

# SCHEME OF EXAMINATION

And

## SYLLABI

for

### **BRIDGE COURSE** **(Power Distribution Management)**

### **LEVEL IV SKILL COMPONENT**

Offered by

**University School of Engineering and Technology**

**1<sup>st</sup> SEMESTER to 2<sup>nd</sup> SEMESTER**



**GURU GOBIND SINGH  
INDRAPRASTHA  
UNIVERSITY**

**Guru Gobind Singh Indraprastha University**  
**Sector 16-C, Dwarka, Delhi – 110078 [INDIA]**

[www.ipu.ac.in](http://www.ipu.ac.in)

**NOMENCLATURE OF CODES GIVEN IN THE SCHEME OF B.VOC**

1. **ET** stands for Engineering and Technology.
2. **AP** stands for Architecture and Planning
3. **V** stands for Vocation.
4. **MC** stands for Mobile Communication.
5. **SD** stands for Software Development.
6. **AE** stands for Automobile.
7. **CE** stands for Consumer Electronics.
8. **PT** stands for Printing Technology.
9. **CT** stands for Construction Technology.
10. **RA** stands for Refrigeration & Air-Conditioning.
11. **PD** stands for Power Distribution Management.
12. **ID** stands for Interior Design.
13. **AA** stands for Applied Arts.
14. **CS** stands for Computer Science.
15. **MS** stands for Management Studies.
16. **EN** stands for Environmental Engineering
17. **PH** stands for Physics
18. **AS** stands for Applied Science.
19. **HS** stands for Humanities and Social Sciences.
20. **SS** stands for Social Services.
21. **L/T** stands for Lecture and Tutorial
22. **P** stands for Practical.
23. **S/D** stands for Drawing/Studio
24. **P/D** stands for Practical/Drawing

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**TITLE OF THE PROGRAMME**  
**BACHELORS OF VOCATION IN POWER DISTRIBUTION MANAGEMENT**

**Preamble:**

Availability of Electric Power is one of the essential elements for industrial growth. It is also one of the primary indicators of living standards in any nation. Developed nations have much higher per capita electric power consumption as compared to developing countries.

Indian power sector has faced challenges like deficit in power generation capacity and less efficient operation in transmission and distribution. It resulted in lesser availability of power with sub-standard quality.

Government has passed 'The Electricity Act 2003', aiming at restructuring Indian power sector with focus on improving quality and availability of electric power. It has provisions of unbundling state electricity boards and privatization of power distribution in urban areas.

It has led to entry of private players in power distribution in many urbanized centers. Many state electricity boards have also been restructured with separate power distribution companies being formed.

It has created demand of specifically trained manpower in the field of power distribution. This course is designed to cater the need of such specifically trained manpower for power distribution sector in urban areas. The course is highly relevant for all those who want to pursue a professional career in Power Distribution Sector.

**Aim:**

The program aim is to train individuals not only in theoretical aspects in power distribution sector, but to impart skills required to perform their job efficiently. Focus is to prepare manpower, having strong technical skills as well as reasonable exposure to inter-personnel, accounting, finance, regulatory mechanism and entrepreneurship skills.

**Objective:**

Objective of the course is to generate manpower for power distribution having following capabilities

1. Technical knowledge required for operation and maintenance of power distribution systems
2. Inter-personnel skills required to team work as well as to supervise & lead team of skilled workers.
3. Basic accounting and finance related knowledge, leading to prudent and informed decisions being taken
4. Understanding of regulatory framework in the field of power distribution sector
5. Hands of experience in operation, maintenance and projects handling in the field of power distribution.

### Program Structure

It is a three year full time program. Course is on semester system pattern. Intervening periods between the semesters will be used for imparting practical hands on training in industry / in-house. It will be a multiple entry/exit program with option to exit at the end of first year or second year. Students exiting at the end of first year, and completing minimum required credits will be awarded diploma in discipline. Students exiting at the end of second year and acquiring minimum credits will be awarded advance diploma in discipline. Students completing three years course with minimum required credit will be awarded Bachelors degree in Power Distribution Management. Students having diploma awarded will be admitted in second year of the course.

### Program Outcome:

- a) Trainees completing first year of the course and exiting with Diploma will be equipped with skills required to perform the required job independently in the field of power distribution sector.
- b) Trainees completing second year of the course and exiting with Advanced Diploma will be equipped with skills required to perform his/her own job independently as well as supervise job of the fellow technicians.
- c) Trainees completing third year of the course and exiting with Bachelor in Vocational degree will be equipped with skills required for managing his/her own job as well as to perform managerial functions for concerned team.



