DEPARTMENT OF TECHNICAL EDUCATION (DIPLOMA SECTOR)
UTTAR PRADESH

CURRICULUM FOR DIPLOMA PROGRAMME
IN
ELECTRICAL ENGINNERING
(5th to 6th Semester)

==========

Semester System

==========

YEAR 2026-2027

Prepared By:

INSTITUTE OF RESEARCH DEVELOPMENT & TRAINING, U.P., KANPUR

UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

CONTENTS

PREFACE

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

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

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

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

F.R. Khan
Director
Institute of Research Development & Training

1. ACKNOWLEDGEMENTS

We gratefully acknowledge the guidance and contribution received from the following persons:

1. Sh. Narendra Kumar Bhushan, IAS Additional Chief Secretary, Technical Education Govt. of U.P. for his exemplary vision & approach.

2. Sh. F. R. Khan Director I.R.D.T. Kanpur continually motivating, guiding and taking keen interest in the review of the curriculum.

3. All the participants from Polytechnics and other technical institutions for their professional input during curriculum workshops.

4. CDC Officer and others concerning staff of IRDT for their support and assistance in conducting curriculum workshops.

(Mohd Nadeem)
Research Assistant
Curriculum In-charge
I.R.D.T. Kanpur

(Dr. Kunwer Mrityunjay Singh)
Curriculum Co-Ordinator
I.R.D.T. Kanpur

2. SALIENT FEATURES

1. Name of the Programme	➢ Diploma in Electrical Engineering
2. Duration of the Programme	➢ Three years (Six Semesters)
3. Entry Qualification	➢ Matriculation or equivalent NEP-2020/NSQF Level 5 as Prescribed by State Board of Technical Education, U.P.
4. Pattern of the Programme	➢ Semester System
5. Ratio between theory and Practice	➢ 40% (Theory) / 60% (Practical)

1) <u>Industrial Training/Internship:</u>

Four and six weeks of industrial training is made mandatory after the II and IV semesters during summer vacation.Total marks allotted to industrial training will be respectively 50 & 100.

In the last (6^{th} Semester) we have made the one semester Industrial training/Internship as optional along with usual classroom training.

2) <u>Audit & Pathways</u>:

As per AICTE and NEP-2020 directives, Essence of Indian Knowledge & Tradition, Indian Constitution, Entrepreneurship & Startup, subjects on Environmental Studies have been incorporated in the curriculum.

3) <u>Student Centered Activities</u>:

A provision of 4-8 hrs. per week has been made for organizing Student Centered Activities for overall personality development of students. Such activities will comprise co– curricular activities such as expert lectures, classroom seminars, games, hobby club like photography, painting, singing etc. declamation contests, field visits, NCC, NSS and other cultural activities, etc.

4) <u>Project work:</u>

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

3. EMPLOYMENT OPPORTUNITIES OF DIPLOMA HOLDERS IN ELECTRICAL ENGINEERING

Keeping present scenario in view following employment opportunities are visualized in different sectors of employment for diploma holders in Electrical Engineering

1. MANUFACTURING INDUSTRY

The Electrical diploma holder will be able to execute following activities:

- Planning and execution for Electrical installation
- Electrical installations and Maintenance of DG Set
- Electrical Power Distribution and Maintenance
- Maintenance of Industrial Electrical System
- Repair and Maintenance of Electrical Machines and Equipment
- Quality Control for Electrical systems
- Energy Conservation
- Assistance in Research and Development
- Assistance in Planning, Designing and Detailing
- Shop-floor Management
- Electrical Safety Measures
- Estimate for Electrical Installations
- Inventory Management
- Marketing and Sales
- Use of PLC and Microcontrollers.

2. GOVERNMENT DEPARTMENTS SUCH AS ELECTRICITY BOARD, MES, PWD, RAILWAYS, AIRBASES, AIRPORTS, DEFENCE, THERMAL, HYDRO AND NUCLEAR POWER STATIONS AND OTHER BOARDS AND CORPORATIONS

The Electrical diploma holder will be able to execute following type of activities in above mentioned Government Departments:

- Assistance in Planning and Design of Electrical generation, transmission, distribution and protection system including testing, quality control
- Estimating for electrical installation
- Construction, erection and commissioning of lines and Sub-stations
- Electrical Safety measures
- Operation and Maintenance of Lines and Sub-stations/underground cables
- Tariffs and Calculations of bills for consumption of electricity
- Inventory Management
- Repair and Maintenance of Electrical Machines/Equipment
- Assist in Operation and maintenance of Generating and sub-stations
- Preventive maintenance and condition monitoring
- Programming of PLC
- Electric Traction Systems
- Hospitals, Commercial Complexes, Service Sector Organizations like Hotels, Tourist-Resorts, high-rise buildings, Cinema/Theater Halls etc.
- The diploma holder in electrical engineering will be involved in following type of activities in above mentioned Service Sector Organizations:
- Lay out of wiring circuit, planning and execution for Electrical Installation
- Standby or captive Power Generation and its Distribution
- Maintenance of Electrical and Electronic Equipment
- Preventive maintenance of Electrical Systems of Lifts, Air-Conditioning Plants etc.
- Inventory Management
- Estimation for electrical repair and maintenance work

3. SELF-EMPLOYMENT

Following type of self-employment opportunities are available to the diploma holder in electrical engineering:

- Trading of Electrical Goods
- Establishing Repair and Maintenance Unit/Centre
- Free Lancer for Repair and Maintenance of House-hold Electrical and Electronic Gadgets such as: Washing Machines, Geysers, Air Conditioners, Coolers and electrical installations etc.
- Electrical contractor
- Motor Winding Unit
- Auto-electrical Work
- Service sector (AMC)
- Micro controller-based systems for different applications

4. (A) PROGRAM OUTCOMES (POS)

PO1: Basics and Discipline specific Knowledge
Assimilate knowledge of basic mathematics, science, engineering fundamentals, and Electrical Engineering.

PO2: Problem's Analysis and solution
Identify, analyze and solve problems using standard methods and established techniques.

PO3: Design and Development
Design solutions for technical problems.
Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing

Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.

PO5: Socio/ Economic /Environmental impact assessment/remedy.

Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication
Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning
Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

4. (B) LEARNING OUTCOMES OF THE PROGRAM

After undergoing this program, students will be able to:	
1.	Maintain the efficient operation of various types of Biomass and Micro hydro power plants.
2.	Repair and maintain of Electric Vehicles and Hybrid Electric Vehicles.
3.	Understand the precautions and awareness regarding various disasters
4.	Prepare accounting records and summarize and interpret the accounting data for managerial decisions.
5.	Understand the history, principles, and key interpretations of the Indian Constitution.
6.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work
7.	Use appropriate procedures for preventing environmental pollution and energy conservation
8.	Analyse AC circuits and apply electromagnetic induction principles in various Electrical equipment and machines
9.	Test various active and passive components like resistor, inductor, capacitor, diode, transistor and use the amplifier and voltage stabilizer
10.	Select and use right kind of quality of electrical material required for a particular Operation.
11.	Plan and execute given task/project as team member/leader
12.	Read and interpret drawings related to electrical machines, equipment and wiring installations
13.	Assemble distribution and extension boards and construct alarm and indicating Circuits using relays, bells and push buttons
14.	Operate and maintain DC shunt, series and compound motors and three phase transformers
15.	Use measuring instruments, tools and testing devices for varied field applications
16.	Repair and maintain UPS and storage batteries and control speed of DC shunt Motor and universal motor
17.	Design and use flip-flops, A/D and D/A converters in digital circuits
18.	Use MAT LAB, SCI LAB for designing and finding solutions to problems related To electrical systems
19.	Programme and develop micro controller-based systems with LED/SWITCH
20.	Use of PLC and make suitable ladder logic programmes for different applications
21.	Operate and maintain indoor and outdoor sub stations and prepare estimate for HT/LT (OH and underground cables) lines
22.	Operate and demonstrate micro controller and PLC based systems in electrical Control circuits for domestic and industrial processes
23.	Design cable trenches, lay underground cables and find faults in transmission/Distribution system
24.	Estimate and determine the cost of wiring installation, HT/LT overhead lines, Pole Mounted Substation and prepare a tender document for a particular job
25.	Plan and execute minor projects related to electrical engineering
26.	Handle electrical energy-based equipment for electric traction systems
27.	Manage resources effectively at the workplace

28.	Use measuring instruments for measurement of electrical or non-electrical quantities
29.	Apply the working principle of a mini hydro plant, fuel cells, thermos electric power, geothermal and tidal energy conversion methods
30.	Trouble shoot various auto electrical faults
31.	Apply all the knowledge and skill gained through various courses in solving a live problem/project in the industry
32.	Test and install various electrical equipment and machines

5. STUDY AND EVALUATION SCHEME FOR ELECTRICALENGINEERING (328)

FIFTH SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
5.1	SWITCH GEAR AND PROTECTION	PROGRAM CORE (THEORY)	03	01	-	4	40	-	40	60	3	-	-	60	100
5.2	PROGRAM ELECTIVE-3	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
5.3	ENERGY CONSERVATION AND AUDIT	PROGRAM CORE (PRACTICUM)	02	-	04	4		60	60	-	-	40	3	40	100
5.4	PROGRAM ELECTIVE-4	PROGRAM CORE (PRACTICUM)	01	-	04	3	-	60	60	-	-	40	3	40	100
5.5	(Q) INDIAN CONSTITUTION	AUDIT COURSE	02	-	-	-	50	-	50	-	-	-	-	-	N/A
5.6	ELECTRICAL ESTIMATION AND CONTRACTING	PROGRAM CORE (PRACTICUM)	02	-	04	4	-	60	60	-	-	40	3	40	100
5.7	SUMMER INTERNSHIP** (6 WEEKS)	-	-	-	-	2	-	60	60	-	-	40	3	40	100
	#STUDENT CENTERED ACTIVITIES	-	-	-	10	-		50	50	-	-	-	-	-	50
Total		-	**13**	01	**22**	**20**	80	**290**	**370**	**120**		**160**		**280**	**650**

NOTE –

1. (Q) - It is compulsory to appear & to pass in examination, but marks will not be included for division and percentage of obtained marks.
2. Students will submit the certificate.
3. ** Students will present a seminar/viva on their summer internship along with certificate, project and report.
4. # Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C.,NSS, library, Cultural Activities and self-study etc.

(328) ELECTRICALENGINEERING

SIXTH SEMESTER
NORMAL PATHWAY

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS INEVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	BUILDING ELECTRIFICATION	PROGRAM CORE (PRACTICUM)	02	-	04	4	-	60	60	-	-	40	3	40	100
6.2	ENTREPRENEURSHIP AND START-UP	HUMANITIES AND SOCIAL SCIENCE	02	-	-	2	40	-	40	60	3	-	-	60	100
6.3	IN-HOUSE PROJECT	PROJECT	04	-	16	12	-	240	240	-	-	160	-	160	400
6.4	ADVANCE SKILL DEVELOPMENT	(Q)OPEN ELECTIVE-3 (THEORY)	02	-	-	2	50	-	-	-	-	-	-	-	N/A
		(Q)OPEN ELECTIVE-3 (Certification Course)													N/A
#STUDENT CENTERED ACTIVITIES			-	-	06	-	-	50	50	-	-	-	-	-	50
Total			**10**		**26**	**20**	**40**	**350**	**390**	**60**		**200**		**260**	**650**

NOTE: -

1. # Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.
2. (Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.
3. Advance skill development mention at 6.4 in the table provides the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agencies of repute of duration not less than 20 Hrs (Offline/Online).

