop condition. 6. Operation of a stepper motor with a fixed number of steps and to determine the angular displacement per step by measuring the total angular rotation. 7. Operation of a stepper motor continuously at different speed. 8. Control of Traffic light.

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5,6,7	11				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

3. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
4. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Subject : Switchgear and Protection	
Subject Code: EE/S5/SWGRP	**Semester: FIFTH**
Duration: one Semester	**Maximum Marks: 175**
Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs./Week	Mid Semester Exam.: 20 Marks
Tutorial: nil	Assignment & Quiz: 10 Marks
Practical: 3 Hrs./Week	End Semester Exam.: 70 Marks
Credit: 04	Practical Exam.: 75 Marks

Aim:

Sl. No.	
1.	To study the principles, concepts & procedural aspects of switchgear & protection.
2.	To Identify various components of switchgear & protection systems.
3.	To Identify faults & know how to repair the switchgear.

Objective:

Sl. No.	The student will be able to:
1.	Explain the principles, concepts & procedural aspects of switchgear & protection.
2.	Identify the various components of switchgear & protection systems.
3.	Select switchgear & protection system as per specification

Pre-Requisite:

Sl. No.	
1.	Power system
2.	Fundamentals of AC, DC Machines

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Fundamental:** 1.1Necessity & functions of protective system. 1.2 Normal & abnormal conditions. 1.3 Types of faults & their causes. 1.4 Use of current limiting reactors & their arrangements. 1.5 Short-circuit KVA calculations for symmetrical faults – problems.	06	10
Unit: 2	**Circuit interrupting devices:** 2.1 Basic fuse terminology: fuse element, rated current, fusing current, fusing factor, prospective current, cut-off current, arcing time, rupturing capacity, total operating time. Fuse Characteristics 2.1.1 HRC fuses – construction, types, working, characteristics, selection and applications 2.2 Isolators- vertical break, horizontal break & pentograph type	11	18

	2.3 Arc formation process, methods of arc extinction, related terms. 2.4 Circuit breakers- Concept, Classification, Working principle, Construction, Specification & Applications of 2.4.1 E.H.V/H.V – Minimum oil circuit breakers (M.O.C.B.), Air Blast Circuit Breaker (A.B.C.B),Sulpher Hexa Fluoride circuit breaker (SF6). vacuum circuit breaker**.** 2.4.2 L.V.- Air circuit breakers (ACB),miniature circuit breakers (M C B) , Moulded case circuit breakers (M C C B) , Earth leakage circuit breaker (E L C B or R C CB), Comparison of fuse & MCCB 2.5 Selection of MCCB for motor. 2.6 Selection and rating of circuit breakers - breaking capacity, making capacity, rated operating duty, rated voltage. 2.7 Elementary idea of Auto-reclosing.		
Unit: 3	**Protective Relaying:** 3.1 Zones of protection, primary & back-up protection, Essential qualities of protection, classification of protective schemes, basic relay terminology. 3.2 CT & PT used in protection: Requirements, Basic circuit diagram, working principle & application of CVT and CCVT. 3.3 Operating principles and construction (in brief) of: Electromagnetic relays, thermal relays, static relays (with merits and demerits), and Microprocessor based relays, Auxiliary switch Flags – conception only. **3.4 Over current relay---** Time-current characteristics of definite time, instantaneous, inverse time and IDMT Relays. Use of very inverse-type O/C relay and extremely inverse type O/C relay**.** Time-setting, current-setting, PSM – problems**.** **3.5 Directional Relay -** Introduction, Characteristics : Constant product characteristics, Polar characteristics, Concept of dead zone**.** 3.6 **Distance Protection Scheme :** Area of applications, Impedance relays, Reactance relay, MHO relay : operating characteristics, effect of arc resistance on their characteristics. **3.7 Differential Relay** : Introduction, Current differential protection for an internal fault – fed from single & both end. Voltage balance differential protection – Schematic diagram & operation (in brief). Mention the position	15	18

	of operating coil and the restraining coil for both the cases. 3.**8 Static over current relays** **3.9 µP based over current relays.**		
Unit: 4	**Equipment Protection:** 4.1 **Generator protection** – Percentage differential stator protection, brief idea of: - rotor protection due to loss of excitation, protection against rotor overheating because of unbalance in load, over-speed protection, protection against motoring and field suppression. 4.2 **Transformer protection** - Percentage differential protection – problems, Buchholz Relay, rate of rise of pressure relay, over-fluxing protection, O/C protection. 4.3 **Protection of Motor:** Abnormalities & faults. Short circuit protection, Overload protection, Single phase preventer. 4.4 **Protection of Busbar & transmission line**	11	16
Unit:5	**Over voltage Protection:** 5.1 Causes of over voltages. 5.2 Lighting phenomena & over voltage due to lightning. 5.3 Protection of transmission line & substation from direct stroke. 5.4 Types of lightning arresters & surge absorbers & their Construction & principle of operation. 5.5 Protection against traveling waves. 5.6 Insulation co-ordination.	05	8
	Total	**48**	**70**

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: 1. Identify different types of circuit breakers 2. Test the different types of relays. 3. Idea about simulation.
2.	Motor Skills: 1. Simulate circuit configuration. 2. Set the relays for various tests.
3.	**List of Practical: (3.1 and 3.2 are compulsory & any Five from the rest)** 3.1 To demonstrate HRC fuse, MCB & ELCB and explain the functions of various components. 3.2 To Identify the components of following types of circuit breakers with their specifications (through visits , video or model).: I) Low tension air circuit breaker.(including protective devices) II) Minimum oil circuit breaker (M O C B) III) Air Blast circuit breaker (ABCB) IV) Sulpher - Hexa fluoride circuit breaker (S F 6) V) Vacuum circuit breaker.

	3.3 To Plot the inverse characteristics of Induction type/ Micrprocessor Based – (i) O/C relay, (ii) E/F relay using Relay Testing Kit. 3.4 To test percentage Differential Protection of Transformer Using Transformer Differential Relay (Electromagnetic/Microprocessor based). 3.5 To demonstrate the operation of single phasing preventer by creating single phasing fault for a given 3-ph induction motor with D.O.L. starter. 3.6 To test Directional Over Current Relay (DOCR) by Relay Testing Kit. 3.7 To simulate Alternator Protection using any simulator 3.8 To simulate the operation of Distance Relay using any simulator 3.9 To prepare a report on specifications of lightning arresters of different manufacturers through Brochures / Literature

Text Books:

Name of Authors	Title of the book	Edition	Name of the Publisher
J.B.Gupta	Switchgear & Protection		S.K.Katharia & Sons
C.L.Wadhwa	Electrical Power System		Wiley Eastern Ltd.
Badriram & Vishwakarma P.N.	Power System Protection & Switchgear		TMH, New Delhi
B. Bhalja, R.P.Maheshwari & N.G. Chothani	Protection and Switchgear		Oxford University Press
V.K. Mehta & R. Mehta	Principles of Power system		S.Chand & Co. Ltd.
B. Ravindranath, M Chandar	Power System Protection and Switchgear		Wiley Eastern Ltd.
Raghuraman	Protection & Switchgear		Scitech Publication (India) Pvt. Ltd.