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**BACHELOR OF VOCATION  
POWER DISTRIBUTION MANAGEMENT  
BRIDGE COURSE for students (10+2)  
(FIRST SEMESTER EXAMINATION)**

Paper Code	Paper ID	Paper	L/T/P	Credits
ETVPD-401		Qualification Pack-Distribution Lineman (Occupational Standards for Power Sector - prescribed by NSDC & Power Sector Skill Council)	12	12
<b>TOTAL</b>			<b>12</b>	<b>12</b>

No. of hours: 12 x 15 = 180

**\*Qualification pack – distribution lineman** are occupational standards for power sector as prescribed by National Skill Development Corporation (NSDC). It is required to undergo training and being accessed for the same to acquire level 4 Skill components, which is a pre-requisite to enter level 5. Important topics to be covered in Qualification Pack

1. Repair and maintenance of Sub-station, Power Distribution Lines and components
2. Operation and maintenance of 11/0.433 KV Distribution Substation
3. Basic health and safety practices for power related work
4. Work effectively with others

**BACHELOR OF VOCATION  
POWER DISTRIBUTION MANAGEMENT  
BRIDGE COURSE for students (10+2)  
(SECOND SEMESTER EXAMINATION)**

Paper Code	Paper ID	Paper	L/T/P	Credits
ETVPD-401		Qualification Pack-Distribution Lineman (Occupational Standards for Power Sector - prescribed by NSDC & Power Sector Skill Council)	12	12
<b>TOTAL</b>			<b>12</b>	<b>12</b>

No. of hours: 12 x 15 = 180

**\*Qualification pack – distribution lineman** are occupational standards for power sector as prescribed by National Skill Development Corporation (NSDC). It is required to undergo training and being accessed for the same to acquire level 4 Skill component, which is a pre-requisite to enter level 5. Important topics to be covered in Qualification Pack

5. Repair and maintenance of Sub-station, Power Distribution Lines and components
6. Operation and maintenance of 11/0.433 KV Distribution Substation
7. Basic health and safety practices for power related work
8. Work effectively with others

As per Power some careful Sector Skill Council, non – ITI students will undergo 360 hours training and then accessed for As per the Level 4 Skill Component. Training will continue in 2<sup>nd</sup> semester and Assessment/exam will be done by sector skill council at the end of 2nd Semester

**Note:** The students are advised to mandatorily complete the bridge course alongwith LEVEL-V regular course. The credits earned are of qualifying nature and should be completed within four semesters (2 years) for obtaining Diploma/Advanced Diploma/ B.Voc Degree, as a pre-requisite. A certificate to this affect shall be issued by the Principal/Director of affiliated Institutes to be submitted to COE. NSQF LEVEL-IV certification may be done through the respective agencies involved.



**BACHELOR OF VOCATION  
POWER DISTRIBUTION MANAGEMENT  
BRIDGE COURSE for students (10<sup>th</sup>+2 years ITI)  
(FIRST SEMESTER EXAMINATION)**

Paper Code	Paper ID	Paper	L/T/P	Remark
ETVPD-401		Qualification Pack-Distribution Lineman (Occupational Standards for Power Sector - prescribed by NSDC & Power Sector Skill Council)	12	Assessment will be done by sector skill council at the end of 1 <sup>st</sup> Semester
As per Power Sector Skill Council 10 + ITI students will undergo 180 hours training and then accessed for level 4 Skill Component				

No. of hours: 12 x 15 =180

**\*Qualification pack – distribution lineman** are occupational standards for power sector as prescribed by National Skill Development Corporation (NSDC). It is required to undergo training and being accessed for the same to acquire level 4 Skill component, which is a pre-requisite to enter level 5. Important topics to be covered in Qualification Pack

1. Repair and maintenance of Sub-station, Power Distribution Lines and components
2. Operation and maintenance of 11/0.433 KV Distribution Substation
3. Basic health and safety practices for power related work
4. Work effectively with others

As per Power Sector Skill Council, 10 + ITI will undergo 180 hours training and then accessed for As per the Level 4 Skill Component. Assessment/exam will be done by sector skill council at the end of 1<sup>st</sup> Semester

**Note:** The students are advised to mandatorily complete the bridge course alongwith LEVEL-V regular course. The credits earned are of qualifying nature and should be completed within four semesters (2 years) for obtaining Diploma/Advanced Diploma/ B.Voc Degree, as a pre-requisite. A certificate to this effect shall be issued by the Principal/Director of affiliated Institutes to be submitted to COE. NSQF LEVEL-IV certification may be done through the respective agencies involved.

\*Qualification Pack for Distribution Lineman is enclosed.

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**And**

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**BACHELOR OF VOCATION**  
**in**  
**POWER DISTRIBUTION MANAGEMENT**

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**BACHELOR OF VOCATION  
(POWER DISTRIBUTION MANAGEMENT)  
FIRST SEMESTER EXAMINATION  
(LEVEL-V)**