OR

SIXTH SEMESTER
INDUSTRIAL PATHWAY

Sr. No.	SUBJECTS	CATEGORY & COURSE TYPE	STUDY SCHEME Periods/Week			Credits(C) (L+T)+P=C	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External	ASSESSMENT
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
			L	T	P		Th	Pr	Tot	Th	Hrs.	Pr	Hrs	Tot		
6.1	ENTREPRENEURSHIP AND START-UPS (ONLINE MODE)	HUMANITIES & SOCIAL SCIENCE (THEORY)	-	-	-	2	-	-	-	100	03	-	-	100	**100**	**THEORY**
6.2	INDUSTRIAL HANDS-ON PRACTICE	INDUSTRIAL TRAINING	-	-	-	12	150*			200**					**350**	
6.3	INDUSTRIAL PROJECT	INDUSTRIAL TRAINING	-	-	-	4	50*			50**					**100**	
6.4	SEMINAR	IN HOUSE	-	-	-	2	-	100	100	-	-	-	-	-	**100**	
Total			**-**	**-**	**-**	**20**									**650**	

NOTE:

1. The Industrial training tenure should not be less than 14 weeks.
2. Industry must be registered with MSME/Directorate of industries/Limited Organization/State/Central Government establishments.
3. Monthly progress reports of Intern/ Trainee should be attested and forwarded by industrial supervisor (allotted to Intern/Trainee) during industrial Internship/Training.
4. The Industrial unit/organisation must evaluate students using the format provided by polytechnic in the form of marks.
5. The Industrial Hands on Practice, Industrial Project and seminar must be evaluated on the basis of the AICTE Internship Policy: Guidelines and procedures (Chapter -9 Procedures / format for organizing internship)
6. "Entrepreneurship and Start-up" course is also mandatory in Industrial internship/training mode. It will be conducted online mode by his/her polytechnic institute. After completing the online course, students must appear for exam conducted by the Board of Technical Education, Lucknow.
7. ***Evaluation by faculty mentor**
   The institute will depute one faculty member for mentoring at least 20-30 students undertaking apprenticeship training. Such mentors will monitor, guide and provide counselling to the students as and when required. Faculty mentor of the institute(s) may make a surprise visit to the internship/apprenticeship site to check the student's presence physically. (The Proforma of the evaluation is attached as the Annexure -1)
8. ** **Evaluation by industry** : The industry shall assess the candidates based on the following parameters attendance, discipline and punctuality, familiarity of tools and material, engineering skills, application of knowledge and problem-solving skills, comprehension and observation, professional ethics, safety and environmental consciousness, communication skills, supervisory skills and general conduct during the period (The Proforma of the evaluation is attached as the Annexure -2)
9. **# Evaluation through seminar presentation/Viva-Voce at the institute :** The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

OPEN ELECTIVE-3

SR.NO.	(Q) THEORY COURSES NAME
1.	PROJECT MANAGEMENT
2.	INTERNET OF THINGS
SR.NO.	**CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc) (Annexure 1)
2.	COURSES CONDUCTED BY INFOSYS SPRINGBOARD
3.	COURSES CONDUCTED BY TCS ION
4.	COURSES CONDUCTED BY OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL ORGANIZATION OR PLATFORMS OF REPUTE
5.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
6.	COURSES CONDUCTED BY C-DAC
7.	COURSES CONDUCTED BY NEILIT

PROGRAME ELECTIVE-3

SR.NO.	SUBJECT NAME
1.	SOLAR POWER TECHNOLOGIES
2.	ELCTRIC TRACTION

PROGRAME ELECTIVE-4

SR.NO.	SUBJECT NAME
1.	ELECTRICAL TESTING AND COMMISSIONING
2.	ILLUMINATION PRACTICES

ANNEXURE-1

LIST OF COURSES CONDUCTED BY TATA TECHNOLOGIES

1. Fundamentals of Innovation and Design Thinking
2. Product Design and Development
3. Product Verification and Analysis
4. Advanced Automobile
5. Electric Vehicle
6. Internet of Things
7. Advanced Manufacturing
8. Advanced Welding & Painting using Simulator
9. Industrial Automation and MES
10. Industrial Robotics
11. Inspection and Quality Control
12. Advanced Plumbing
13. AI and ML

6. DETAILED CONTENTS OF VARIOUS SUBJECTS

THEORY	5.1 SWITCH GEAR AND PROTECTION	L	T	P
		3	1	-

COURSE OBJECTIVES:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain switchgear and protection schemes used in electrical power systems.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the necessity, functions, and characteristics of protective switchgear, and analyze types of faults in power systems.
CO2: Describe the construction, working principles, and selection criteria of switchgear elements and arc extinction methods used.
CO3: Classify and evaluate the operation of various types of protective relays.
CO4: Analyze faults and apply appropriate protection schemes for various power system components.
CO5: Assess protection techniques for busbars and transmission lines, and explain the concept, need, and methods of neutral grounding in electrical systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	3	2	2	1	1	2	*	*
CO2	3	2	3	3	1	1	2	*	*
CO3	3	3	2	3	1	1	2	*	*
CO4	3	3	3	3	2	2	2	*	*
CO5	3	3	2	2	3	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Basics of Protection & Fundamental quality requirements (10 Periods)

Necessity, purpose and functions of protective switchgear; Characteristics of a protection system, Normal and abnormal conditions. Types of faults, their causes and effects. Protection zones and backup protection, Need of current limiting reactors and their arrangements.

Unit – II: Circuit Interruption Devices Isolators (11 Periods)

Vertical break, Horizontal break and Pantograph type. HRC fuses – Construction, working, characteristics and applications. Arc formation process, methods of arc extinction (High resistance and Low resistance), Arc voltage, Recovery voltage, Re-striking voltage, RRRV. HT circuit breakers (Sulphur-hexa Fluoride (SF6), Vacuum circuit breaker) - Working, construction. L.T. circuit breaker (Air circuit breakers (ACB), Miniature circuit breakers (MCB)) - Working and applications. Selection of LT and HT circuit breakers (ratings). Gas insulated switchgear.

Unit – III: Protective Relays (13 Periods)

Basic relay terminology- Protective relay, Relay time, Breaker time, Fault Clearing time, Pick-up, reset value, current setting, plug setting multiplier, Time setting multiplier, burden, reach.
Protective relays: Classification, principle of working, construction and operation of – Electromagnetic, Induction type relays. Block diagram and working of Static relays.
Overcurrent relay-Time current characteristics, principle of operation of - Non directional Over Current relay, Induction type Directional Power Relay, Directional Induction type Over Current relay.
Introduction to Microprocessor based over current relays.
Distance relaying- Principle, operation and classification of distance relays.
Ddifferential relay-operation of current balance and voltage balance ddifferential relays.

Unit – IV: Protection of Alternator, Transformer and Motors (11 Periods)

Alternator Protection: Faults, Differential protection Over current, earth fault, overheating protection.
Transformer Protection: Faults, Differential, over current, earth fault, over heating protection, Limitations of differential protection. Buchholz relay: Construction, operation.
Motor Protection: Short circuit protection, Overload protection (through thermal Relay), Single phase preventer.

Unit – V: Protection of Busbar, Transmission Line and Concept of Neutral Grounding (11 Periods)

Faults on Bus bar and Transmission Lines.
Bus bar protection: Differential and Fault bus protection.
Transmission line protection: Over current, Distance and Pilot wire protection.
Grounding (equipment and system), Ungrounded Neutral system, Need of neutral grounded, Methods of Neutral Grounding.

INSTRUCTIONAL STRATEGY

Engage students in demonstrate and illustrate principles of switch gear and protection incorporate case studies and examples from everyday life to study the importance of switch gear in electrical utilities.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. Mehta V. K; Rohit Mehta, Principles of Power System, S. Chand and Co., New Delhi., ISBN: 978-81-2192-496-2.
2. Rao, Sunil S., Switchgear and Protection, Khanna Publishers, New Delhi, ISBN: 978-81-7409- 232-3.
3. Singh, R. P., Switchgear and Power System Protection, PHI Learning, New Delhi, ISBN: 978-81-203-3660-5.
4. Gupta. J. B., Switchgear and Protection, S. K. Kataria and Sons, New Delhi, ISBN: 978-93-5014- 372-8.
5. Veerapan, N., Krishnamurty, S. R., Switchgear and Protection, S. Chand and Co., New Delhi. ISBN: 978-81-2193-212-7.
6. Ram, Badri; Vishwakarma D. N., Power System Protection and Switchgear, McGraw-Hill, New Delhi. ISBN: 978-07-107774-X
7. Dr. T. D. Bisht, Ashish Sahoo, Pooja Yadav , Switch Gear & Protection, Asian Publishers, Muzaffarnagar, ISBN No. 978-93-91541-62-0

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	10	17
II	11	20
III	13	23
IV	11	20
V	11	20
Total	**56**	**100**

THEORY	5.2.1 SOLAR POWER TECHNOLOGIES	L	T	P
		3	-	-

COURSE OBJECTIVES:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
• Maintain the efficient operation of various types of solar power technologies

COURSE OUTCOMES (CO):

The theory and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:
CO1: Explain the solar energy potential in India and describe the solar water heaters, solar cookers, heating systems, and solar lighting technologies.
CO2: Analyze the working principles, specifications, and configurations of various concentrated solar power systems.
CO3: Describe solar PV panels and explain the layout and operation of various PV systems.
CO4: Evaluate the function and specifications of solar charge controllers, batteries, inverters, and signal conditioning systems.
CO5: Compare off-grid and grid-tied solar PV systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	2	2	3	2	2	*	*
CO2	3	3	3	2	3	2	2	*	*
CO3	3	3	3	3	2	2	2	*	*
CO4	3	3	3	3	2	2	3	*	*
CO5	3	3	3	3	3	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Solar Energy **(06 Periods)**
Solar Map of India: Global solar power radiation
Different types of Solar water heaters: working and installation Solar Heating systems,
Different types of Solar cookers, Solar lighting.

Unit – II: Concentrated Solar Power (CSP) **(08 Periods)**
Concentrated Solar Power (CSP) plants or solar thermal electric systems Parabolic Trough: working and specifications Parabolic Dish: Construction, working and specifications Power Tower, Fresnel Reflectors: Construction, working and specifications Solar Stirling engines.

Unit – III: Solar PV Panel and Installation (10 Periods)

Types construction, working, Typical specifications of solar cells Solar PV working principle: Series and parallel connections of solar modules Solar Photovoltaic (PV) system: components layout and working. Solar modules, arrays and their standard specifications Roof top and streetlight solar PV systems.
Solar water pumping application.

Unit – IV: Solar PV Electronics (10 Periods)

Solar Charge controllers: working and specifications, switchgear and cables Batteries: Different types for solar PV systems, Solar Inverters: working Signal conditioning systems: working, Solar Power tracking: construction, working, I-V, P-V characteristics.