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2	8	TWENTY	ONE	1 X 20 = 20	THREE	TWO	TEN	10 X 5 = 50
B	3,4	12				THREE	TWO		
C	5,6	4				TWO	ONE		

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 50 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 35, Viva-voce – 15.**

Name of the subject: INDUSTRIAL PROJECT AND ENTREPRENEURSHIP DEVELOPMENT	
Subject Code: EE/S5/IPED	**Semester: S5**
Duration: one Semester	**Maximum Marks: 75**
Teaching Scheme	**Examination Scheme**
Theory: 1 Hrs/week	Mid Semester Exam.: Marks
Tutorial:	Assignment & Quiz: Marks
Practical: 3 Hrs/week	End Semester Exam.: Marks
Credit: 03	Practical : 7 5 Marks

Aim:	
Sl. No.	
1.	It is intended to provide opportunity for students to develop understanding of the interrelationship between different courses learnt in the entire diploma programme and to apply the knowledge gained in a way that enables them to develop & demonstrate higher order skills.

Objective:	
Sl. No.	The student will be able to:
1.	Generate creative ability by developing something which has Engineering relevance
2.	Handle real life problems that a diploma-holder may encounter as a professional
3.	Identify entrepreneurship opportunity
4.	Develop entrepreneurial values and attitude
5.	Use the information to prepare project report for business venture
6.	Develop awareness about enterprise management

Pre-Requisite:	
Sl. No.	
1.	Knowledge of subjects up to 4th Semester of Electrical Engineering.

PART A: Industrial Project

Following activities related to project are required to be dealt with, during this semester

1. Form project batches (Max. 6 students per batch)

2. Each project batch should select topic / problem / work by consulting the guide & / or industry.

(One from Group 1 and another from Group 2)

3. Each project batch should prepare action plan of project activities & submit the same to respective guide.

4. At the end of semester, each project batch should submit the action plan and abstract of the project along with list of materials required if project involves fabrication or other facilities required in other kinds of project.

5. Action Plan should be part of the project report.

Actual work of project should be done in sixth semester.			
Group	Projects		
1	(1) Design and Estimation of electrification of a modern multistoried building along with the required sub-station complying I.E. Rules. (2) Design of Rural Electrification Scheme for small Village, Colony. (3) Energy Conservation and Audit. (4) Substation Model (Scaled) (5) Wind Turbine Model (Scaled) (6) Pole Mounted Substation Model (Scaled) (7) Conduct load survey to ascertain the total load requirements of a locality / polytechnic. (8) Any other items as may be assigned by the teacher concerned.		
2	(1) Rewinding of Three Phase/Single Phase Induction Motor. (2) Rewinding of Single Phase Transformer. (3) Fabrication of Inverter up to 1000 VA. (4) Fabrication of Battery Charger. (5) Fabrication of Small Wind Energy System for Battery Charging. (6) Fabrication of Solar Panel System for Battery Charging. (7)Fabrication of Water level controller. (8)Fabrication of DC motor speed control circuit by SCRs. (9) Microprocessor/ Micro controller Based Projects. (10) Simulation Projects using Matlab. (11) Any other items as may be assigned by the teacher concerned.		

Part B: Entrepreneurship Development

Following activities related to Entrepreneurship Development is required to be dealt with, during this semester:

1. **Students should be taught about the basic idea of following aspects Entrepreneurship Development** :

Chapter	**Contents**
1.	**Entrepreneurship, Creativity & Opportunities** **03 Hrs** 1.1) Concept, Classification & Characteristics of Entrepreneur 1.2) Creativity and Risk taking. 1.2.1) Concept of Creativity & Qualities of Creative person. 1.2.2) Risk Situation, Types of risk & risk takers. 1.3) Intrapreneuring and Entrepreneurship.

	1.4) Business Idea: Methods and techniques to generate business idea. 1.5) Transforming Ideas in to opportunities : Transformation involves Assessment of idea & Feasibility of opportunity 1.6) SWOT Analysis
2.	**Information And Support Systems** **05 Hrs** 2.1) Industrial Policy reform in West Bengal 2.2) Financial assistance schemes of SIDBI (Small Industries Development Bank of India) 2.3) Financial assistance scheme of NSIC (National Small Industries Corporation) 2.4) Guidance/Assistance available from following organizations: i) National Research Development Corporation (NRDC) ii) Small Industries Service Institute(SISI) iii) State Financial Corporation (SFC) iv) District Industries Centre (DICs) v) Chambers of Commerce and Industry and Industrial Association
3.	**Forming of Business Organization** **02 Hrs** 3.1) Market Survey 3.2) Advantages and Disadvantages of following types organizations: a) Sole Proprietorship b) Partnership c) Joint stock company i) Private Limited Company ii) Public Limited Company 3.3) Assess yourself-are you an entrepreneur ?
4.	**Project Report Preparation** **06 Hrs** 4.1) Project Report and its utility 4.2) Preparation of Project Report of any one business. Following statements are required to be prepared: i) Calculation of working capital requirement. ii) Cost of Production. iii) Profitability Statement. iv) Cash Flow statement. v) Mean of Financing. vi) Land and site Development

	vii) Building viii) Plant and Machinery ix) Preliminary and Pre-operative Expenses x) Manpower Estimates Staff and Labour xi) Administrative Overheads. xii) Miscellaneous Assets. xiii) Calculation of Depreciation. xiv) Interest Calculation. xvi) Project Implementation Schedule.

2. At the end of the semester every student has to prepare Project Report of a business model as mentioned above in chapter 4.