Paper Code	Paper ID	Paper	L	T/P	Credits
<b>THEORY PAPERS</b>					
ETVPD-501		Electrical Circuit Theory	3	0	3
ETVPD-503		Electrical Measurement & Measuring Instruments	3	0	3
ETVPD-505		Installations, Commissioning and Maintenance of Electrical Equipments	2	0	2
ETVHS-519		Communication Skills (Common to all Disciplines)	2	1	3
<b>OPEN ELECTIVE-I (Select any one)</b>					
ETVAS-507		Applied Mathematics	3	0	3
ETVCS-509		Data Analysis and Discrete Mathematics	3	0	3
ETVAS-511		Aptitude & Logical Reasoning	3	0	3
ETVME-501		Applied Mechanics	3	0	3
<b>GENERAL ELECTIVE-I (Select any one)</b>					
ETVHS-513		Human Values and Professional Ethics	2	1	2
ETVHS-515		Life Skills	2	0	2
ETVHS-517		Personality Development & Behavioral Science	2	0	2
<b>PRACTICAL/VIVA VOCE (Select any one based on Lab from OPEN ELECTIVE-I)</b>					
ETVAS-557		Applied Mathematics Lab	0	3	3
ETVCS-559		Data Analysis and Discrete Mathematics Lab	0	3	3
ETVAS-555		Aptitude & Logical Reasoning Lab	0	3	3
ETVME-551		Applied Mechanics Lab	0	3	3
<b>PRACTICAL/VIVA VOCE</b>					
ETVPD-551		Electrical Circuit Theory Lab	0	3	3
ETVPD-553		Electrical Measurements & Measuring Instruments Lab	0	3	3
ETVPD-555		Installations, Commissioning and Maintenance of Electrical Equipments Lab	0	3	3
ETVPD-557		Vocation Workshop – I (Discipline specific)	0	3	3
ETVCS-559		Basic Programming Lab (Common to all disciplines except MC,SD, CT)	0	2	2
<b>TOTAL</b>			<b>15</b>	<b>19</b>	<b>33</b>

**\*Industrial Training-I:**

The students are advised to undergo two weeks training either In-House or at industry/ Skill Knowledge Provider (SKP)/ Sector Skill Council (SSC) during winter vacation and should submit their training report for evaluation during the second semester.

**\*\*General Elective –II (Select any One): NCC, NSS, YOGA, Sports, Community Services, ECO Club**

**Note:** The student can opt to take General Elective-II during the first to fifth semesters and can earn credits and /or certificate as per the requirements of the course opted for during the fifth semester. *The camps or classes for the said programme can be held either during weekend/holidays or winter/summer vacations. If in case, the classes are held during Saturday /Sunday then faculty should be given off in lieu of Saturday/Sunday.* Those students who complete General Electives-II shall be given certificate if they opt out of the programme taking Diploma/Advanced Diploma and credits will be posted in 5th Semester for B.Voc Degree students.

**Note:**

**It is very important to decide the General Elective(s), Core Elective(s) and Open Elective(s) to be offered in the next semester well before the completion of current semester. General/Core and/or Open Elective Paper(s) will be floated, if about 50% (Not less than 1/3<sup>rd</sup>) of the total students opt for the same in each case.**

Scheme and Syllabi for B. Voc. (Power Distribution Management), w. e. f. batch 2015-16, approved in the 24th BOS of USET & AC Sub Committee Meeting of USET held on 31<sup>st</sup> July, 2015.



**BACHELOR OF VOCATION  
POWER DISTRIBUTION MANAGEMENT  
SECOND SEMESTER EXAMINATION  
(LEVEL-V)**

Paper Code	Paper ID	Paper	L	T/P	Credits
<b>THEORY PAPERS</b>					
ETVPD-502		Power Distribution Systems	3	0	3
ETVPD-504		Industrial Electronics	3	0	3
ETVPD-506		Power Distribution System Automation	2	0	2
ETVEN-502		Environmental Science (Common to all disciplines)	3	0	3
<b>OPEN ELECTIVE-II (Select any one)</b>					
ETVPD-508		Electrical Engineering Materials	3	0	3
ETVEC-506		Basic Electronics	3	0	3
ETVPH-502		Applied Physics	3	0	3
<b>PRACTICAL/VIVA VOCE</b>					
ETVPD-552		Power Distribution Systems Lab	0	3	3
ETVPD-554		Industrial Electronics Lab	0	3	3
ETVEN-552		Environmental Science Lab / Field work (Common to all disciplines)	0	2	2
ETVPD-556		CADD (Electrical) Lab	0	2	2
ETVPD-558		Project-I	0	3	3
ETVPD-560		Industrial Training-I*	0	0	2
ETVPD-562		Vocation Workshop-II	0	3	3
<b>TOTAL</b>			<b>14</b>	<b>18</b>	<b>32</b>

**Note for Project:**

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports.

**Industrial Training-II:**

The students are advised to undergo 6-8 weeks training in **Industry/ Skill Knowledge Provider (SKP)/ Sector Skill Council (SSC)** during summer vacation and should submit training report for evaluation during the Third semester and credits will be posted during third semester.

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**ELECTRICAL CIRCUIT THEORY**

**Paper Code: ETVPD-501**  
**Paper: Electrical Circuit Theory**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5marks.

**Objectives & Pre-requisites:** Understanding of basic concepts of electrical elements, electrical networks, phasor diagram, alternating current quantities and mathematics of metric level.

**Learning Objective:** Power distribution systems involve flow of current in various conditions (including under fault conditions). All electrical engineering personnel, either at supervisory or at managerial level, must be at good understanding of analytical skill in current and power flow. As power distribution systems involves, single as well as three phase power circuits, analysis of these from circuit theory point of view is a necessity. In complex situation, network analysis is done through software, which employs graph theory in many cases. So basic understanding of graph theory is also required.