Unit – V: Solar PV Off-grid and Grid Tied Systems (08 Periods)

Solar off grid systems : Layout
Solar Grid tied (on grid) systems: Working principle of grid-tied dc-ac inverter, grid synchronization and active power export Net metering: main features and working

INSTRUCTIONAL STRATEGY

Engage students in understanding fundamental of solar energy and identify and describe solar PV system and also install and maintain small scale solar PV. Student study design basic roof top and off grid solar PV system.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. Solanki, Chetan Singh, - Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning, New Delhi, ISBN: 9788120351110
2. Kothari, D.P. et al: Renewable Energy Sources and Emerging Technologies, PHI
3. David M. Buchla, Thomas E. Kissell, Thomas L. Floyd, - Renewable Energy Systems, Pearson Education New Delhi, ISBN: 9789332586826
4. Rachel, Sthuthi, Earnest, Joshua; -Wind Power Technologies, PHI Learning
5. O.P. Gupta, Energy Technology, Khanna Publishing House, ISBN: 978-93-86173-683
6.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	06	14
II	08	18
III	10	25
IV	10	25
V	08	18
Total	**42**	**100**

UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

THEORY	5.2.2 ELECTRIC TRACTION	L	T	P
		3	-	-

COURSE OBJECTIVES:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
• Maintain electric traction systems.

COURSE OUTCOMES (CO):

The theory and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Compare different traction systems (Electric, Diesel, Battery) and analyze the technical problems and remedies associated with AC traction.
CO2: Explain the layout of Traction Substations (TSS) and identify the function of various protective equipment used for transformers and catenary.
CO3: Describe the constructional details of Overhead Equipment (OHE), including catenary, cantilever assembly, and current collectors (Pantograph).
CO4: Interpret the block diagrams and power circuit connections of AC Electric Locomotives and list the auxiliary equipment.
CO5: Select suitable traction motors based on characteristics and apply methods of speed control and electric braking (Regenerative/Rheostatic).
CO6 : Discuss the requirements of Railway Signalling, Supervisory Control (SCADA) networks, and power supply schemes for Metro Rail systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	-	3	-	1	*	*
CO2	3	1	1	1	1	-	1	*	*
CO3	3	-	2	-	-	-	1	*	*
CO4	3	2	-	-	-	-	1	*	*
CO5	3	2	1	-	2	-	1	*	*
CO6	3	1	-	1	2	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Basics of Traction **(06 Periods)**

General description of Electrical Traction system in India.
Advantages and Disadvantages of Electric Drive, Diesel Electric Drive, Battery Drive
Problems associated with AC traction System and remedies for it.

Unit – II: Power Supply Arrangements **(08 Periods)**

Traction Substation: layout, list of equipment and their functions.
Miscellaneous equipment at control post or Switching station.
Protection system for traction transformer and 25 kV centenary construction.

Unit – III: Overhead Equipment **(07 Periods)**

Different types of overhead equipments
Pentagonal OHE Centenary Construction
OHE Supporting Structure, Cantilever assembly diagram
Overhead system- Trolley collector, Bow collector, Pantograph Collector
Types and construction of pantograph

Unit – IV: Electric Locomotive **(07 Periods)**

Classification and Nomenclature of Electric Locomotive
Block diagram of AC locomotive
Power Circuit of AC Locomotive
Equipment (List and Function only) used in auxiliary circuit of AC Locomotive.

Unit – V: Traction Motors and Train Lighting **(08 Periods)**

Desirable characteristics of traction motor.
Types of motors used for traction with their characteristics and features
Control of motors used for traction and methods to control
Requirements of braking, types of braking
Electric braking, Regenerative braking
brief idea of train lighting system.

Unit – VI: Signalling and Supervisory Control **(06 Periods)**

Requirements of signalling systems
Types of signals, track circuits
Advantages of remote control
Systems of remote control, equipment and network
Metro rail-supply systems, advantages, schemes in India

INSTRUCTIONAL STRATEGY

Understanding the Principles and grasp the basic concepts of electric traction, its components, and the technologies involved.Analyze Electric Traction Systems: Understand how different electric traction systems (e.g., DC, AC, and hybrid) operate.Design and Apply Solutions: Evaluate energy efficiency, system design, and troubleshooting in electric traction systems.Recognize Global Practices: Compare electric traction practices in different countries and understand their advantages and challenges.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. G.C. Garg, Utilization of Electric Power & Electric Traction, Khanna Book Publishing Co., New
2. Delhi (ISBN: 978-93-86173-355) Revised Ed. 2018
3. Gupta J.B., S.K. Kataria and Son, Utilization of Electric power and traction
4. Partab H., Dhanpat Rai and Co, Art and Science of Utilization of Electrical Energy
5. Partab H., Dhanpat Rai and Co, Modern Electric Traction
6. Suryanarayana N.V., New Age International Publishers, Reprint 2010
7. Open Shaw Taylor, Orient Longman ltd., Utilisation of electrical energy.
8. Dr. T. D. Bisht, Ashish Sahoo, Pooja Yadav ,Electric Traction, Asian Publishers, Muzaffarnagar, ISBN No. 978-93-91541-68-2

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	06	14
II	08	19
III	07	17
IV	07	17
V	08	19
VI	06	14
Total	**42**	**100**

PRACTICUM	5.3 ENERGY CONSERVATION AND AUDIT	L	T	P
		2	-	4

COURSE OBJECTIVES:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
• Undertake energy conservation and energy audit.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:
CO1: Explain the national energy scenario, key provisions of the Energy Conservation Act 2001, and assess the role of BEE.
CO2: Apply energy-saving techniques in induction motors and transformers and evaluate the performance of energy-efficient equipment.
CO3: Analyze energy-saving opportunities in various applications using efficiency metrics and modern control technologies
CO4: Evaluate cogeneration technologies and tariff structures to optimize energy usage.
CO5: Conduct a basic energy audit using appropriate instruments and procedures and prepare a report.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	3	2	2	*	*
CO2	3	3	3	3	2	2	2	*	*
CO3	3	3	2	3	3	2	2	*	*
CO4	3	3	2	2	3	3	2	*	*
CO5	3	3	2	3	3	3	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Energy Conservation **(02 Periods)**

Basics Energy Scenario: Primary and Secondary Energy, Energy demand and supply, National scenario. Energy conservation and Energy audit; concepts and difference Indian Electricity Conservation Act 2001 and its latest amendments; relevant clauses of energy conservation BEE and its Roles. Star Labelling: Need and its benefits.

Practicals:-

1. Identify star labelled electrical apparatus and compare the data for Three-star ratings.

2. Identify star labelled electrical apparatus and compare the data for Four-star ratings.
3. Identify star labelled electrical apparatus and compare the data for Five-star ratings.

Unit – II: Energy Conservation in Electrical Machines (06 Periods)

Need for energy conservation in induction motor and transformer.

Energy conservation techniques in induction motor by: Improving Power quality. Motor survey Matching motor with loading. Operating in star mode. Replacement by energy efficient motor.

Energy conservation techniques in Transformer. Replacement by energy efficient transformers.

Energy Conservation Equipment: Soft starters, Automatic star delta convertor, Variable Frequency Drives, Automatic p.f. controller (APFC), Intelligent p. f. controller (IPFC) Energy efficient motor; significant features, advantages, applications and limitations.

Practicals:-

1. Demonstrate that power factor of an induction motor load is improved by connecting capacitor bank.
2. Conduct a survey on installed motor and assess the matching of motor with its load.
   Determine the reduction in power consumption in star mode operation of Induction motor compared to delta mode.
3. Connect Soft starter with suitable rating Induction Motor and Observe its operation during starting and running. Also measure the current and power consumption

Unit – III: Energy conservation in Electrical Installation systems (06 Periods)

Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems

Energy Conservation in Lighting System a) Replacing Lamp sources. b) Using energy efficient luminaries. c) Using light-controlled gears. d) Installation of separate transformer / servo stabilizer for lighting.

Energy Conservation techniques in fans, electronic regulators.

Practicals:-

1. To measure energy efficiency ratio (EER) of an air conditioner.
2. Compare power consumption of different types of Tube light with choke, electronic ballast and LED lamps by direct measurements.
3. Measure the Current, Power and Energy consumption of Modern BLDC Ceiling Fan.
4. Measure the Current, Power and Energy consumption of Ceiling Fan.

Unit– IV: Energy conservation through Cogeneration and Tariff (08 Periods)

Co-generation : concept, significance for energy conservation, Types of cogeneration basis of technology (Steam turbine cogeneration, Gas turbine cogeneration). Factors governing the selection of cogeneration system. Advantages of cogeneration.

Tariff: Types of tariff structure, Transformers Tariff structure, Special tariffs; Time-off-day tariff, Peak-off-day tariff, Power factor tariff, Maximum Demand tariff, Load factor tariff. Application of tariff system to reduce energy bill. Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC).

Practicals:-

1. Collect electricity bill of a commercial consumer and suggest suitable tariff for conservation and reduction of its energy bill.
2. Collect electricity bill of a residential consumer and suggest suitable means for conservation and reduction of the energy bill.
3. Collect Electricity bills of typical residential or College service connections for the period of 1 year and prepare the bar chart of energy consumption and energy cost. Discuss the result.

Unit– V: Energy Audit of Electrical System (06 Periods)

Energy audit (definition as per Energy Conservation Act) Energy audit instruments and their use. Questionnaire for energy audit projects. Energy flow diagram (Sankey diagram) Simple payback period, Energy Audit procedure (walk through audit and detailed audit). Energy Audit report format.

Practicals:-

1. Carrying out Mini Energy Audit of Institute's lab/classroom (lighting , fans and ACs) and preparation of sample energy audit report format.
2. Prepare a sample energy audit questionnaire for the given industrial facility.