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
J.S. Saini B.S.Rathore	A Handbook of Entrepreneurship		Aapga Publication
Raj Shankar	Entrepreneurship Theory & Practice		TMH
Alpana Trehan	Entrepreneurship		Dreamtech Press
M.Schaper, T Volery, P Weber, K Lewis	Entrepreneurship And Small Business		Wiley
J.B.Patel D.G.Allampally	A Manual on How to Prepare a Project Report		EDI STUDY MATERIAL Ahmadabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org
J.B.Patel S.S.Modi	A Manual on Business Opportunity Identification & Selection		
S.B.Sareen H. Anil Kumar	National Derectory of Entrepreneur Motivator & Resource Persons.		
Gautam Jain Debmuni Gupta	New Initiatives in Entrepreneurship Education & Training		
P.C.Jain	A Handbook of New Enterpreneurs		

Video cassette		
Sl no.	Subject	Source
1.	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmadabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org
2.	Assessing Entrepreneurial Competencies	
3.	Business Opportunity Selection and Guidance	
4.	Planning for completion & Growth	
5.	Problem solving-An Entrepreneur skill	

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester.
2. **External Assessment of 50 marks** shall be held at the end of the Fifth Semester. **Distribution of marks: On the basis of Action plan of Project and Project Report of Entrepreneurship Development – 35, Viva-voce – 15.**

Name of the Course: Utilization, Traction, Heating and Drives	
Course Code: EE/S5/UTHD	**Semester: Fourth**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 20 Marks
Tutorial: hrs./week	Assignment & Quiz: 10 Marks
Practical: 2 hrs./week	End Semester Exam.: 70 Marks
	Practical : 50 Marks
Credit: 5 (Five)	

Aim:

Sl. No.	
1.	To understand basic areas of utilization of electrical energy e.g. illumination, motor drives etc.
2.	To study various methods of electric heating
3.	To understand basics of electric traction.
4.	To understand cost of electrical energy and conservation of electrical energy.

Objective:

Sl. No.	The students will be able to:
1.	Explain working of various sources of light and flood lighting
2.	Compare different methods of electric heating
3.	Select electric drives for specific applications.
4.	Explain concept of electric traction system.
5.	Apply various measures for economic aspects of utilizing electrical energy.

Pre-Requisite:

Sl. No.	
1.	Electrical Technology and Electrical Machines.

	Contents (Theory)	Hrs./Unit	Marks
Unit: 1	**Illumination**: 1.1. Definitions of Terms Used in Illumination: Light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Illumination, Lux or Meter Candle, Mean Horizontal Candle Power (MHCP), Mean Spherical Candle Power (MSCP), Mean Hemi-spherical Candle Power (MHSCP), Reduction Factor, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, Utilization Factor, Maintenance Factor, Depreciation Factor, Colour Renderng Index, Waste Light Factor, Absorption Factor, Reflection Factor, Solid Angle, Beam Angle 1.2. Laws of Illumination: - Law of Inverse Squares - Lambert's Cosine Law. (No Numerical) 1.3 Types, basic principle, Details Specifications and application of following sources of light: - Incandescent Lamps.	10	18

	- Halogen Lamps. - Low Pressure Mercury Vapour Lamps (Fluorescent Tube). - High Pressure Mercury Vapour Lamps. - Sodium Vapour Lamps. - Compact Fluorescent Lamps (C.F.L.) - Metal Halide Lamps - LED Lamps - Neon Signs.		
Unit 2	**<u>Electric Heating and Welding</u>**: **Electric Heating** 2.1. Advantages of Electric Heating. 2.2. Classification of Electric Heating Methods: 2.2.1. Resistance Heating:(Construction, Operation and application) - Direct Resistance Heating: Salt Bath Furnace. - Indirect Resistance Heating: Resistance Ovens, Requirements of Heating Element Material, Name of some common heating element materials, Causes of Failure of Heating Elements, Methods of Temperature Control. 2.2.2. Arc Heating: (Construction, Operation and application) - Direct Arc Furnace: - Indirect Arc Furnace. 2.2.3. Induction Heating: (Construction & Operation and application) - Core Type Induction Furnaces: Ajax Wyatt Furnace. - Coreless Induction Furnace. 2.2.4. Dielectric Heating: - Principle of Dielectric Heating. - Advantages of Dielectric Heating - Limitations of Dielectric Heating. - Applications of Dielectric Heating. Power supply requirement and simple numerical of above heating methods. (No deduction of any formula) **Electric Welding:** 2.3. Methods of Electric Welding 2.3.1. Resistance Welding: - Principle of Resistance Welding. - Advantages of Resistance Welding. - Types of Resistance Welding - (Only List) Spot Welding Machine. 2.3.2. Electric Arc Welding: - Formation and Characteristics of Electric Arc. - Effect of Arc Length. - Arc Blow. Electrodes for Metal Arc Welding, V-I Characteristics required for of Arc Welding. 2.3.3. Arc Welding Machines: - DC Welding Machines - MG Set, AC Rectified Welding Unit. - AC Welding Machines - Welding Transformer.	14	20
Unit 3	**Electric Drives:** 3.1 – Introduction. - Drives - Mechanical Drive and Electric Drive. - Advantages and Disadvantages of Electric Drive. - Factors Governing Selection of Electric Motors. -Comparative discussion between the various Electric drive duties - continuous,	8	10

	short-time & intermittent. 3.2. Requirements of various types of common loads such as - Hoist, Elevator, Conveyor, Rolling mills, Centrifugal pumps, Punches, Shears etc. - Selection of motors in respect of types, size and rating for above loads on the basis of mechanical characteristics, speed control, reversibility, working environment and cost.		
Unit 4	**Electric Traction:** 4.1. Introduction: - History of electric traction - Various systems of traction. - Electric traction Vs other traction systems - Electric Traction as viable transport strategy for 21st Century -Choice of traction system: Diesel-electric or Electric. 4.2 Electric Traction: -Different systems of track electrification (Block diagram) DC, AC, Composite. Advantage & disadvantages of each. -analysis of single phase 25 KV AC system and DC system. 4.3. Traction Mechanics: - Units Used in Traction Mechanics. - Types of Services. - Speed Time Curve. - Simplified Speed Time Curve (No Derivation) - Average Speed and Schedule Speed. - Factors Affecting The Schedule Speed. - Tractive Effort - Specific Energy Consumption - Factors Affecting Specific Energy Consumption. - (Simple Numerical on Simplified Speed Time Curves and Specific Energy Consumption) 4.4. Mechanics of train movement, Adhesion & coefficient of Adhesion, concept of weight transfer, effect of unsprung mass and wheel diameter. 4.5. Traction Motors: - Desirable Characteristics of Traction Motors, Special features of traction motor. - Suitability of DC Series Motor for Traction. - Suitability of Three Phase Induction Motor for Traction.	10	15
Unit 5	**Economic Aspects of Utilising Electrical Energy:** 5.1 - Economic Aspects of Utilising Electrical Energy. 5.2 - Costing of Electrical Energy: Fixed Charges, Semi Fixed Charges and running Charges. 5.3 - Formulation of Electrical Tariffs. 5.4 - Various Types of Tariffs: Tariffs in force for Domestic, Commercial and Industrial Consum 5.5 - Energy Conservation: Importance and need of Energy Conservation, Measures for Energy Conservation in (i) Electric Drives (ii) Electric Traction (iii) Electric Heating (iv) Refrigeration and Air Conditioning (v) Illumination.	6	7
	Total	48	70