**UNIT-I**

**Basic Concepts:** Current, e.m.f, potential difference, resistance inductance, capacitance, resistivity, electric flux, flux density, field intensity, electric potential, work power & energy –Ohm's law, Kirchhoff's law, relationship between voltage, charge & capacitance

Sinusoidal Source, Phasor representation of sinusoidal functions, Steady state response of circuits to sinusoidal functions, resonance in AC Circuits, Star-Delta connections, Nodal Analysis, Mesh Analysis, Sudden application of Sinusoidal functions

**Network Theorems:** Circuit Theorems: Mesh equation, Nodal equation, star / delta transformation, Superposition theorem, Maximum power transfer, Thevenin's theorem, Norton's theorem.

**[T1, T2][No. of Hrs. 10]****UNIT-II**

**Single Phase Circuits-**Definition of instantaneous value, peak value, effective value, average value, form factor, peak factor, Reactance, impedance, conductance, susceptance, admittance, Phase angle

Power factor- calculate the instantaneous value of current & voltage, frequency of the sinusoidal alternating quantity from instantaneous value of current & voltage, frequency of the sinusoidal alternating quantity from instantaneous value, current in both branches of a two branches of a two branch parallel circuit, total current, power and power factor of a parallel circuit. Rectangular and polar co-ordinates, sinusoidal voltage and current, Pure resistive, inductive and capacitive networks. RL, RC and RLC series and parallel circuits. Numerical on the above topics in respect of A.C Circuit.

**[T1, T2][No. of Hrs. 10]****UNIT-III**

**Polyphase Circuits-** advantages of 3 phase system over single phase system, Three phase systems, different types of three phase connections, three phase supply, analysis of three phase circuits, three phase unbalanced load circuits, power in three phase circuits,

Draw phasor diagram for balanced and Un-balanced star and delta connected load and determine the relationship between phase and line quantities; Calculate line current, phase current, phase voltage and power for star and delta connected loads; Two wattmeter method of power measurement.

**[T1, T2][No. of Hrs. 10]****UNIT-IV**

**Graph Theory:** introduction, concept of graphs of the networks, trees and their properties, incidence matrix, fundamental tie-set matrix, fundamental cut-set matrix, equilibrium equations on loop and node bases and their solutions.

**TWO-PORT Network:** introduction, Different parameters and relationship between different parameters, inter-connections of two port networks, open circuit and short- circuit impedances and ABCD constants, image impedance, image parameters.

**[T1, T2][No. of Hrs. 10]****Text Books:**

[T1] Van Vakenburg, "Network Analysis", Prentice Hall of India

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[T2] D R Choudhary, “Network and Systems”, New Age International



**ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS****Paper Code: ETVPD-503****Paper: Electrical Measurement & Measuring Instruments**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5marks.

**Objectives & Pre-requisites:** Basic understanding of electrical engineering concepts likes voltage, current, power, power factor, elementary electrical circuits and basic electronics.

**Learning Objectives:** Measurement of power flow is a very important activity at various stages of power distribution. It is required not only for technical reasons such as load flow analysis and fault finding, but for commercial aspects also. Effective energy metering is very much required to keep losses at various stages of power distribution under control. Concepts of power and energy metering, procedures associated and instruments used are introduced to students in this course.

**UNIT-I****06 Periods**

**Electrical Measurements:** True value, accuracy, precision errors, correction, sensitivity, resolution, instrument efficiency; Standards of Measurement & Errors; Indicating and Integrating instruments; Voltmeter, Ammeter, Wattmeter, Multi-meter and Energy meter; Extension of instrument ranges.

**[T1, T2][No. of Hrs. ]****UNIT-II****14 Periods**

**Measurement of Resistance, Inductance and Capacitance:** Measurement of low, medium and high resistances; Insulation resistance measurement; AC bridges for inductance and capacitance measurement.

**Instrument Transformers:** Current and Potential transfers, applications, ratio and phase angle errors, design considerations and testing.

**UNIT-III****10 Periods**

**Electronic Measurements:** Concept of digital measurement, block diagram Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer; Electronic Multi-meter; Concept of digital measurement, Electronic Voltmeter; Block diagram Study of digital voltmeter; Multi-meter, Electronic Wattmeter & Electronic Energy Meter; Time, Frequency and phase angle measurements using CRO; Power Analyzer and Harmonics Analyzer; Spectrum & Wave analyzer; Digital Counter, Frequency Meter, Voltmeter, Multi-meter; Application of Cathode Ray Oscilloscope, Dual Trace & Dual Beam Oscilloscopes Storage Oscilloscope in measurement, Lissajous Pattern.

**UNIT-IV****10 Periods**

**Instrumentation:** Transducers, classification & selection of transducers; Strain gauges, inductive & capacitive transducers; Piezoelectric and Hall-effect Transducers; Thermistors and Thermocouples; Photo-diodes & Photo-transistors; Encoder type digital transducers; Signal conditioning and telemetry; Basic concepts of smart sensors and application; Data Acquisition Systems.

**Text Books:**

- [T1] A.K.Sawhney; "A Course in Electrical and Electronic Measurements and Instrumentation" Dhanpat Rai & Co.