INSTRUCTIONAL STRATEGY

Engage students in experiments and demonstrate that illustrate principles of Energy Conservation, incorporate case studies and examples from everyday life to demonstrate the importance of Energy Conservation.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. Guidebooks No. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency (BEE), Bureau of Energy Efficiency (A Statutory body under Ministry of Power, Government of India) (Fourth Edition 2015).
2. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
3. Henderson, P. D., India - The Energy Sector, University Press, Delhi, 2016. ISBN: 978- 0195606539
4. Turner, W. C., Energy Management Handbook, Fairmount Press, 2012, ISBN 9781304520708
5. Sharma, K. V., Venkataseshaiah; P., Energy Management and Conservation, I K International Publishing House Pvt. Ltd; 2011 ISBN 9789381141298
6. Mehta, V. K., Principles of Power System, S. Chand & Co. New Delhi, 2016, ISBN 9788121905947
7. Singh, Sanjeev; Rathore, Umesh, Energy Management, S K Kataria & Sons, New Delhi ISBN-13: 9789350141014.
8. Desai, B. G.; Rana, J. S.; A. Dinesh, V.; Paraman, R., Efficient Use and Management of Electricity in Industry, Devki Energy Consultancy Pvt. Ltd.
9. Chakrabarti, Aman, Energy Engineering and Management, e-books Kindle Edition
10. Dr. Vijay Mittal, Dr. T.D.Bisht, Anil Kumar Kukreja, Ravindra Patel, Asian Publishers, Muzaffarnagar, ISBN No. 978-93-91541-11-8

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	02	14
II	06	24
III	08	24
IV	06	24
V	06	14
Total	**28**	**100**

PRACTICUM	5.4.1 ELECTRICAL TESTING AND COMMISSIONING	L	T	P
		1	-	4

COURSE OBJECTIVES:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
• Follow standard safety procedures in testing and commissioning of electrical equipment.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:
CO1: Apply electrical safety practices and insulation testing methods to assess and maintain the condition of electrical equipment and insulating materials.
CO2: Demonstrate the procedures and safety requirements for installing and aligning electrical machinery.
CO3: Conduct routine and special tests on electrical machines and interpret results.
CO4: Identify diagnostic tools for mechanical, electrical, and magnetic faults.
CO5: Develop and implement preventive maintenance schedules for electrical machines.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	3	3	2	2	*	*
CO2	3	2	2	2	2	2	2	*	*
CO3	3	3	2	3	2	2	2	*	*
CO4	3	3	2	3	2	2	2	*	*
CO5	3	3	3	2	3	3	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Electrical Safety and Insulation (03 Periods)
Do's and don'ts regarding safety in domestic electrical appliances as well for substation/ power station operators' Electrical safety in industry/power stations/ substations at the time of operation/ control/ maintenance. Fire detection alarm, fire-fighting equipment's, measuring insulation resistance by different methods such as i) Polarization, ii) Dielectric absorption, iii) Megger and to predict the condition of insulation Reconditioning of insulation, insulating oil - properties of insulating oil, causes of deterioration of oil.

Practical: -
1. Determine breakdown strength of transformer oil.

2. Perform insulation resistance test on any one motor/transformer using Megger.

Unit – II: Installation & Erection Concept of foundation for installation of machinery

(02 Periods)

Requirements of foundation for static and rotating electrical machinery. Concept of leveling and aligning Procedure for leveling and aligning alignment of direct coupled drive, effects of mis-alignment Installation of transformer and procedure of installation of transformer, Requirements of installation of pole mounted transformer Devices and tools required for loading, unloading, lifting, and carrying heavy equipment and precautions to be taken while handling them.

Practical: -

1. Evaluating the parts of an Alternator and testing an assembled alternator same on a test bench for proper operation
2. Evaluating the parts of a Transformer assembled Transformer same on a test bench for proper operation

Unit– III: Testing and Commissioning (03 Periods)

Concept of testing and Objective of testing. Roles of I.S.S. in testing of electrical equipment, Types of tests and concepts: Routine tests, supplementary test, special tests, Methods of testing - Direct/Indirect/Regenerative testing. Tolerances for the various items for equipment –transformer, induction motor, dc motor, synchronous machines Commissioning, Tests before Commissioning for transformer, induction motor, alternator 1962 Testing of three-phase Induction motor as per I.S.325 -. Testing of single-phase induction motor Testing of synchronous machines and D.C. machines

Practical: -

1. Find regulation and efficiency of single-phase transformer by direct loading and back-to-back connection method and compare the results.
2. Determine efficiency of D.C. machine by Swinburne's test.
3. Determine efficiency of D.C. machine by Hopkinson's test.

Unit– IV: Troubleshooting Plans (03 Periods)

Internal and external causes for failure / abnormal operation of equipment. List of mechanical faults, electrical faults and magnetic faults in the electrical equipment remedies, applications Use of tools like bearing puller filler gauges, dial indicator. Common troubles in electrical equipments and machines. Preparation of trouble shooting charts for D.C. Machines, AC Machines and transformers.

Practical: -

1. Prepare trouble shooting charts for electrical machines such as Transformer, D.C. machines, Induction motor, and Synchronous machines.
2. Use of tools like bearing puller, filler gauges, dial indicator.

Unit– V: Maintenance (03 Periods)

Concept of maintenance, types of maintenance, Routine, preventive and breakdown maintenance. Causes of failure of electrical machines Preventive maintenance-procedure or developing maintenance schedules for electrical machines. Factors affecting preventive maintenance schedule)

(a) Distribution transformer

b) Single phase and three phase Induction motors

c) Batteries.

Practical: -

1. Prepare the preventive maintenance schedule of Distribution transformer.
2. Prepare the preventive maintenance schedule of induction motor
3. Prepare the preventive maintenance schedule of batteries.

INSTRUCTIONAL STRATEGY

Focus on the theoretical foundations of electrical testing and commissioning, emphasizing key concepts like safety protocols, testing procedures, and industry standards. Incorporate practical sessions where students can perform actual testing on electrical systems, such as insulation resistance, earth resistance, and continuity tests, using industry-grade equipment. Use real-world case studies to help students analyze common commissioning issues and develop troubleshooting skills, fostering critical thinking and problem-solving abilities in the field.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. Deshpande, M. V. PHI Learning Pvt. Ltd., 2010, Design and Testing of Electrical Machines ISBN No 8120336453, 9788120336452.
2. Rao, B V S Asia Club House, First Reprint, 2011, Operation and Maintenance of Electrical Equipment Vol-I, ISBN No 8185099022
3. Rosenberg. Mc GRAW-HILL, 1st Edition, May 2003, Maintenance and Repairs, ISBN No 9780071396035
4. Sharotri, S.K. Glencoe/ Mcgraw- Hill; 2nd Edition, June 1969; Preventive Maintenance of Electrical Apparatus, ISBN No 10: 007030839X 13: 978-0070308398

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	03	20
II	02	15
III	03	20
IV	03	20
V	03	25
Total	**14**	**100**

UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

PRACTICUM	5.4.2 ILLUMINATION PRACTICES	L	T	P
		1	-	4

COURSE OBJECTIVES:

The aim of this course is to help the student to attain the following industry identified competency through various teaching experiences:

- Design illumination schemes and associated electrification of buildings.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Apply basic illumination principles and photometric laws to perform lighting calculations.

CO2: Identify and compare various types of lamps.

CO3: Design and implement lighting control circuits.

CO4: Develop illumination schemes for residential and commercial.

CO5: Analyze lighting requirements in street lighting, industrial lighting, and decorative or functional lighting environments.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	2	3	2	1	2	*	*
CO2	3	2	2	2	2	1	2	*	*
CO3	3	2	3	3	2	2	2	*	*
CO4	3	2	3	2	3	2	2	*	*
CO5	3	3	3	2	3	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I Fundamentals of illumination **(2 Periods)**

Basic illumination, Terminology, Laws of illumination, Concept of Photometry, Measurement of illumination. Lighting calculation methods, Watt /m2 method, Lumens or light flux method, Point to point method.

Practical:

1. Conduct illumination level assessment in workplace using lux meter.
2. Measure illumination level with and without reflectors used in the various Luminaries.

Unit – II Types of lamps **(3 Periods)**

Incandescent lamp, ARC lamps – AC and DC arc lamps, fluorescent lamp

Types of other lamps: Mercury vapour lamp, HPMV lamp, Mercury iodide lamp, Sodium va- pour lamp, Halogen Lamps, Ultraviolet Lamps, Neon Lamps. Neon Sign Tubes. Metal halides, HID and Arc lamps, LED lamps, CFL

Practical:

1. Fit the given lamp in the selected mounting
2. Estimate and compare luminous efficiency of incandescent and compact fluorescent lamp.

Unit– III Illumination Control and Control Circuits **(4 Periods)**

Purpose of lighting control and Dimmer, Dimmer Transformer, Auto transformer dimmer, Two winding transformer dimmer

Electronic Dimmer: working principle and operation

1. Thyristor operated dimmer
2. Triac operated dimmer

Control of Enhance Lighting, Methods used for light control, Control circuits for lamps (re- fer): ON/OFF control

Control circuits for lamps: single lamp controlled by single switch, two switches.

Practical:

1. Prepare light dimmer arrangement using the relevant dimmer type of transformer
2. Build an electronic dimmer – Part I
3. Build another type of electronic dimmer – Part II

Unit– IV Illumination for Interior Applications **(2 Periods)**

Standard for various locations of Interior Illumination

Design considerations for Interior location of residence premises (1/2 BHK)

Illumination scheme for different Interior locations of Commercial, industrial unit.

Practical:

1. Measure the illumination output of different lamps (Incandescent, Fluorescent, CFL,LED, HPSV, HPMV) and compare it with their wattage.

Unit– V Illumination for Other Applications (3 Periods)

Factory Lighting, Street Lighting (Latest Technology), Flood Lighting, Railway Lighting

Brief idea: Lighting for advertisement /Hoardings/sports lighting, Agriculture and Horticulture lighting, Health Care Centers / Hospitals, Decorating Purposes, Stage Lighting, Aquariums and Ship- yards

Practical:

1. Build a single lamp control by single switch
2. Build a single lamp control by two switches

INSTRUCTIONAL STRATEGY

Effective illumination practices enhance learning environments. Use bright, natural light to boost focus and mood. Incorporate adjustable lighting for varied tasks, minimizing glare and shadows. Ensure even light distribution to reduce eye strain. Integrate smart controls for energy efficiency and adaptability, creating optimal conditions for engagement and productivity.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. Lindsey, Jack L., Applied Illumination Engineering, The Fairmont Press Inc.
2. Simons, R. H., Bean, Robert; Lighting Engineering: Applied Calculations, Architectural Press. ISBN: 0750650516.
3. Casimer M Decusatis, Handbook of Applied Photometry, Springer, ISBN 1563964163.
4. Butterworths, Lyons Stanley, Handbook of Industrial Lighting, Butterworths
5. Simpson Robert S, Lighting Control Technology and Applications, Focal Press
6. Kao Chen, Energy Management in Illuminating Systems, CRC Press

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	2	18
II	3	22
III	4	22
IV	2	16
V	3	22
Total	**14**	**100**

THEORY	5.5 INDIAN CONSTITUTION	L	T	P
		2	-	-

COURSE OBJECTIVES:

To provide a comprehensive understanding of the Indian Constitution's history and philosophy, and to familiarize them with the administrative structure, powers, and functions of the Union, State, and Local governments, along with the Judiciary and Election Commission.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the making of the Indian Constitution, interpret the Preamble, and discuss the significance of Fundamental Rights and Duties.

CO2: Describe the structure of the Union Executive, detailing the powers and roles of the President, Prime Minister, and Council of Ministers.

CO3: Distinguish between the functions of the Lok Sabha and Rajya Sabha and explain the jurisdiction and structure of the Supreme Court.

CO4: Discuss the administrative framework of State Governments, focusing on the roles of the Governor, Chief Minister, and State Secretariat.

CO5: Outline the hierarchy and functions of Local Administration, including District Administration, Municipal Corporations, and Zila Panchayats.