Contents (Practical)	
Skills to be developed	
Intellectual Skills: i) Interpret results **ii) Calculate values of various components for given circuits.** **ii) Select Instruments**	
Motor Skills: i) Connect the instruments properly. **ii) Take accurate readings.** **iii) Draw related graphs.**	
List of Laboratory Experiments:	
Sl. No.	List of Practical: **(At least Eight Experiments are to be performed)**
1.	To determine Illumination of a surface for a Drawing Room by means of lux meter.
2	To determine candle power of a lamp in comparison to standard C.P. of lamp by optical bench method.
3	To verify the Inverse Square Law and compare the difference in output luminescence of incandescent, fluorescent and compact fluorescent lamps.
4	To Study of Sodium vapour lamp, Mercury vapour lamp, CFL with their connections and the technical specification.
5	To study of torques/Armature current, Speed/Armature current & Torque/Speed characteristics for D.C. series motor using mechanical loading. (Either braking arrangement or using D.C. Gen).
6	To study of different current collectors used for drawing current from O.H. system for traction (using models and block diagram).
7	To calculate the Total Cost in a (i) Residential and (ii) Commercial or Industrial Bill.
8.	To study of Electric Arc Welding using welding transformer.
9.	To study of the principle of Induction Heating using an induction heater.
10.	To Study Electricity Act 2003 : Energy Audit, role of energy manager, energy auditor and prepare power point presentation/report.

Text Books:

Sl No.	Name of Authors	Titles of the Book	Name of Publisher
1	H. Partab	Modern Electric Traction	Dhanpat Rai & Sons
2	C.L. Wadhawa	Generation Distribution and Utilization of Electrical Energy	New Age
3	J. Upadhyay S. N. Mahendra	J. Upadhyay S. N. Mahendra	Allied Publishers Ltd.
4.	A.T.Starr	Generation, transmission and utilization of Electrical power	
5.	J.B.Gupta	Utilization of Electric Power & Electric Traction	S.K.Kataria & Sons

EX A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1,	5	TWENTY	ONE	1 X 20 = 20	TWO	FIVE, TAKING AT LEAST ONE FROM EACH GROUP	TEN	10 X 5 = 50
B	2	5				THREE			
C	3,5	5				THREE			
D	4	5				TWO			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job - 15, Notebook - 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job - 15, Viva-voce - 10.**

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Name of the course : Illumination Engineering (Elective)	
Course Code : EE/S5/ILE (EL)	**Semester : Fifth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit:	

Aim:

Sl. No.	
1.	To measure the level of illumination.
2.	To study various types of lamps.
3.	To design illumination schemes for various applications in residential, commercial & industrial locations.

Objective:

Sl. No.	Student will be able to:
1.	Measure the level of illumination.
2.	Differentiate between various types of lamps.
3.	Identify & list of various lighting accessories and components.
4.	Design a control circuit for illumination.
5.	Design and execute illumination schemes for various applications in Residential, Commercial & Industrial locations.

Pre-Requisite:			
1.	Knowledge of Optics and light sources.		
2.	Wiring, switching and control circuits.		
Contents (Theory):		Hrs./Unit	Marks
Unit : 1	**1. Fundamentals of Light :** 1.1 Electromagnetic radiation & Light. 1.2 Electromagnetic spectrum – Ultraviolet, Visible, Infrared spectrum. 1.3 Human eye as an optical system – basic concept. 1.4 Spectral sensitivity of human eye – Photopic, Scotopic, Mesopic vision. 1.5 Visual characteristics – Brightness, Contrast, Glare, Flicker. 1.6 Visual performance - Visibility level, Contrast rendering factor. 1.7 Colorimetry – Visual basis, Source colour, Object colour. 1.8 Colorimetric instrument – Colorimetry of light source and materials, Colour rendering index.	**07**	**10**
Unit : 2	**2. Measurements:** 2.1 Photometry – Basic concept, Fundamentals of detector. 2.2 Photometric measurements – Methods to measure Luminous intensity, Luminous flux, Luminance, Illuminance. 2.3 Application of Polar Photometer & Goniophotometer. 2.4 Luxmeter – Working principle & Application. 2.5 CIE standard source of illuminant. 2.6 Radiation of energy – Black body radiation, Full radiator, Thermal radiation, Radiation from incandescent lamps.	**07**	**12**
Unit : 3	**3. Lamps & Accessories :** 3.1 Lamp materials – glass, filament, phosphor coating, ceramics, electrodes, gases, capping cement etc. 3.2 Theory & basic properties of low & high pressure gas discharge.	**10**	**12**

	3.3 Theory of operation, Life, Characteristics and Application of - a) High & Low pressure sodium vapour. b) High & Low pressure mercury vapour. c) Metal halide. d) Fluorescent lamp. e) LED. f) LASER. 3.4 Optical fiber – its construction as light guide, characteristics, application in lighting. 3.5 Luminaire – Types of luminaire, Design consideration, Indian standard recommendation.		
Unit : 4	**4. Illumination Control & Control circuits :** 4.1 Purpose of lighting control – Energy conservation. 4.2 Electromagnetic & Electronic ballast – Operation & comparison in light control. 4.3 Ignitor – its function in lamps. 4.4 Control circuits & operation of – a) Fluorescent lamp circuit. b) Low pressure sodium vapour lamp circuit. c) High pressure sodium vapour lamp circuit.	**08**	**12**
Unit : 5	**5. Interior Lighting :** 5.1 National standards of interior lighting calculation. 5.2 Lighting calculations of interior lighting. (Numerical) 5.3 Design considerations for interior lighting of - (a) Residential complex. (b) Commercial complex. (c) Industrial premises. 5.4 Design with Lighting design software. 5.5 Daylighting – Sky luminance pattern, Daylight factor, estimation of average daylight factor, window design considerations for maximum daylighting, Application of daylight in	**10**	**12**

	interior lighting. 5.6 Use of photocell, occupancy sensor in lighting controls. 5.7 Concept of Isolux contour in lighting design.		
Unit : 6	**6. Exterior Lighting :** 6.1 Lighting calculations of exterior lighting. (Numerical) 6.2 Calculation of lighting & design considerations for exterior lighting of - (a) Road lighting. (b) Flood lighting – Industrial complex, Commercial complex, Sports complex. 6.3 National & CIE standards of exterior lighting calculation.	**06**	**12**
	Total	**48**	**70**

Practical:
Skills to be developed:
Intellectual Skills:
1. To select appropriate equipment.
2. Apply different lighting designing skills.
Motor Skills:
1. Ability to draw the circuit diagrams.
2. Ability to measure illuminance properly.
List of practical: (At least Eight Experiments are to be performed)
1. To measure illuminance (daylight & artificial light) at different points of a classroom by Luxmeter & draw – (i) Variation of Illuminance characteristics with distance and (ii) Isolux plot.
2. To study the technical data of different types of lamps available in the market & draw their connection diagram.
3. To study the different lighting accessories, ignitor & electronic ballasts required for different types of lamps – Sodium vapour, Mercury vapour, Metal halide, CFL, Fluorescent lamp.
4. To study the different luminaries available in the market for various types of lamps with their technical specifications, their design consideration, Indian standard recommendation.