**Reference Books:**

- [R1] W.D. Cooper, "Modern Electronics Instrumentation & Measurement Technique"; PHI



**INSTALLATIONS, COMMISSIONING AND MAINTENANCE OF ELECTRICAL EQUIPMENTS****Paper Code: ETVPD-505****Paper: Installations, Commissioning and Maintenance of Electrical Equipments**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5marks.

**Objectives & Pre-Requisites:** Students should be familiar with basic concepts of electrical engineering. Understanding of tools and equipments in mechanical workshop will be helpful as installation as well as maintenance requires these.

**Learning Outcomes:** Electrical installations are well regulated by Indian Electricity Rules, so good understanding of these is very much required for power distribution personnel. Distribution lines, transformers, sub-stations, domestic installations, industrial installations, fire fighting equipments and batteries are core constituent of any power distribution systems. A good understanding of installation, commissioning and maintenance of all these are must for any technical personnel in the field of power distribution. This subject is aimed at imparting knowledge in this domain to students.

**UNIT – I**

05 Periods

Knowledge of Indian electricity rules, safety code and requirements, causes and prevention of accidents, procedure on occurrence of accidents, first aid, artificial respiration, investigation and management of accident, workmen's safety devices and periodical inspection of safety devices.

Maintenance concepts, types of maintenance, maintenance schedules, maintenance management, history cards and job cards

**UNIT-II****II(a)**

06 Periods

Transmission and Distribution System: Caution notice, Authorized persons, danger notice, permit to work, arranging of shutdowns personally and telephonically foreign voltages and lines in the vicinity, location of local/temporary and telephonically foreign voltages and lines in the vicinity, location of local/temporary earth cancellation of permit and restoration of supply. Patrolling and Inspection of line- patrol books and line maintenance registers, frequency and schedule of patrolling points to be noted during patrolling from ground: special inspections: night inspections: emergency inspection support – head inspections, measurement of clearance of overhead lines, location of underground cables and rectifying the same. Open or loose neutral connection and non – provision of fuses on service lines and their effects on system, dim filtering lights.

**II(b)**

07 Periods

Distribution transformer: Transformer maintenance register, schedule of maintenance, point to be attended to in respect of various items of equipment's such as distribution transformer. LT switch, lightening arrestors, cross arms, gang operating switch, lightening arrestors, cross arms, gang operating switch, conductors/earth wire, guys, earthing, foundations etc. checking of insulation resistance of earth resistance, transformer, oil level and BDV test due to higher earth resistance, improvement of earth resistance, balancing of phases, dangerous situations due to higher earth resistance, improvement of earth resistance value, grounded neutral.

**II(c)**

07 Periods

Grid Substations: - Checking and maintenance of bus – bars, isolating switches, voltage and current transformers, lightening arrestors, control and relay panels, shut capacitors, HT/LT circuit breakers, LT switches, power transformers and their dehydration oil tests, earthing system and batteries.

**Unit – III****III(a)**

04 Periods

Domestic Installation: - Introduction, testing of electrical installation of a building, testing of insulation resistance to earth, testing of insulation and resistance between conductors continuity or open circuit test, short circuit testing of earthing continuity, polarity test, localization of faults, IE rules for domestic installation.



**III(b)**

06 Periods

Installation, testing and commissioning of electrical installations in a big industry including high voltage transformers and its connected equipment in the switch yard, medium voltage distribution panels, power control centres, motor control centres, lighting arrangement, storage, pre-installation checks, installation, alignment, connecting and starting, Pre-commissioning checks, drying out, Causes of fire, precautions to avoid fire, types of fire-fighting equipment and their uses. Commissioning of fire-fighting equipment