CO6: Examine the structure of the Election Commission of India and its critical role in conducting free and fair elections.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	-	-	-	-	3	1	3	*	*
CO2	-	-	-	-	2	2	2	*	*
CO3	-	-	-	-	3	1	2	*	*
CO4	-	-	-	-	2	2	2	*	*
CO5	-	-	-	-	3	2	2	*	*
CO6	-	-	-	-	3	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT

Unit – I: The Constitution – Introduction **(06 Periods)**
The History of the Making of the Indian Constitution
Preamble and the Basic Structure, and its interpretation
Fundamental Rights and Duties and their interpretation

Unit – II: Union Government **(06 Periods)**
Structure of the Indian Union Government
President – Election, Role and Power
Prime Minister and Council of Ministers

Unit – III: Indian Legislature & Judiciary **(06 Periods)**
Composition of Lok Sabha and Rajya Sabha
Powers & Functions of Lok Sabha and Rajya Sabha
Structure of Supreme Court including Appointment of Judges
Powers & Functions of Supreme Court

Unit – IV: State Government **(03 Periods)**
Governor – Role and Power
Chief Minister and Council of Ministers State Secretariat

Unit – V: Local Administration **(04 Periods)**
District Administration
Municipal Corporation
Zila Panchayat

Unit – VI: Election Commission **(03 Periods)**
Structure of Election Commission of India
Role and Function of Election Commission

INSTRUCTIONAL STRATEGY

Teach the Indian Constitution through interactive methods like case studies, debates, and role-plays to engage students. Use visuals and simplified texts to explain key features like fundamental rights and duties. Encourage discussions on amendments and landmark judgments. Incorporate quizzes and group projects to foster critical thinking and civic awareness

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
2. The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition
4. Our Constitution Subhash Chand Kashyap NBT New Delhi.

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1.1. https://www.constitution.org/cons/india/const.html
1.2. http://www.legislative.gov.in/constitution-of-india
1.3. https://www.sci.gov.in/constitution
1.4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/
1.5. https://ncert.nic.in/textbook.php

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	6	20
II	6	20
III	6	20
IV	3	12
V	4	16
VI	3	12
Total	**28**	**100**

PRACTICUM	5.6 ELECTRICAL ESTIMATION AND CONTRACTING	L	T	P
		02	-	04

COURSE OBJECTIVES:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Design electrical installation with costing for tendering

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Apply the provisions of National Electric Code (NEC) 2023 and safety practices (Permit to Work, PPE) to electrical installation projects.

CO2: Prepare and compare commercial documents including tenders, quotations, comparative statements, and purchase orders for project execution.

CO3: Design and estimate the cost of electrical installations for non-industrial buildings (Residential, Commercial, Cinema Halls) including earthing.

CO4: Plan and design industrial wiring schemes for factories, agricultural pumps, and flour mills, including motor wiring and multiple earthing systems.

CO5: Select materials and estimate costs for HT/LT distribution lines (Overhead/Underground) and 11kV Substations (Indoor/Outdoor).

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	2	-	-	2	2	2	2	*	*
CO2	2	2	-	-	1	3	1	*	*
CO3	3	2	2	2	1	2	1	*	*
CO4	3	2	2	2	1	2	1	*	*
CO5	3	3	3	2	1	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Electric Installation and Safety **(04 Periods)**

Scope and features of National electric code 2023
Types of electrical installation
Fundamental principles for electrical installation
Permit to work, safety instructions and safety practices
Purpose of estimating and costing.

Practical: -

1. To understand the objective of safety in Electric installation.
2. List out all the personal protective equipment's PPE's available in industry.
3. Prepare an estimate of institute/College for electrical connection and costing of equipment's used.

Unit – II: Estimation and Costing **(08 Periods)**

Meaning and purpose of- rough estimate, detailed estimate, supplementary estimate, annual maintenance estimate and revised estimate.
Factors to be considered while preparation of detailed estimate and economical execution of work.
Contracts- Concepts of contracts, types of contracts, contractor, role of contractor.
Tenders and Quotations- Type of tender, tender notice, preparation of tender document, and method of opening of tender.
Quotation, quotation format, comparison between tender and quotation.
Comparative statement, format comparative statement. Order format, placing of purchasing order.
Principles of execution of works, planning, organizing and completion of work, Billing of work.

Practical: -

1. Prepare a tender notice for purchasing a transformer of 100 KVA for commercial installation.
2. Prepare a quotation for purchasing different electrical material required.
3. Prepare a comparative statement for above material Prepare purchase order for the same.
4. Estimate with a proposal of the electrical Installation of streetlight scheme for small premises after designing.
5. Estimate with a proposal of the L.T. line installation. Prepare report and draw sheet.

Unit– III: Non-Industrial Installations **(06 Periods)**

Types of non-industrial installations- Office buildings, shopping and commercial centre, residential installation, Electric service and supply.
Design consideration of electrical installation in commercial buildings.
Design procedure of installation- steps involved in detail, Estimating and costing of unit
Earthing of commercial installation.
Design electrical installation scheme of commercial complex.

Practical: -

1. Prepare Electrical Estimation for Residential and Industrial wirings.

2. Design drawing, estimating and costing of hall / cinema theatre / commercial installation Prepare report and draw sheet.

Unit– IV: Industrial Installation **(04 Periods)**

Classification of industrial buildings Classification based on power consumption,
Drawing of wiring diagram and single line diagram for single phase and three phase Motors.
Design consideration in industrial installations Design procedure of installation-detailed steps
Design electrical installation scheme of factory/ small industrial unit, Preparation of material schedule and detailed estimation. Installation and estimation of agricultural pump and flourmill.

UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

Practical: -

1. Design electrical installation scheme for any one factory / small industrial unit. Draw detailed wiring diagram. Prepare material schedule and detailed estimate. Prepare report and draw sheet.
2. To plan multiple earthing system for industrial installation.
3. To measure the earth resistance of various equipment installed in institute/college.
4. List out the various bus schemes in substation.

Unit– V: Distribution Lines and LT Substation (06 Periods)

Introduction to overhead and underground distribution line.
Materials used for distribution line HT and LV.
Cables used for distribution line, factors determining selection of LT/ HT power Cables, cable laying and cable termination method according to IS.
Design, estimation and costing of HT LT overhead line and underground cabling.
Estimation of load, Load factor, diversity factor and determination of rating of distribution.
Transformer. Design, estimation and costing of outdoor and indoor 11 KV substation.

Practical: -

1. Estimate with a proposal of the electrical Installation of streetlight scheme for small premises after designing.
2. Estimate with a proposal of the L.T. line installation. Prepare report and draw sheet.
3. Estimate with a proposal of the 500 KVA, 11/0.433 KV outdoor substation and prepare a report.
4. Identify indoor and outdoor switch gear system.

INSTRUCTIONAL STRATEGY

Teach Electrical Estimation and Contracting using hands-on simulations and real-world projects. Break down cost estimation, material selection, and contract drafting through case studies. Use software tools for practical learning. Encourage group discussions on standards and safety. Incorporate site visits and expert talks to enhance understanding and application.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. Raina, K.B.; Dr. S. K. Bhattacharya New Age International Publisher First, Reprint 2010, Electrical Design Estimating and Costing ISBN: 978-81-224-0363-3.
2. Allagappan, N. S. Ekambarram, Tata Mc-Graw Hill Publishing Co. Ltd, Electrical Estimating and Costing, ISBN 13: 9780074624784.
3. Singh, Surjit Ravi Deep Singh, Dhanpat Rai and Sons, Electrical Estimating and Costing, ISBN13:1234567150995.
4. Gupta, J.B. S.K. Kataria and Sons Reprint Edition, A Course in Electrical Installation Estimating and Costing ISBN 10: 935014279113: 978-9350142790.
5. Bureau of Indian Standard. IS: 732-1989, Code of Practice for Electrical Wiring Installation.
6. Bureau of Indian Standard. SP-30:2011, National Electrical Code 2011.
7. Dr. T. D. Bisht, Ashish Sahoo, Dinesh Kumar Gautam, Electrical Design, Drawing & Estimating -I , ISBN No. 978-93-5502-015-4
8. Dr. T. D. Bisht, Ashish Sahoo, Electrical Design, Drawing & Estimating -II , ISBN No. 978-93-5502-194-6

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	04	15
II	08	30
III	06	20
IV	04	15
V	06	20
Total	**28**	**100**

PRACTICUM	6.1 BUILDING ELECTRIFICATION	L	T	P
		2	-	4

COURSE OBJECTIVES:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Design electrical installation systems in building complexes

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Select appropriate wiring tools, switches, holders, and accessories based on their construction and application for specific electrical tasks.

CO2: Classify electrical wires and cables (LT/HT/EHT) and demonstrate methods of jointing, laying, and selecting suitable cable sizes.

CO3: Design and construct wiring circuits for domestic applications (Staircase, Godown, Master Switch) using PVC Casing-Capping or Conduit systems.

CO4: Prepare electrical plans, load assessments, and cost estimates for residential buildings (up to 5kW) adhering to NEC 2023 and BIS standards.

CO5: Test wiring installations for insulation/polarity and measure earth resistance while explaining the working of protective devices (MCB, ELCB, RCCB).

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	-	-	3	1	-	1	*	*
CO2	3	2	-	3	1	-	2	*	*
CO3	3	2	2	3	1	1	2	*	*
CO4	3	2	2	2	2	2	2	*	*
CO5	3	3	3	3	2	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Wiring Tools and Accessories Various tools required for wiring (04 Periods)

Application, care & maintenance of tools: Screwdrivers, pliers, Try square, saws, hacksaw, chisel, hammers, mallet, rawal punch, hand drill machine, portable drilling machine, files, plumb bob, line thread, electricians' knife, test lamp, tester.

Switch – Their types according to construction such as surface switch, flush switch, and pull switch, rotary switch, knife switch, pendent switch, Main-switch (ICDP, ICTP). Their types according to working such as single pole, double pole, two-way, two-way centre off, intermediate, series parallel switch

Holders- Their types such as bayonet cap lamp holder, pendent holder, batten lamp holder, angle holder, bracket holder, tube light holder, screw type Edison and goliath Edison lamp holder, swivel lamp holder.

Socket outlets and plugs- two pin, three-pin, multi pin sockets, two-pin and three-pin plug.

Others- Iron connector, adaptor, and ceiling rose, distribution box, neutral link, bus-bar chamber. Wooden/ mica boards, Moulded/ MS Concealed boxes of different sizes. Modular accessories.

BIS symbols of various electrical accessories.

Practicals:-

1. Prepare the chart of electrical accessories with their symbols.

Unit – II: Electrical Wires and Underground Cables Conductors (06 Periods)

Wire, cable, bus bar, stranded conductor, cable, armoured cable, flexible cable, solid conductor, PVC wires, CTS wire, LC wire, FR (Fire retardant) wire. Tools used for measurement of wire size, Wire jointing methods.

Classification of cables, low tension, high tension, and extra high-tension cables, solid, oil filled and gas filled type Cable insulation materials –Polyvinyl chloride (PVC), cross linked polythene (XLPE)

Selection of suitable cable size and type from standard data Cable jointing methods Cable laying methods. Factors determining selection of electric cables.

Practicals:-

1. Select the electric wire using measuring and testing instruments for particular applications.
2. Identify cables of different current ratings.

Unit – III: Wiring Methods and wiring layout Factors determining the selection of wiring methods (06 Periods)

Classification of wiring methods. PVC casing-capping wiring- wiring rules according to IS: 732-2019 Conduit wiring- Types of conduit, types of conduit wiring (Surface/Concealed). Conduit wiring accessories. Comparison of various wiring systems. General BIS rules for domestic installations.