5. To study of – (i) Photocell, (ii) Occupancy sensor in artificial lighting control.
6. To design an illumination scheme of a conference hall of medium size.
7. To design an illumination scheme for a workshop in your institute.
8. To design an illumination scheme for a playground of medium size.
9. To design an illumination scheme for a shopping complex of medium size.
10. To visit a standard lamp manufacturing industry and make a report on lamp manufacturing process.
11. A case study of optimum lighting design with lighting design software.

List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	Jack L. Lindsey	Applied Illumination Engineering	The Fairmont Press Inc.
2.	R.H. Simons, Robert Bean	Light Engineering : Applied calculations	Architectural Press
3.	Casimer M Decusatis	Handbook of Applied Photometry	Springer

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5,6,	11				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Subject: Energy Conservation and Audit (Elective)	
Subject Code: EE/S5/ECA(EL)	**Semester: Fifth**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/ week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical: 2 hrs/week	End Semester Exam.: 70 Marks
Credit: 04	Practical : 50 Marks

Aim:

Sl. No.	
1.	To study causes for limited growth of conventional energy sources and limitations of non conventional sources of energy
2.	To study methods of energy conservation for different load conditions
3.	To Select appropriate tariff system and methods for reducing electricity consumption and energy saving.

Objective:

Sl. No.	The students will be able to:
1.	List causes for limited growth of conventional energy sources and limitations of non conventional sources of energy.
2.	Suggest methods of energy conservation for different load conditions.
3.	Select appropriate tariff system and methods for reducing electricity consumption and energy saving.
4.	Apply Tools for energy audit and recommend measures for energy conservation.

Pre-Requisite:

Sl. No.	
1.	Utilization of Electrical Energy
2.	Knowledge of energy sources

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Energy** Review of various energy sources, Need of energy conservation and energy audit.	04	08
Unit: 2	**Energy Conservation:** Lighting energy: methods/Techniques of efficient lighting . Heating: methods/Techniques of energy Saving in Furnaces, Ovens and Boilers. Cooling: methods/Techniques of Energy Saving in Ventilating systems and Air Conditioners Motive power, Energy Efficient Motors, and Efficient use of energy in motors with the help of voltage reducers, automatic star/ delta converters . Power factor improvement devices and soft starters/Variable Frequency Drives. Amorphous Core Transformers Cogeneration -Types and Advantages.	12	18

Unit : 3	**Tariff and Energy Conservation in Industries:** Energy cost and Recent WBSEB tariffs, Application of Tariff System to reduce Energy bill, Energy conservation by improving load factor and power factor.	06	08
Unit : 4	**Energy Conservation In Transmission and Distribution Systems:** Reactive power compensation, demand side management, system voltage optimization and phase current balancing, Losses in transmission and distribution system and its minimization	08	08
Unit : 5	**Energy and the Environment:** Environment and social concerns related to energy utilization, The green house effect, Global Warming and its effect , Pollution, Acid Rains, Global Energy and environment Management.	04	08
Unit : 6	**Energy Audit:** Procedure of Energy audit, ABC analysis, Energy Flow Diagram and its importance, Measurements in energy audit and various measuring instruments, Questionnaires for the energy audit, internal energy audit checklist, Equipment used for energy conservation, Calculation of payback period for energy conservation equipment. IE rules and regulations for energy audit, Electricity act 2003 (Numerical).	14	20
	Total	**48**	**70**

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: 1. Identify different methods used for energy conservation. 2. Understand the importance of energy conservation. 3. Select proper tariff for given industry/institute. 4. Collect technical information regarding electricity act.
2.	Motor Skills: 1. Prepare energy audit report. 2. Write visit report. 3. Use different methods of energy conservation. 4. Use of energy saving devices.

Suggested list of Experiments/Reports:

Sl. No.	Laboratory Experiments
1.	To save energy by using electronic ballast as compared to conventional choke.
2.	To Collect the Standard tariff rates and suggest suitable tariff for given industry/Lab/Institute/Commercial establishment.
3.	To make a survey of one establishment to identify different methods used for energy

	conservation.
4.	To prepare Energy audit report for Industry/workshop/ Institute .
5.	To search on the website of power ministry and collect the information regarding role of energy manager, energy auditor and prepare power point presentation/report.
6.	To list energy saving equipments for domestic and commercial applications
7.	To list the different equipments used in energy auditing

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Siemens	Power Factor Correction		New Age Vol.38 2005
T.Gonen	Electric Power Distribution System Engg.		Tata McGraw Hill
M.J. Steinburg and T.H. Smith	Economy Loading of Power plant and Electric system		John Willey and sons
C.L. Wadhawa	Generation Distribution and Utilization of Electrical Energy		New Age 2004
Steven R. Patrick, Dale R. Patric Stephen W. Fardo	Energy conservation Guide book		Fairmont Press
Giovanni Petrecca	Industrial Energy Management: Principles and applications		Kluwer Academic Publisher

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5,6,	11				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 50 marks** shall be held at the end of the Fifth Semester. **Distribution of marks: On the basis of Experiment/Reports – 15, Viva-voce – 10.**

Name of the Subject: HEATING, VENTILATION & AIR CONDITIONING (Elective)	
Subject Code: EE/S5/HVAC (EL)	**Semester : FIFTH**
Duration : One Semester	**Maximum Marks : 150**
Teaching Scheme	**Examination Scheme**
Theory : 03 hrs/week	Mid Semester Exam: 20 Marks
Tutorial: -- hrs/week	Assignment & Quiz: 10 Marks
Practical : 02 hrs/week	End Semester Exam: 70 Marks
Credit: 04	Practical : 50 Marks

Aim :-

S.No	
1.	This is a technology subject which is an elective subject for third year diploma in Electrical Engineering. Presently the need of Heating Ventilation and Air conditioning (HVAC) is increasing with the growth in IT sector, commercial establishments, hospitals, hotels etc. Therefore there is a growing need of engineers / technicians in this field. Hence, technicians/supervisors from electrical engineering branch are also expected to have some basic knowledge of HVAC systems.
2.	This subject covers installation, testing and maintenance of Heating Ventilation and Air conditioning systems. After completing this subject the student can carry out installation, testing and maintenance of HVAC equipment efficiently and effectively. He can work as service engineer or get self employed.
3.	Student can work with building management system (BMS).