**Unit – IV**

05 periods

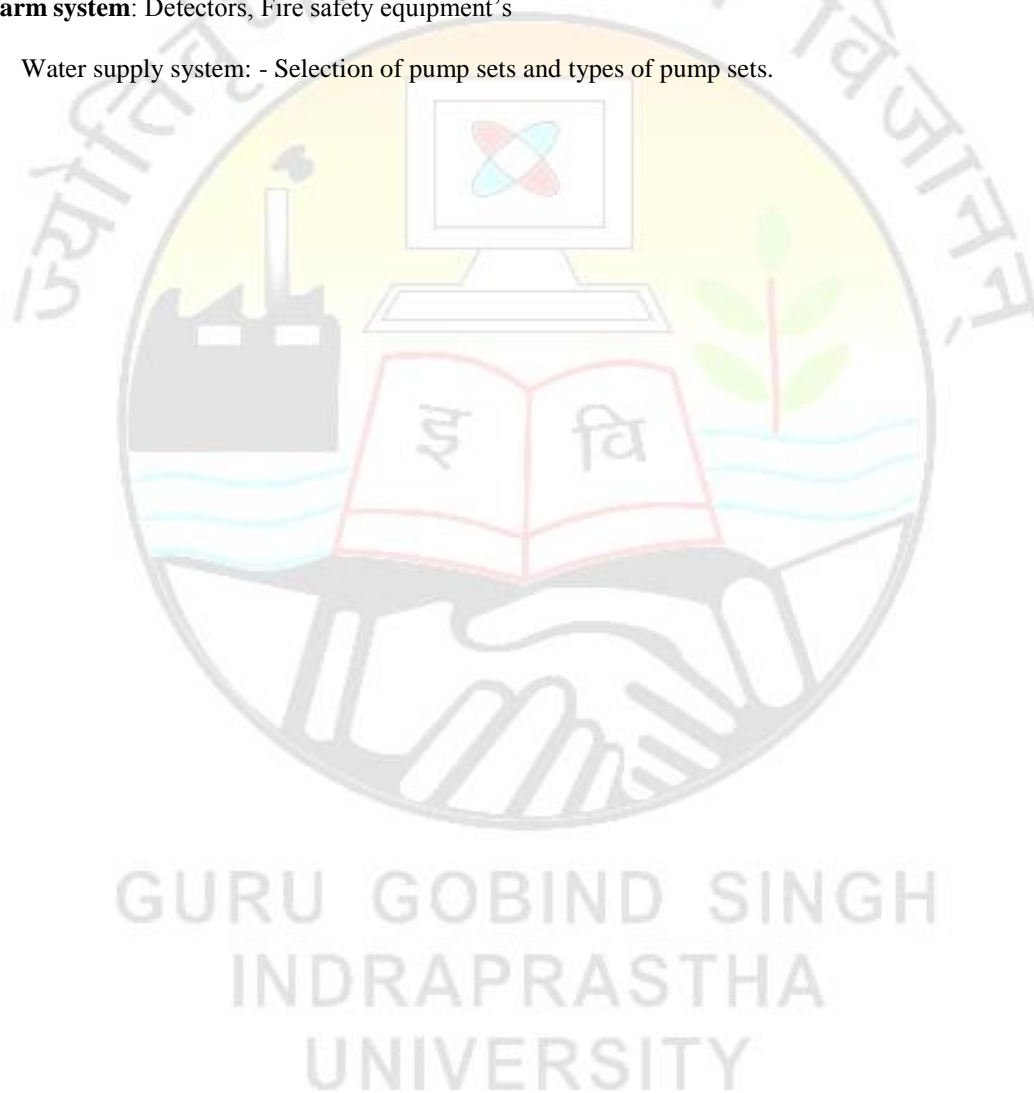
**IV(a) Batteries:**

Construction, working and application of lead acid battery, alkaline (Ni-Fe and Ni-Cd) battery, methods of charging, specification of battery, factors affecting battery life.

**IV(b) Fire-fighting system:** Wet riser system, Dry riser system, Sprinkler system: - Design of system

**Fire alarm system:** Detectors, Fire safety equipment's

**IV(c) Water supply system:** - Selection of pump sets and types of pump sets.



**COMMUNICATION SKILLS**  
**(Common to All Disciplines)**

**Paper Code: ETVHS-519**  
**Paper: Communication Skills**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objectives and Pre-requisites:** Students should have studied General English up to secondary level and the subject aims at developing communication skills in writing, speaking as well as body language.

**Learning Outcomes:** The students should be able to communicate effectively to his/her superiors as well as juniors at work place in his/her professional field.

**UNIT-I**

Recognizing and Understanding Communication Styles: What is Communication?, Passive Communication, Aggressive Communication, Passive-Aggressive Communication, Assertive Communication, Verbal and Non Verbal Communication, Barriers and Gateways to Communication.

[T1, T2][No. of Hrs. 08]

**UNIT-II**

**Listening Skills:** Types of Listening (theory /definition), Tips for Effective Listening Academic Listening- (lecturing), Listening to Talks and Presentations, Basics of Telephone communication

**Writing Skills:** Standard Business letter, Report writing, Email drafting and Etiquettes, Preparing Agenda and writing minutes for meetings, Making notes on Business conversations, Effective use of SMS, Case writing and Documentation.

[T1, T2][No. of Hrs. 12]

**UNIT-III**

**Soft Skills:** Empathy (Understanding of someone else point of view), Intrapersonal skills, Interpersonal skills, Negotiation skills, Cultural Aspects of Communication.

[T1, T2][No. of Hrs. 10]

**UNIT-IV**

**Group Communication:** The Basics of Group Dynamics, Group Interaction and Communication, How to Be Effective in Groups, Handling Miscommunication, Handling Disagreements and Conflicts, Constructive Criticism.

[T1,T2][No. of Hrs. 12]

**Text Book(s):**

[T1] Mckay, M., Davis, M. & Fanning, P.(2008). Messages: The Communication Skills Book, New Harbinger Publications

[T2] Perkins, P.S., & Brown, L. (2008). The Art and Science of Communication: Tools for effective communication in the workplace, John Wiley and Sons

**Reference Books:**

[R1] Krizan et al (2010). Effective Business Communication, Cengage Learning.

[R2] Scot, O. (2009). Contemporary Business Communication, Biztantra, New Delhi.

[R3] Chaney & Martin (2009). Intercultural Business Communication, Pearson Education

[R4] Penrose et al (2009). Business Communication for Managers, Cengage Learning.