Design, working and drawing of following electrical circuits: Simple light and fan circuits, Staircase wiring, Go-down wiring circuit, Bedroom lighting circuit, Corridor lighting circuit, Series parallel circuit, Master switch control circuit, Different lighting circuit using - Intermediate switch, Call bell circuit using bell indicator, Design of wiring circuits according to user's requirement.

Practicals:-

1. Prepare wiring installation on a board showing control of one lamp, one fan and one socket from one switch board in PVC surface conduit wiring system.
2. Control one lamp from two different places using PVC surface conduit wiring system.
3. Prepare wiring installation on a board. Control one lamp from three different places using PVC surface conduit wiring system.

UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

Unit – IV: Residential Building Electrification Domestic Dwellings/Residential Buildings

(08 Periods)

Reading of Civil Engineering building drawing, Interpretation of electrical installation plan and electrical diagrams, electrical symbols as per IS: 732:2019.

Electrical installation for residential building as per NEC 2023.

Difference between residential and industrial load, rules/requirements related to lighting load followed in electrical installations, Positioning of equipment. Lighting and power circuits: Light and fan circuit, Power circuit wiring and circuit Schematic diagram according to IS: 2042(Part-I)-1962: multiline and single line representation Load assessment: Selection of size of conductors, Selection of rating of main switch and protective switch gear. Design and drawing, estimation and costing of a residential installation having maximum 5 KW load; Sequence to be followed for preparing estimate.

Calculation of length of wire and other materials, labour cost

Testing of wiring installation as per IS: 732-2019: Insulation resistance - between earth and conductors, between conductors, polarity test of single pole switches. Testing of earth continuity path. Residential building Service Connection- types Underground and overhead. Calculation of Material required for service connection.

Practicals:-

1. Design 2 BHK residential installation scheme and estimate the material required. And draw the details required for installation on A4 size sheet.
2. Perform go-down wiring for three blocks using PVC casing capping.
3. Test wiring installation using megger.

Unit – V: Protective Devices and Earthing for Electrical Installation **(04 Periods)**

Miniature circuit Breaker (MCB), Construction, Principle, rating and uses,

MCCB- Construction, Principal rating and uses,

Earth Leakage Circuit Breaker (ELCB)-Construction, Principle, rating and uses.

Residual Current Circuit Breaker (RCCB)- Construction, Principle rating and uses.

System and equipment earthing and its requirements, Measurement of earth resistance using earth tester, Methods of reducing earth resistance, Methods of earthing and their procedure- Driven pipe, pipe and plate earthing, modern methods of earthing.

Practicals:-

1. Measurement of Earth Resistance by using Earth tester.
2. Dismantling of MCB and identify various parts.

INSTRUCTIONAL STRATEGY

Building electrification includes conduct an energy audit, engage stakeholders, prioritize energy efficiency upgrades, develop an electrification plan, secure incentives, phase implementation with project milestones, provide workforce training, and monitor progress to optimize energy use and achieve decarbonization goals.

MEANS OF ASSESSMENT

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

- Presentation/Seminar

RECOMMENDED BOOKS:

1. Raina, K.B. and S.K. Bhattacharya, Electrical Design Estimating and Costing, New Age International Ltd., New Delhi, ISBN 978-81-224-0363-3
2. Allagappan, N., S. Ekambarram, Electrical Estimating and Costing, New Delhi, ISBN-13: 9780074624784
3. Singh, Surjit, Electrical Estimating and Costing, Dhanpat Rai and Co. New Delhi, ISBN: 1234567150995
4. Gupta, J B: A Course in Electrical Installation Estimating and Costing, S K Kataria and Sons, New Delhi, ISBN:978-93-5014-279-0
5. Bureau of Indian Standard, IS: 732-2019, Code of practice for electrical wiring installation
6. Bureau of Indian Standard, SP 30 National Electrical Code 2023
7. Bureau of Indian Standard, SP 72 National Lighting Codes 2010

WEBSITES FOR REFERENCE: -

a. http://nptel.ac.in/courses/108108076/1, assessed on 18th January 2016
b. http://www.electrical4u.com, assessed on 18th January 2016
c. https://www.youtube.com/watch?v=A9KSGAnjo2U, assessed on 18th January 2016
d. http://www.electricaltechnology.org/2015/09, assessed on 30 Jan 2016
www.slideshare.net/bawaparam/made-by-paramassesed on 30 Jan2016
e. www.electricaltechnology.org/2013/09/electrical-wiring.html assessed on 16 March 2016.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	11	20
II	11	20
III	11	20
IV	13	23
V	10	17
Total	**28**	**100**

THEORY	6.2 ENTREPRENEURSHIP AND START-UPS	L	T	P
		2	-	-

COURSE OBJECTIVES:

To foster an entrepreneurial mind set by equipping students with the skills to identify business opportunities, formulate comprehensive business plans, understand management functions, and navigate the financial and legal landscapes of starting and sustaining a venture.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the concept of entrepreneurship, classify business structures, and distinguish between the roles of an entrepreneur and manager.
CO2: Identify feasible business ideas using activity maps and develop a preliminary Business Plan based on case study analysis.
CO3: Analyze market strategies using STP and SWOT analysis, and formulate the Vision, Mission, and Objectives for a start-up.
CO4: Discuss the fundamental functions of management, organizational structures, and the processes of recruitment, selection, and training.
CO5: Select appropriate financing methods (Govt schemes, Venture Capital) and apply Intellectual Property Rights (IPR) concepts to protect business ideas.
CO6: Describe the strategies for business succession, harvesting, and the legal types of dissolution.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	-	-	-	-	2	3	2	*	*
CO2	-	2	2	-	1	3	2	*	*
CO3	-	2	2	-	2	3	2	*	*
CO4	-	-	-	-	1	3	1	*	*
CO5	-	2	-	-	2	3	2	*	*
CO6	-	-	-	-	1	3	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Introduction to Entrepreneurship and Start – Ups **(05 Periods)**

Definitions, Classification of Entrepreneur
Traits of an Entrepreneur, Intrapreneurship, Motivation
Types of Business Structures- On the Basis of size and on the basis of ownership
Similarities/differences between entrepreneurs and managers

Unit – II: Business Ideas and their implementation **(04 Periods)**

Discovering ideas and visualizing the business
Activity map
Business Plan (Case Study)

Unit – III: Ideas to Start-up **(08 Periods)**

Marketing and Accounting- Definition and Importance.
Market Analysis – STP (Segmentation, Targeting, Positioning)
Competition evaluation and Strategy Development – Vision, Mission, Goal, Objectives.
Risk analysis- SWOT Analysis.

Unit – IV: Management **(06 Periods)**

Definition Concept and Functions of Management
Company's Organization Structure- Concept and Classification
Recruitment and Selection- Definition, Training and Development- Importance.

Unit – V: Financing and Protection of Ideas **(03 Periods)**

Financing methods available for Entrepreneurship/ Startups in India (Government Scheme, Banking, NBFCs, SHG and Micro Financing).
Intellectual Property Rights- Overview of - Copyrights, Trademark, Geographical Indicators, Patenting and Licenses
Communication of Ideas to potential investors – Investor Pitch.

Unit – VI: Succession, Dissolution and Harvesting strategy **(02 Periods)**

Ways of succession
Types of Dissolution

INSTRUCTIONAL STRATEGY

Entrepreneurship and start-ups includes: use experiential learning, integrate real-world projects, provide mentorship, foster interdisciplinary collaboration, partner with businesses, invite industry professionals for lectures, organize business plan competitions, offer practical consulting opportunities, and help students launch real ventures to build entrepreneurial skills and mindsets.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/Proto type making.

RECOMMENDED BOOKS:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company – Steve Blank and Bob Dorf, K & S Ranch, ISBN: 978-0984999392
2. Entrepreneurship Development (A New Venture Creation) – Vasant Desai, Himalaya Publishing House
3. Entrepreneurship Development – S.S. Khanka, S. Chand & Company Ltd., New Delhi
4. Entrepreneurship Development – Gupta and Srinivasan, S. Chand & Company Ltd., New Delhi
5. Demand: Creating What People Love Before They Know They Want It – Adrian J. Slywotzky with Karl Weber, Headline Book Publishing, ISBN: 978-0755388974
6. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses – Eric Ries, Penguin UK, ISBN: 978-0670921607
7. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business – Clayton M. Christensen, Harvard Business Review Press, ISBN: 978-1422196021

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.fundable.com/learn/resources/guides/startup
2. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate-structure/
3. https://www.finder.com/small-business-finance-tips
4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/
5. NPTEL Course on Entrepreneurship https://onlinecourses.nptel.ac.in/noc23_mg74/preview
6. National Geographic Channel you tube Video on "GI Tag Crafts of Bharat"

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	05	15
II	04	15
III	08	25
IV	06	20
V	03	10
VI	02	15
Total	**28**	**100**

THEORY	6.4.1 PROJECT MANAGEMENT	L	T	P
		2	-	-

COURSE OBJECTIVES:

The aim of this course is to help the students to develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the fundamental concepts of project management, including the project life cycle and priorities, and construct a Work Breakdown Structure (WBS) for a given project.

CO2: Apply the capital budgeting process to generate and screen project ideas and analyze market feasibility using demand forecasting techniques.

CO3: Estimate project costs, working capital requirements, and prepare projected financial statements including Cash Flow and Break-Even analysis.

CO4: Evaluate the financial viability of projects using discounting (NPV, IRR) and non-discounting (Payback, ARR) capital budgeting techniques and social cost-benefit analysis.

CO5: Develop project schedules using Network Planning techniques (CPM/PERT) to analyze time-cost trade-offs and determine the least cost duration.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	2	1	1	-	-	3	1	*	*
CO2	2	2	-	-	1	3	2	*	*
CO3	2	2	-	-	-	3	1	*	*
CO4	2	2	-	-	2	3	2	*	*
CO5	2	3	1	2	-	3	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT

UNIT-I: Concept of a project: **(04 Periods)**

Classification of projects- importance of project management- The
project life cycle- establishing project priorities (scope-cost-time) project priority matrix- work break down structure.

UNIT-II: Capital budgeting process: **(06 Periods)**
Planning- Analysis-Selection-Financing-Implementation-Review.
Generation and screening of project ideas- market and demand analysis- Demand forecasting techniques. Market planning and marketing research process- Technical analysis

UNIT-III: Financial estimates and projections: **(06 Periods)**

Cost of projects-means of financing-estimates of sales and production-cost of production-working capital requirement and its financing-profitability , projected cash flow statement and balance sheet. Break even analysis.

UNIT-IV: Basic techniques in capital budgeting: **(06 Periods)**

Non discounting and discounting methods- payback period- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return.
Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of projects**.**

UNIT-V: Project administration: **(06 Periods)**

Progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress,
time-cost trade off.
Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management software.

INSTRUCTIONAL STRATEGY
Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial and start- up qualities in the students.

MEANS OF ASSESSMENT
- Assignments and quiz/class tests
- Mid-term written tests
- Model/Proto type making.