Objective :-

S.No	The student will be able to:-
1.	Install HVAC equipment.
2.	Test the equipment for its performance evaluation.
3.	Carryout routine and preventive maintenance of HVAC system.
4.	Troubleshoot and repair HVAC equipment.
5.	Calculate heat load and approximate capacity of the equipment using thumb rule.
6.	Select appropriate equipment.

Pre-Requisite:-

S.No	
1.	Basics of electronic instrumentation

Content (Theory)		Hrs/Unit	Marks
Unit : 1	**Introduction** 1.1 Laws of thermodynamics 1.2 Comparison between heat engine, heat pump and refrigeration 1.3 Definitions of refrigeration, ton of refrigeration, COP, enthalpy, entropy	**02**	**04**

Unit : 2	**Types of refrigeration systems** 2.1 Vapour compression system – components used in vapour compression system, operation of vapour compression system, its representation on P – H and T – S diagrams, effect of superheating and under cooling of refrigerant. 2.2 Vapour absorption system – components used in vapour absorption system, its operation, its merits and demerits compared to vapour compression system 2.3 Air refrigeration system – components used in air refrigeration system, its operation and applications	**04**	**04**
Unit : 3	**Refrigerants and Lubrication** 3.1 Classification of refrigerants 3.2 Types of refrigerants presently in use 3.3 Desirable properties of refrigerants (Physical, chemical, thermodynamic) 3.4 Applications of important refrigerants 3.5 Eco-friendly refrigerants 3.6 Properties of lubricants 3.7 Lubricants and refrigerant compatibility 3.8 Foaming of oil and crankcase electric heater 3.9 Effect of lubricant flood back to compressor 3.10 Additives used in lubricants 3.11Necessity of oil separator	**06**	**06**
Unit : 4	**Components of vapour compression system** 4.1 Various types of compressors – reciprocating (hermetic, semi sealed, open), rotary (centrifugal, lobe type, screw type, blade type), applications of each type 4.2 Various types of condensers (air cooled, water cooled, evaporative), applications 4.3 Types of cooling towers – natural draft, forced draft 4.4 Types of evaporators – direct expansion type, flooded type, shell and coil type, double tube type, plate surface type 4.5 Throttling devices – hand expansion valve, constant pressure expansion valve, thermostatic expansion valve, high side float valve, capillary tube, electronic expansion valve 4.6 Accessories – receiver, oil separator, drier, strainer, solenoid valve **Note –** schematic diagram and brief description only of the above components 4.7 Applications of refrigeration – Ice plant, water cooler, refrigerator, milk dairy, cold storage, breweries, superconductors, transport refrigeration and air conditioning	**12**	**16**
Unit : 5	**Airconditioning** 5.1 Psychrometry – Definition, psychrometric properties of air, use of psychrometric chart 5.2 Representation of simple air conditioning process on psychrometric chart. 5.3 Sling psychrometer	**05**	**10**

	5.4 Air conditioning systems (Schematic layout, working and application of each of the following) • Central air conditioning system – direct expansion type, chilled water type • Package type air conditioning system • Unitary air conditioning system, split type system • Evaporative cooling 5.5 Applications of airconditioning – comfort airconditioning, industrial Air conditioning, transport air conditioning		
Unit : 6	**Components in air supply and distribution system** 6.1 Fans and blowers (centrifugal, axial flow) – schematic diagram and applications 6.2 Filters – (Dry, viscous, wet, electronic type) – schematic diagram and applications 6.3 Different types of humidifiers and dehumidifiers 6.4 Grills and registers 6.5 Duct system – heat gain or loss in ducts 6.6 Causes of pressure loss through air ducts 6.7 Different methods of duct designing	**04**	**06**
Unit : 7	**Thermal insulation** 7.1 Desirable properties of insulating materials for airconditioning purpose 7.2 Different types of insulating materials used for airconditioning 7.3 Selection of insulating materials for walls, ceiling, floor, air ducts, chilled water pipes	**02**	**04**
Unit : 8	**Controls used in airconditioning** 8.1 High pressure and low pressure cutouts, overload protector, thermostat, oil safety switch, fusible plug, pressure equalizer 8.2 Microprocessor based controls and variable frequency drive 8.3 Fluid flow control devices (simple sketch and wiring diagram is expected)	**03**	**06**
Unit : 9	**Heat load** 9.1 Definitions – SHF, RSHF, EFSHF 9.2 Factors responsible for heat load 9.3 Conditions of airconditioning and representation of comfort zone on psychrometric chart 9.4 Determination of capacity of airconditioning unit by referring tables only (no calculations)	**03**	**06**
Unit : 10	**Heating and ventilation** 10.1 Plain heating, electric heating, steam heating, hot water heating, solar heating 10.2 Heating with humidification and heating with dehumidification 10.3 Natural ventilation 10.4 Mechanical ventilation – 1) Air extraction system 2) Air supply system, combined supply and extraction system 10.5 Air distribution system – perimeter system, extended plenum system, upward flow system, downward flow system, ejector system 1o.6 Return duct system (only schematic diagrams and brief description of the above system)	**07**	**08**
	Total	**48**	**70**

Contents (Practical)	
Sl. No.	Skills to be developed
1.	Intellectual Skills: 1. Interpret results 2. Write specifications
2.	Motor Skills: . 1. Conduct trial 2. Read drawing and identify components 3. Carry out Welding
Sl. No.	**list of Experiments/Reports (Any eight)**
1.	To carryout trial on vapour compression test rig for finding its performance.
2.	To dismantle and assemble open type and hermetic type compressors, to draw freehand sketches of various parts and to write specifications of compressors.
3.	To carryout copper tube welding
4.	To study and draw block diagram of control panel wiring with respect to L.P. / H.P. cutouts, oil pressure cutout, thermostat, humidistat, solenoid valve
5.	To troubleshoot the air-conditioning plant in relation to a) High condenser pressure b) Low cooling effect c) Reduced volume of supply of air d) compressor not starting
6.	To prepare maintenance schedule of central air conditioning plant – weekly, quarterly, half yearly, yearly
7.	To demonstrate and study of various tools used in refrigeration such as – tube cutter, bending tools, flaring tool (block and yoke type), swaging tool, brazing tool, blow lamp etc.
8.	To demonstrate purging, gas charging, leak testing and pump down of the refrigeration system
9.	To visit to air conditioned hotel or theater to study control panel and various controls, starting and stopping system, air supply and air return system. Write a detailed report.
10.	To visit to cold storage to study different components of vapour compression system, temperature and humidity conditions required for different food items. Write a detailed report.
11.	To prepare a report (use internet) based on the following points to purchase an air conditioner: i)Manufactures, ii)Technical specifications, iii) Features offered by different manufacturers, iv) Price range. Then select the air conditioner which you would like to purchase. Give justification for your selection in short.
	Note: For visits professional practices periods may be utilized.