**APPLIED MATHEMATICS**  
**(Open Elective-I)**

**Paper Code: ETVAS-507**  
**Paper: Applied Mathematics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Applied Mathematics that are required for an engineering student.*

**UNIT- I**

Successive differentiation: Leibnitz theorem for  $n^{\text{th}}$  derivative (without proof). Infinite series: Convergence and divergence of infinite series, positive terms infinite series, necessary condition, comparison test (Limit test), D'Alembert ratio test, Integral Test, Cauchy's root test, Raabe's test and Logarithmic test (without proof). Alternating series, Leibnitz test, conditional and absolutely convergence. Taylor's and Maclaurin's expansion (without proof) of function ( $e^x$ ,  $\log(1+x)$ ,  $\cos x$ ,  $\sin x$ ) with remainder terms, Taylor's and Maclaurin's series, Error and approximation.

[T1], [T2][No. of hrs. 12]

**UNIT- II**

Asymptotes to Cartesian curves. Radius of curvature and curve tracing for Cartesian, parametric and polar

curves. Integration: integration using reduction formula for  $\int_0^{\pi/2} \sin^n \theta d\theta$ ,  $\int_0^{\pi/2} \cos^n \theta d\theta$ ,  $\int_0^{\pi/2} \sin^n \theta \cos^m \theta d\theta$ . Application of integration : Area under the curve, length of the curve, volumes and surface area of solids of revolution about axis only. Gamma and Beta functions.

[T1], [T2][No. of hrs. 12]

**UNIT- III**

Matrices: Orthogonal matrix, Hermitian matrix, Skew-Hermitian matrix and Unitary matrix. Inverse of matrix by Gauss-Jordan Method (without proof). Rank of matrix by echelon and Normal (canonical) form. Linear dependence and linear independence of vectors. Consistency and inconsistency of linear system of homogeneous and non homogeneous equations. Eigen values and Eigen vectors. Properties of Eigen values (without proof). Cayley-Hamilton theorem (without proof). Diagonalization of matrix. Quadratic form, reduction of quadratic form to canonical form.

[T1], [T2][No. of hrs. 12]

**UNIT-IV**

Ordinary differential equations: First order linear differential equations, Leibnitz and Bernoulli's equation. Exact differential equations, Equations reducible to exact differential equations. Linear differential equation of higher order with constant coefficients, Homogeneous and non homogeneous differential equations reducible to linear differential equations with constant coefficients. Method of variation of parameters. Bessel's and Legendre's equations (without series solutions), Bessel's and Legendre's functions and their properties.

[T1], [T2][No. of hrs. 12]

**Text:**

- [T1] B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications.  
[T2] R. K. Jain and S.R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publications.

**References:**

- [R1] E. Kresyzig, "Advance Engineering Mathematics", Wiley publications  
[R2] G. Hadley, "Linear Algebra", Narosa Publication  
[R3] N.M. Kapoor, "A Text Book of Differential Equations", Pitambar Publication.  
[R4] Wylie R, "Advance Engineering Mathematics", Tata McGraw-Hill  
[R5] Schaum's Outline on Linear Algebra, Tata McGraw-Hill  
[R6] Polking and Arnold, "Ordinary Differential Equation using MATLAB", Pearson.

**DATA ANALYSIS AND DISCRETE MATHEMATICS**  
**(Open Elective-I)**

**Paper Code: ETVCS-509**

**Paper: Data Analysis and Discrete Mathematics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objectives:** To understand the basics concepts of Discrete Mathematical Structures. To get the Knowledge about sets, relations and functions, basics of lattices and graphs. To get familiar with propositional logic.

**UNIT-I**

**Overview of Data analysis Techniques:** Simple Linear Regression Analysis, Multiple Linear Regression Model, Multi-Collinearity, Variable selection and Model Building, Logistic Regression Models

[T3] [No. of Hrs: 11]

**UNIT-II**

**Sets:** Sets, Subsets, Equal Sets Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications.

**Relations and Functions:** Properties of Relations, Equivalence Relation, Partial Order Relation Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions, Hashing functions, Recursive function.

[T1][T2] [No. of Hrs: 11]

**UNIT-III**

**Partial Order Relations And Lattices:** Partial Order Sets, Representation of POSETS using Hasse diagram, Chains, Maximal and Minimal Point, Glb, lub, Lattices & Algebraic Systems, Principle of Duality, Basic Properties, Sublattices, Distributed & Complemented Lattices.

**Propositional Logic:** Proposition, First order logic, Basic logical operation, truth tables, tautologies, contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Universal and existential quantifiers.

[T1][T2] [No. of Hrs: 11]

**UNIT-IV**

**Graphs:** Types and operations (bipartite graph. Subgraph, distance of a graph, cut-edges & cut vertices, isomorphic and homomorphic graphs), degree of graphs, adjacent and incidence matrices, path circuit (Floyd's and Warshall algorithms), hamiltonian graph, graph colouring.