RECOMMENDED BOOKS:

1. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill
2. Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson – McGraw Hill
3. Project management - David I Cleland - Mcgraw Hill International Edition, 1999
4. Project Management – Gopala krishnan – Mcmillan India Ltd.
5. Project Management-Harry-Maylor-Peason Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	04	18
II	06	22
III	06	20
IV	06	20
V	06	20
Total	**28**	**100**

THEORY	6.4.2 INTERNET OF THINGS	L	T	P
		2	-	-

COURSE OBJECTIVES:

To provide students with foundational knowledge of the Internet of Things (IoT), covering its architecture, components, networking, data handling, and real-world applications, enabling them to understand and contribute to IoT systems across domains.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the definition, evolution, and three-layer architecture of IOT and discuss its impact on society and associated challenges.

CO2: Identify the core components of embedded systems and describe their interaction with the physical world.

CO3: Interpret IOT networking fundamentals (IP, MAC) and compare wireless communication protocols and application protocols.

CO4: Demonstrate data acquisition and visualization using IoT platforms and apply basic security mechanisms.

CO5: Discuss applications of IOT in various domains and examine future trends like AIoT and Edge Computing.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	1	-	1	*	*
CO2	3	1	1	2	-	-	1	*	*
CO3	3	2	1	2	-	-	2	*	*
CO4	3	2	2	3	1	1	2	*	*
CO5	3	1	2	1	2	1	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT

Unit I - Introduction to Internet of Things (05 periods)

- Basic Definition of "Internet of Things (IoT)"
- Evolution and history of IoT
- Technological trends enabling IoT: ubiquitous computing, cloud computing, low-cost sensors, wireless communication
- IoT architecture overview: perception, network, and application layers
- Impact of IoT on society: smart cities, healthcare, agriculture, transportation, and home automation
- Challenges in IoT: privacy, security, scalability

.

Unit II - Design consideration of IoT (05 Periods)

- Overview of embedded systems in IoT
- Components of an embedded system : microcontroller, sensors, actuators, memory, power supply
- Interactions of embedded systems with the physical world.
- Introduction to Core hardware components and software tools most commonly used in IoT devices.

Unit III Interfacing by IoT devices (07 Periods)

- Interaction between software and hardware in an IoT device.
- IoT networking basics: IP addressing, MAC, DNS, DHCP
- Basic networking hardware: routers, switches, access points, gateways
- Introduction to Structure of the Internet: client-server and peer-to-peer models
- Overview of Wireless communication protocols: Wi-Fi, Bluetooth, ZigBee, LoRa, NB-IoT
- Brief introduction to Cloud connectivity and MQTT/HTTP protocols

Unit IV: Data Handling and IoT Platforms (07 Periods)

- Role of data in IoT: sensing, logging, analysis, and actuation
- Data acquisition and storage methods (local and cloud-based)
- Introduction to data analytics in IoT: basic visualization, dashboards
- Overview of popular IoT platforms: ThingSpeak, Blynk, Google Firebase, AWS IoT
- Real-time data monitoring and alerts
- Security concerns and basic protection mechanisms (encryption, authentication, firewalls)

Unit V: Applications, Projects and Future of IoT (04 Periods)

- Overview of Application domains: Smart home, Industrial IoT, Healthcare, Smart farming
- Mini project ideas: Smart temperature logger, IoT-based light control, Air quality monitor
- Social, ethical, and environmental implications of IoT
- Career prospects and skills in IoT
- Trends and future scope of IoT: AIoT, 5G, Edge Computing

RECOMMENDED BOOKS:

1. "Internet of Things" by Jeeva Jose – Beginner-friendly, suitable for diploma students, covers basics to applications.
2. "Internet of Things: A Hands-On Approach" by Arshdeep Bahga & Vijay Madisetti – Practical approach with architecture, design, and cloud integration.
3. "Getting Started with the Internet of Things" by Cuno Pfister – Ideal for Arduino beginners with sensor interfacing and networking basics.
4. "Internet of Things: Architecture and Design Principles" by Raj Kamal – Covers technical architecture, protocols, and design considerations.
5. "Exploring Raspberry Pi" by Derek Molloy – For advanced learners, focuses on Linux-based IoT development and hardware interfacing.

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. http://esp32.net/
6. NPTEL

INSTRUCTIONAL STRATEGY

Engage students in experiments and demonstrate that illustrate principles of IoT.Understand the architecture, protocols, and components of IoT systems. Develop skills to design and implement simple IoT-based applications. Explore communication models and data handling in IoT

MEANS OF ASSESSMENT

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	05	20
II	05	20
III	07	22
IV	07	22
V	04	16
Total	**28**	**100**

7. GUIDELINES FOR ASSESSMENT OF STUDENT-CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 50 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 15 Marks for general behaviour and discipline

(by HODs in consultation with all the teachers of the department)

ii. 10 Marks for attendance as per following:

(by HODs in consultation with all the teachers of the department)

a) 75 - 80% 6 Marks

b) 80 - 85% 8 Marks

c) Above 85% 10 Marks

iii. * Even Semester:

25 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSS activities as per following: (by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) State/National Level participation

b) Participation in two of above activities

c) Inter-Polytechnic level participation

**Odd Semester:

25 Marks maximum

a) Language Lab Practices / foreign language practices

b) Group Discussion and Personality Development

c) Industrial Visits/Industrial Talks

d) Power Point Presentations and Resume Making

e) Development of Aptitude and Reasoning Skills

f) Participation in the technical Exhibitions, Symposiums, Seminars, Workshops at the Institute /District/State/National Level.

8. RESOURCE REQUIREMENT

A. PHYSICAL RESOURCES

a. Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

b. Equipment Requirement:

Following Laboratories are required for diploma programme in Electrical Engineering (5th and 6th Semester):

ENERGY CONSERVATION AND AUDIT LAB

S. No.	Name of Equipment	Broad Specifications	Quantity
01	Catalogues by different manufacturers of Refrigerators, Televisions, and Air conditioners.	Three-star, Four-star, Five star	1
02	Three phase Induction Motor – DC Generator (5KW) Set	3 hp, 415 Volts	01
03	AC Voltmeter	0 – 500V	03
04	AC Clamp on ammeter	0-20A	03
05	PF meter	Three phase 5/10Amp, 300/600V	01
06	Wattmeter	Single phase, 5/10A, 300/600V, 1500W	02
07	Capacitor Bank	3 phase, 50Hz,1 KVAR (in steps of 0.2KVAR)	01
08	Star-Delta converter	Suitable for the 3 hp, 415 Volts motor	01
09	Lamp bank	5 kW	01
10	AC Ammeter	0-10 A	01
11	DC Voltmeter	0-300 V	01
12	DC Ammeter	0-20 A	01
13	Rheostat	800 Ohms,1A.	01
14	Standard window A.C.	1 Ton, 3 Star	01
15	Anemometer		01
16	Thermometer		01
17	Flow meter		01
18	Tubelight with Choke and Starter	20W, 40W; 230V AC 50 Hz	2
19	Tube Light with Electronic ballast	18W, 36W, 58W; 230V AC 50 Hz	2

20	BLDC Fan	230V AC 50 Hz Commonly 1200 mm (48 inches).	1
21	Ceiling Fan	230V AC 50 Hz Commonly 1200 mm (48 inches).	2

ELECTRICAL TESTING AND COMMISSIONING LAB

S. No.	Name of Equipment	Broad Specifications	Quantity
1	Transformer oil insulation testing kit	0-80 KV	1
2.	Digital Megger	1 KV	1
3.	Transformer	1 kVA, Primary Voltage: 0-125V, 0-125V; Secondary Voltage: 0-125V, 0-125V	02
4.	Alternator	3.5 KVA, 2 pole, 415 VOLT 50 Hz 3000 RPM	1
5.	Voltmeter	100V, 300V (MI type)	02
6.	Ammeter	1A, 10A (MI type)	02
7.	Wattmeter (MI type)	100W, 1000W	01 Each
8.	Auto Transformer	0-270V, 10A	01
9.	Swinburns test	Test Kit	1
10.	Hopkinson test	Test Kit	1
11.	Armature Growler Tester	Armature Dia: 20mm to 100 mm; Armature Length: 40mm-500mm; 1-phase 230V AC	1
12	Filler gauge	Standard	1
13.	Bearing puller	Standard	1
14.	Dial Indicator	Standard	1

ILLUMINATION PRACTICES LAB

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Digital Lux meter	Range: 0-50,000 lux	2
2.	Different types of Lamps	Incandescent, Fluorescent, CFL, LED, HPSV, HPMV	L.S.
3.	Lamp Holders/Mountings	Standard holders (e.g., B22, E27) compatible with the lamps	L.S.
4.	Luminaires with Reflectors	Various fixtures, some with removable reflectors	4-5 sets
5.	Wattmeter	0-2.5/5A, 0-75/150/300V Portable Wattmeter	2
6.	Single phase autotransformer	0-230V/0-270V, 2 Amp	2
7.	Electronic Dimmer Components	TRIAC (e.g., BT136), DIAC (e.g., DB3), Potentiometer (e.g., 470kΩ), Resistors, Capacitors	L.S.
8.	Breadboard	Standard size for circuit design	10
9.	Switches (One-way & Two-way)	Standard single-pole (SPST) and two-way (SPDT) switches	10 each
10.	Connecting wires	Flexible, insulated copper wires	L.S.
11.	Patch cords		L.S.
12.	AC Voltmeter	Range (0-75/150/300V), Portable analog MI type	2
13.	AC Ammeter	Range (0-5-10-20A), Portable analog MI type	2

BUILDING ELECTRIFICATION LAB & ELECTRICAL ESTIMATION AND CONTRACTING LAB

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Screw driver	8 inch, 10 inch, 12 inch	10 each
2.	Combination Pliers	6 inch, 8 inch	10 each
3.	Round Nose Pliers	15 cm	10
4.	Electrical Knife	10 cm	10
5.	Heavy duty Screw driver	10 inch, 12 inch	10 each
6.	Nose Pliers	6 inch	10
7.	BP Hammer	½ pound, ¼ pound	10 each
8.	Cold Chisels	15 cm	10
9.	Tri square	15 cm	10
10.	Former Chisels	14 cm, 20 cm, 25 cm	10 each
11.	Poker	15 cm	10
12.	Hacksaw	30 cm	10
13.	Drilling machine	Motor power 435W, ac single phase 230V ac,50Hz Drilling capacity 10mm, slotted and adjustable drilling, no load speed 700 RPM,	2
14.	Wire Stripper	-	10
15.	Measuring Tape	-	5
16.	Standard wire gauge	-	5
17.	Meggar	Insulation tester having hand driven generator to generate 500 volts DC having effective range of measuring insulation resistance from 0 to 500 M ohm	2
18.	Digital Earth Tester	10 volt, 0.10-100 ohms, 3 ½ digit (1999 counts), 14 mm LCD display. Complete with all accessories (hammers, screw driver, 3 spikes)	2
19.	Single phase energy meter	Single phase, induction type, 50 Hz, 10A, 250 V, accuracy+ 1%	5
20.	Clamp on meter	200 A AC and DC current measurement. Voltage: DC: 600 volts, AC: 600 volts; DC Accuracy: ± 1% + 5 digit AC Accuracy: ± 1.5% + 5 digit. 300 ohm resistance range with continuity check.	2
21.	Multi-meter	0-600 V (AC and DC both), 10mA-10A (AC and DC both), 2ohm-20 Kohm	10
22.	ELCB	Single phase , 16 amp	5
23.	DP switch	16 amp, 32 amp	5 each
24.	Personal Protective Kit	Helmet, Eye Goggle Safety shoes hand Gloves face shield	2
25.	Earthing electrode	2 Meter copper	1
26.	Copper plate	1 feet * 1 feet	1
27.	GI Pipe	0.5 inch	1
28.	GI wire	2.5 mm	10 meter