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
P. N. Anathanarayanan	Basic Refrigeration and Air-conditioning		Tata Mcgraw Hill, New Delhi
M. Adithan, S.C. Laroyia,	Practical Refrigeration and Air-conditioning		New Age International (P) Ltd.

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3,4	11	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	5,6,7,8,9 ,10	12				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 50 marks** shall be held at the end of the Fifth Semester. **Distribution of marks: On the basis of Experiment/Reports – 15, Viva-voce – 10.**

Name of the Subject : Electric Traction (Elective)			
Subject Code: EE/S5/ET(EL)		**Semester: Fifth**	
Duration: one Semester		**Maximum Marks: 150**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester Exam.: 20 Marks	
Tutorial: hrs./week		Assignment & Quiz: 10 Marks	
Practical: 2 hrs./week		End Semester Exam.: 70 Marks	
		Practical : 50 Marks	
Credit: 04			

Aim:

Sl. No.	
1.	One of the practical applications of electricity, which enters into the everyday life of many of us, is its use in service of mass transport – the electric propulsions of vehicles – electric trains, trolley buses, tram cars and in the latest developments such as metro and sky bus.
2.	In view of the growing importance and technological developments, which have come about in this area in the recent past; for Electrical Engineering students, it is desirable to study the course dealing with electric traction.

Objective:

Sl. No.	The students will be able to:
1.	Identify and explain use of components of the power supply arrangements for electric traction.
2.	Maintain different overhead equipments.
3.	Differentiate the various types of current collecting systems and current collecting gears based on utility.
4.	Differentiate the various types of current collecting systems.
5.	Explain special requirements of train lighting and various systems of train lighting.
6.	Describe the recent trends in Electric traction, such as LEM propelled traction

Pre-Requisite:

Sl. No.	
1.	Utilization, traction & Heating in 4th Semester.
2.	A.C and D.C. Motors and Power Supply

	Contents (Theory)	Hrs./Unit	Marks
Unit: 1	1.1 - Nomenclature used For Electric Locomotives 1.2 - Types of Electric Locomotives by Nomenclature. 1.3 – AC Locomotive: 1.3.1 - Equipments of AC Electric Locomotive: - Power Circuit Equipments and Auxiliary Circuit Equipments. 1.3.2- Equipments in Power Circuit and their Functions: - Power Circuit Diagram of AC Locomotive: Pantograph, Circuit breaker, Tap Changer, Traction Transformer, Rectifier, Smoothing, Choke, Traction Motor. 1.3.3 - Equipments in Auxiliary Circuit & their Functions: Head Light, Flasher Light, Horn, Marker Light, Batteries, Arno Converter, Blowers, Exhausters, Compressors, Selsyn transformer.	12	18
Unit 2	2.1 – Constituents of Supply System: Substations, Feeding Posts, Feeding and Sectioning Arrangements, Sectioning and Paralleling Post, Sub sectioning and Paralleling Post, Sub sectioning Post, Elementary Section, Miscellaneous Equipments at Control Post or Switching Stations.	08	10

	2.2 – List of Major Equipments at Substation. 2.3 – Location and spacing of substation.		
Unit 3	**Overhead Equipments:** 3.1 – Overhead Equipments (OHE). 3.2 – Principles of Design of OHE: Composition of OHE, Height of Contact Wire, Contact Wire Gradient, Encumbrances, Span Length. 3.3 – Automatic Weight Tension and Temp. Compensation. 3.4 – Uninsulated Overlaps. 3.5 – Insulated Overlaps. 3.6 – Neutral Section. 3,7 – Section Insulator. 3.8 – Isolator. 3.9 – Polygonal OHE: Single Catenary Construction, Compound Catenary Construction, Stitched Catenary Construction, Modified Y Compound Catenary. 3.10 – Effect of Speed on OHE. (No derivation and No numerals)	09	12
Unit 4	**Current Collecting Equipments:** 4.1 – Introduction. 4.2 – Systems of Supplying Power in Electric Traction: Overhead System, Third Rail or Conductor Rail System. 4.3 – Current Collectors for Overhead System: - Trolley Collector or Pole Collector, Bow Collector, Pentograph Collector. 3.4 – Types of Pentographs: Diamond Pentograph and Faiveley Type. 3.5 – Methods of raising and lowering of Pentograph	06	10
Unit 5	**Train Lighting:** 5.1 – Systems of Train Lighting. 5.2 – Special Requirements of Train Lighting. 5.3 – Method of obtaining Unidirectional Polarity. 5.4 – Method of obtaining Constant Output. 5.5 – Single Battery System. 5.6 – Double Battery Parallel Block System.	05	8
Unit 6	**LEM Propelled Traction:** 6.1 – Introduction. 6.2 – Linear Electric Motor (LEM) 6.3 – Linear Induction Based Traction System: - Moving Primary Fixed Secondary Single Sided LIM. - Moving Secondary Fixed Primary Single Sided LIM. - Moving Primary Fixed Secondary Double Sided LIM. 6.4 – Strengths/Weaknesses of LIM Propelled Railway Traction: - Strengths of LIM Propelled Railway Traction System. - Weaknesses of LIM Propelled Railway Traction System. 6.5 – LIM Propelled Underground Metro Rail System: - Factors Influencing Adoption of LIM for Metro Rail. - International Scenario. 6.6 – Wheel Less Traction: Levitation Schemes, Present Scenario.	08	12
	Total	48	70

Contents (Practical)

List of Practical Work:

Sl. No.	Nature of work (students are expected to identify and explain function of each item related to their work)
1.	To study of Electric AC Locomotives.
2	To study of Different types of Relays, Contactors used in AC Locomotive
3	To prepare drawing (on half Imperial sheet) for Power Circuit of any type of Electric Locomotive
4	To prepare drawing (on half Imperial sheet) for Protection of Electric Locomotive.
5	To prepare drawing on half Imperial sheet for Traction Substation Layout or Feeding Post
6	To prepare drawing on half Imperial sheet for Pentagonal OHE Catenary, Different Catenary according to speed limit, Cantilever assembly, OHE Supporting structure, Pantograph, Cross section of Contact Wire.
7	To visit to Traction Substation (for substation layout and OHE) and writing a report. Also write a report on OHE maintenance schedule.
8	To visit to Railway Station (for signaling and train lighting) and writing a report
9	**Mini Project:** Collection of information using Internet on any two topics related to electric traction and submission of printouts

Sl No.	Name of Authors	Titles of the Book	Name of Publisher
1	H. Partab	Modern Electric Traction	Dhanpat Rai & Sons
2	J. Upadhyay S. N. Mahendra	Electric Traction	Allied Publishers Ltd.
3	Andreas Steimel	Electric Traction –Motive Power and Energy supply	Oldenbourg-indstrieverlag

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1,	5	TWENTY	ONE	1 X 20 = 20	TWO	FIVE, TAKING AT LEAST ONE FROM EACH GROUP	TEN	10 X 5 = 50
B	2,3	7				FOUR			
C	4,5	5				TWO			
D	6	3				TWO			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

EXAMINATION SCHEME (SESSIONAL)

2. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job - 15, Notebook - 10.**
3. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the Practical work done throughout the semester. **Distribution of marks: Mini Project work - 5, Sessional work – 5, Viva-voce - 15.**

Name of the Subject: Professional Practices III	
Subject Code: EE/S5/PFIII	**Semester: Fifth**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory:	Mid Semester Exam.: Marks
Tutorial:	Assignment & Quiz: Marks
Practical: 3 hrs / week	End Semester Exam.: Marks
	Practical : 50 Marks
Credit: 2	

Aim:

Sl. No.	
1.	To acquire information from different sources
2.	To present a given topic in a seminar, discuss in a group discussion
3	To prepare report on industrial visit, expert lecture.

Objective:

Sl. No.	The student will be able to
1.	Acquire information from different sources
2.	Prepare notes for given topic
3.	Present given topic in a seminar
4	Interact with peers to share thoughts
5	Prepare a report on industrial visit, expert lecture

Pre-Requisite:

Sl. No.	
1.	Survey of different electrical industries

Activities

Sr . No.	Activities	Hours
1.	**Industrial / Field Visit :** Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to **<u>any one</u>** from the list below (should not have completed in earlier semester): i) A thermal power generating station ii) A Hydel power generating station iii) A Wind mill and / or Hybrid power station of wind and solar iv) An electrical substation v) A switchgear manufacturing / repair industry vi) An Electrical machine manufacturing industry vii) A large industry to study protection system viii) Any Industry having Automation for manufacturing processes	**12**

	ix) A transformer repair Workshop x) Industry of power electronics devices xi) Maintenance department of a large industry. xii) A Loco shed xiii) Railway / metro railway signaling system xiv) Transmission tower project area xv) Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. xvi) Any other technical field area as may be found suitable alternative to above list.	
2.	**Guest Lecture by professional / industrial expert**: Lectures by Professional / Industrial Expert to be organized from **<u>any TWO</u>** of the following areas (not covered in earlier semesters): i) Modern trends in AC machine ii) Automotive wiring and lighting iii) Modern techniques in Power Generation iv) New trends in power electronics devices v)TQM vi)Recent modification in IE rules vii)Role of power factor improvement as a tool in reducing cost of generation viii) Digital metering ix) Hydro power generation x) Functioning of Electricity regulatory Commission. xi)Introduction and application areas for MEMS (Micro Electromechanical System) xii) Interview techniques xiii)Career opportunities for diploma engineers xiv) Cyber crime & Cyber laws xv)Social networking – effects & utilities xvi) Ethical Hacking. xvii) Industrial Dispute and Labour Laws xviii)Entrepreneurship development and oppurtunities xix) Role of micro, small and mediun enterprise. In Indian economy. Individual report of the above lecture should be submitted by the students.	**4**
3.	**Seminar / Poster presentation:** Students should either present in seminar or prepare poster on **ANY ONE** topic as suggested below (should not be already done in earlier semester): Students (Group of 4 to 5 students) have to search / collect information about the topic through literature survey/ internet search / visit and discussion with expert or concerned persons	**12**

	1. Magnetic Levitation system 2. Recent development in electrically operated vehicles for mass development 3. Alternative fuel and energy options 4. Schemes of power generation in coming five years 5. Impact of load shedding on rural population 6. Embedded system 7. Computer security 8. Bio – technology 9. Scheme for setting up a new venture in MSME sector 10. Comparative study of Metro railway in Kolkata and Delhi 11. Brushless commutation of DC motors **12.** Any other topic of present techno economic relevance as may be decided by concerned teacher.	
4.	**Group Discussion** The students should discuss in a group of six to eight students. Each group to perform **<u>any TWO</u> group discussions**. Topics and time duration of the group discussion to be decided by concerned teacher. Concerned teacher may modulate the discussion so as to make the discussion a fruitful one. At the end of each discussion each group will write a brief report on the topic as discussed in the group discussion. Some of the suggested topics are – i) Role of Electrical Engineer in Disaster management ii) CNG Vs LPG as fuel iii) Load shedding and remedial measures iv) Rain water harvesting v) Trends in energy conservation vi) Safety in day to day life vii) Energy saving in the institute vii) Pollution control viii) Any other common topic related to electrical field as directed by concerned teacher.	**12**
5.	**Students' Activities / mini project (any one):** i) Develop a website for your institute ii) Animation project using c, c++, VB ii) Prepare a report in open software Latex. Report should include text, table, figure, mathematical expression, heading etc. all features of a report. iii) Make a list of all items required to assemble an updated version of personal computer. Write technical specification, manufacturers' names, cost of all the parts and prepare a comparative analysis to arrive at a decision for final combination of items. Also make such list for required external hardware/devices. Prepare a powerpoint presentation alongwith the report. Students are encouraged to use open softwares for such purpose.	**8**

	iv) The students in a group of 3 to 4 will collect information from market regarding specification, cost, frame size of motors produced by different manufacturers as available in the market for household pump motors, industrial motors etc. They will submit individual report on the same.	

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous internal assessment of 50 marks** is to be carried out by the teachers throughout the Fifth semester. **Distribution of marks: Activities =20, Group Discussion = 10, field visit = 10, guest lecture attendance and report = 10**