B. Furniture Requirement

Norms and standards laid down by AICTE -APH (latest) be followed for working out furniture requirement for diploma courses

C. Human Resources:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, workload norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

9. EVALUATION SCHEME GUIDELINES: As Per AICTE ATTACHED (ANNEXURE- 2)

a. Theory Courses:

- Internal Assessment: 40%
- End Semester Examination: 60%
- Passing Criteria: A student must secure a minimum of 40% marks separately in both internal assessment and end semester examination to pass the course.

b. Practical Courses:

- Internal Assessment: 60%
- End Semester Examination: 40%
- Passing Criteria: A student must secure a minimum of 40% marks separately in both internal assessment and end semester examination to pass the course.

c. Summer Internship / Projects / Seminars, etc.:

- Evaluation is based on the following components:
  - Quality of work completed
  - Report preparation and documentation
  - Viva-voce performance
  - Presentation skills

Note:
Internal assessment is conducted based on the student's overall performance, which includes:

- Two best out of three mid-semester tests
- Quizzes and assignments
- Class participation and attendance
- Viva-voce and lab records (for practical subjects)

ANNEXURE- 2

EVALUATION METHODOLOGY

1. EVALUATION METHOD for THEORY

	Internal Assessment (40 marks)				External Assessment (60 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Written Test**	**Written Test**	**Attendance and Assignments**	**Pre – Semester Examination**	**End Semester Examination**
Portion	2 units	2 units	Regularly	All units	All units
Duration1hr	1hr	1hr	-	3hrs	3hrs
Exam Marks	20	20	20	60	60
Converted to	10	10	15	15	60
Tentative Schedule	5^{th} Week	10^{th} Week	Regularly	12^{th} -13^{th} Week	

IA1 and IA2: A written assessment test worth 20 marks should be conducted for two units. The marks earned (20 marks) will be converted to 10 marks. The best of the two assessments will be evaluated for an internal 10-mark assessment.

IA3: Assignments given after the completion of each unit, along with attendance throughout the semester, will be assessed for a total of 15 marks.

IA4: The pre-semester examination should follow the end-semester examination question pattern. The marks should be adjusted to 15 for internal assessment.

2. EVALUATION METHOD for PRACTICAL

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Practical Test and Quiz – Viva Voce**	**Practical Examination**
Portion	50% Practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	3 hrs	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

IA1 and IA2: Complete all exercises and experiments as outlined and retain them for the practical test. The test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be internally evaluated for a total of 20 marks.

IA3: Maintain a practical file for each exercise while ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, and practical test along with a valid certificate (Progress Card). This will be assessed for 20 marks.

IA4: The pre-semester practical examination, quiz, and viva-voce should follow the end-semester practical examination pattern, with marks adjusted to 20 for internal assessment.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Practical Test	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Viva-Voce	**10**
	Total	**40**

3. EVALUATION METHOD for PRACTICUM (End Exam-Practical)

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Micro Project**	**Practical Examination**
Portion	50% practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	Regularly	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

IA1 and IA2: Complete all exercises and experiments as instructed and retain them for the practical test. The test should be conducted according to the evaluation scheme. The best of the two practical tests will be internally assessed for a total of 20 marks.

IA3: Maintain a practical file for each exercise, ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be evaluated by 20 marks.

IA4: Submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be assessed by both the laboratory supervisor and an internal examiner. This evaluation will contribute 20 marks.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Mini Project	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Viva-Voce	**10**
	Total	**40**

4. EVALUATION METHOD for PRACTICUM (End Exam-Theory)

	Internal Assessment (40 marks)						External Assessment (60marks)
	IA 1		IA 2		IA 3	IA 4	
Mode	**Written Test**	**Practical Test**	**Written Test**	**Practical Test**	**Attendance and Practical Documentation**	**Pre Semester Examination and Micro Project**	**End Semester Examination**
Portion	2 units	Practical related to the units	2 units	Practical related to the units	All unit	All Practical	All unit
Duration	1hr	3hrs	1hr	3 hrs	3hrs	Regularly	3hrs
Exam Marks	10	20	10	20	60	60	60
	30		30				
Converted to	10		10		15	15	60
Tentative Schedule	5th Week		10th Week		Regularly	12th -13th Week	

IA1 and IA2: A written assessment test worth 10 marks should be conducted for two **UNIT**s. Complete all exercises and experiments as outlined and retain them for the practical test worth 20 marks. The practical test should be conducted in accordance with the evaluation scheme. The total marks earned (30 marks) will be converted to 10 marks. The best of the two assessments will be internally evaluated for a total of 10 marks.

IA3: Attendance and the pre-semester examination should follow the end-semester examination question paper pattern. The marks should be adjusted to 15 for internal assessment.

IA4: Maintain a practical file for each exercise. Submit the required documents for the practical file, quiz/viva-voice, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be assessed for 40 marks. Additionally, submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be evaluated by both the laboratory supervisor and an internal examiner. The total of 60 marks will be converted to 15 marks.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION FOR IA4

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Attendance & Mini Project	**10**
	Total	**40**

10. LIST OF EXPERTS

1. Shri Anand Kumar, HOD Electrical Engineering, Govt. Poly. Lucknow.
2. Shri Rizwanullah, Siddiqui, HOD Electrical Engineering, MMIT, Shravasti.
3. Smt. Priyanka Tiwari, Lecturer Electrical Engineering, Govt. Poly. Kanpur.
4. Shri Sunil Kumar, Lecturer Electrical Engineering, Govt. Poly. Unnao.
5. Smt. Sakshi Mishra, Lecturer Electrical Engineering, Govt. Poly. Harak, Barabanki.
6. Dr. Preeti Sonkar, Lecturer Electrical Engineering, Govt. Poly. Kanpur.
7. Shri Anurag Agarwal, Lecturer Electrical Engineering, Govt. Poly. Unnao.
8. Shri. Anuj Banswar, Lecturer Electrical Engineering, Govt. Poly. Puranpur.
9. Shri. Ankit Kumar, Lecturer Electrical Engineering, Govt. Poly. Hapur.
10. Shri. Deep Chandra, Lecturer Electrical Engineering, Govt. Poly. Bindki, Fatehpur.
11. Shri. Praveen Kumar Tiwari, Lecturer Electrical Engineering, MMIT, Hariharpur, Gorakhpur.
12. Shri. Homendra Pal Singh, Lecturer Electrical Engineering, Govt. Poly. Debai, Bulandshahr.
13. Shri. Vivek Anand Verma, Lecturer Electrical Engineering, Govt. Poly. Jigirsand, Ballia.
14. Shri. Tilak Singh, Lecturer Electrical Engineering, Govt. Poly. Talbhet, Lalitpur.
15. Shri. Rohit Chaudhary, Lecturer Electrical Engineering, Govt. Poly. Kirthal, Bagpat.

****

(ANNEXURE-I)

PROCEDURES / FORMATS FOR ORGANIZING INTERNSHIPS.

STUDENT INTERNSHIP PROGRAM APPLICATION

Complete and submit to the TPO/ Internship Program Coordinator.

1. Student Name:		Enroll. No.:	
2. Campus Address:		Phone:	
3. Home Address:		Phone:	
4. Student email address:			
5. Branch:		6. Internship Semester: _____	
7. Internship Preferences			
	Company/Industry	Core Area	Location
Preferance-1			
Preferance-2			
Preferance-3			
Faculty mentor Signature: _____Date_____.			
Student Signature: _____Date_____. Signature confirms that the student agrees to the terms, conditions, and requirements of the Internship Program			

Signature with seal
HOD/Principal

(ANNEXURE-I)

REQUEST LETTER FROM INSTITUTE TO INTERNSHIP/INDUSTRIAL TRAINING PROVIDER

Ref. No.: _____ Date: _____

To,
The HR Manager/Training Coordinator
……
……

Subject: Request for Internship/Industrial Training for Diploma Students

Sir/Madam,

We are pleased to introduce……., a premier institution affiliated with Board of Technical Education, Uttar Pradesh, offering diploma programs in various diploma disciplines.

As a part of the curriculum, our students are required to undergo Internship/Industrial Training to gain practical exposure and enhance their technical competencies. Therefore, we kindly request your esteemed organization to provide Internship/Training opportunities to our students during the period from …….. to ……..

S. No.	Name	Enroll. No.	Semester/Year	Discipline

Yours sincerely,

(Head of Department/Principal)

(ANNEXURE-II)

PROFORMA FOR EVALUATION OF INTERNSHIP BY INDUSTRY

Student Name: ……Evaluation Date: ……

Industry Supervisor Name: ……

Company/Organization: ……

Title of the Project: ……

Please evaluate your intern by indicating the frequency with which you observed the following behaviors:

Parameters	**Max. Marks**	**Marks Given**
Attendance and Punctuality	20	
Discipline and Professional Behavior	20	
Technical Knowledge and Understanding of Processes	30	
Practical Skills and Quality of Work	20	
Ability to Apply Theoretical Knowledge	20	
Problem Solving and Analytical Ability	10	
Communication and Interpersonal Skills	20	
Teamwork and Collaboration	10	
Internship Report/Documentation	20	
Presentation and Viva-Voce	30	
Total Marks	200	

Additional comments, if any:

Signature with seal of Industry supervisor HR Manager

(ANNEXURE-II)

INTERNSHIP REPORT

STUDENT'S DIARY/ DAILY LOG

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor visiting the industry from time to time and got ratified on the day of his visit.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

INTERNSHIP REPORT

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor, TPO and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria:

i. Originality.

ii. Adequacy and purposeful write-up.

iii. Organization, format, drawings, sketches, style, language etc.

iv. Variety and relevance of learning experience.

v. Practical applications, relationships with basic theory and concepts taught in the course.

UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

(ANNEXURE-II)

MONITORING & EVALUATION OF INTERNSHIP

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.

2. Evaluation by faculty supervisor of Industry.

3. Evaluation through seminar presentation/viva-voce at the Institute.

1. EVALUATION BY INDUSTRY

The industry will evaluate the students based on the Punctuality, eagerness to learn, Maintenance of Daily Diary and skill test in addition to any remarks.

2. MONITORING/ SURPRISE VISIT BY TPO/ STAFF/ FACULTY MENTOR

TPO/Staff/ Faculty Mentor of the institutes will make a surprise visit to the internship site, to check the student's presence physically, if the student is found absent without prior intimation to the T & P Cell, entire training will be cancelled. Students should inform the TPO, faculty mentor as well as the industry supervisor at least one day prior to availing leave by email. Students are eligible to avail 1-day leave in 4 weeks and 2 days leave in 6 weeks of the internship period apart from holidays and weekly offs.

3. EVALUATION THROUGH SEMINAR PRESENTATION/VIVA-VOCE AT THE INSTITUTE

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.

Seminar presentation will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in students.