[T1][T2] [No. of Hrs: 12]

**UNIT-IV**

[T1][T2] [No. of Hrs: 11]

**Text Book(s):**

- [T1] Rosen, K.H., Discrete Mathematics and its Applications, McGraw Hill, (2006) 6 th ed.
- [T2] Kolman, Busby and Ross, "Discrete Mathematical Structure", PHI, 1996.
- [T3] Regression Analysis by Example by Samprit Chatterjee, Wiley

**Reference Book(s):**

- [R1] S.K. Sarkar, "Discrete Maths"; S. Chand & Co., 2000.
- [R2] Tremblay, J.P. and Manohar, R., Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, (2007).



**APTITUDE & LOGICAL REASONING**  
**(Open Elective-I)**

**Paper Code: ETVAS-511**  
**Paper: Aptitude & Logical Reasoning**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objectives and Pre-requisites:** At the end of the course the students will be able to (a) Interpret different data, (b) Establish relationship between numbers & (c) Solve different logical. To impart students with logical skills to solve problems easily.

**UNIT-I**

Data sufficiency, Measurement, Time and distance, Arithmetic, Relationship between numbers.

[T1][T2][No. of Hrs. 10]

**UNIT-II**

Basic mathematical relations and formula, Computation, Data interpretation.

[T1][T2][No. of Hrs. 10]

**UNIT-III**

Differences, Discrimination, Decision-making, Judgment, Problem-solving, Analogies, Analysis.

[T1][T2][No. of Hrs. 10]

**UNIT-IV**

Arithmetic reasoning, Relationship concept, Arithmetic number series, Similarities, Verbal and figure classification, Space visualization, Observation.

[T1][T2][No. of Hrs. 10]

**Text Books:**

- [T1] Arun Sharma, "How to prepare for Logical Reasoning for the CAT".  
 [T2] A.K. Gupta, "Logical and Analytical Reasoning".

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**APPLIED MECHANICS**  
**(Open Elective-I)**

**Paper Code: ETVME-501**  
**Paper: Applied Mechanics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objectives and Pre-requisites:** The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required to the students for further understanding of other applied subjects. To introduce the concepts of rigid body mechanics for bodies at rest and in motion to students. To make the students appreciate the applications of basic laws of physics to a variety of problems. Inculcating and enhancing analytical skills to solve numerical problems. Upon the completion of course student should be able to understand the importance of mechanics in engineering and various concepts.

**Learning outcomes:** Students will be able to state the relevant laws and apply them to numerical problems. Students will be able to draw free-body diagrams for a given problem and get the required solution. Students will be able to visualize the applications of basic laws in solving numerical problems. Students will be able to correlate the concepts learnt in the relevant courses of higher classes.

**UNIT-I:**

**Introduction-** Concept of mechanics and applied mechanics – Explanation of mechanics and applied Mechanics, its importance and necessity, giving suitable examples on bodies at rest and in motion, explanation of branches of this subject.

**Laws of Forces-** Force and its effects. Units and measurement of force. Characteristics of force vector representation. Bow's notation. Types of forces, action and reaction, tension & thrust. Force systems: Coplanar and space force systems. Coplanar, concurrent and non-concurrent forces. Free body diagrams. Resultant and components of forces, concept of equilibrium; parallelogram law of forces. Equilibrium of two forces, superposition and transmissibility of forces, Newton's third law, triangle law of forces, different cases of concurrent coplanar, two forces systems, extension of parallelogram law and triangle law to many forces acting at one point-polygon law of forces, method of resolution into orthogonal components for finding the resultant, graphical methods, special case of three concurrent, coplanar forces, Lami's theorem.

[T1, T2, T3][No. of Hrs: 11]

**UNIT-II:**

**Moments-** Concept of moment, Varignon's theorem – statement only. Principle of moments – application of moments to simple mechanism. Parallel forces, like and unlike parallel forces, calculation of their resultant, concept of couple, moving a force parallel to its line of action, general cases of coplanar force system, general conditions of equilibrium of bodies under coplanar parallel forces.

**Friction-** Concept of friction, laws of friction, limiting friction and coefficient of friction, sliding friction and rolling friction, inclined plane.

[T1, T2, T3][No. of Hrs: 11]

**UNIT-III:**

**Centre of Gravity and Centroid-** Concept of gravity, gravitational force, Centroid and centre of gravity. Centroid for regular lamina and center of gravity for regular solids. Position of centre of gravity of compound bodies and centroid of composite area. CG of bodies and areas with portions removed.

**Moment of Inertia of Plane Areas-** Concept of Moment of Inertia and second moment of area and Radius of gyration, theorems of parallel and perpendicular axes, second moment of area of common geometrical sections: rectangle, triangle, circle (without derivations). Second moment of area for L, T and I sections. Section modulus without derivation.

[T1, T2, T3][No. of Hrs: 12]

**UNIT-IV**

**Laws of Motion-** Concept of momentum, Newton's laws of motion, their application, derivation of force equation from second law of motion, numerical problems on second law of motion, piles, lifts, bodies tied with

string, Newton's third law of motion numerical problems, conservation of momentum, impulse and impulsive force (definition only).

**Simple Lifting Machines-** Concept of machine, mechanical advantage, velocity ratio and efficiency of a machine, their relationship, law of machine, simple machines (lever, wheel and axle, pulleys, jacks winch crabs only).

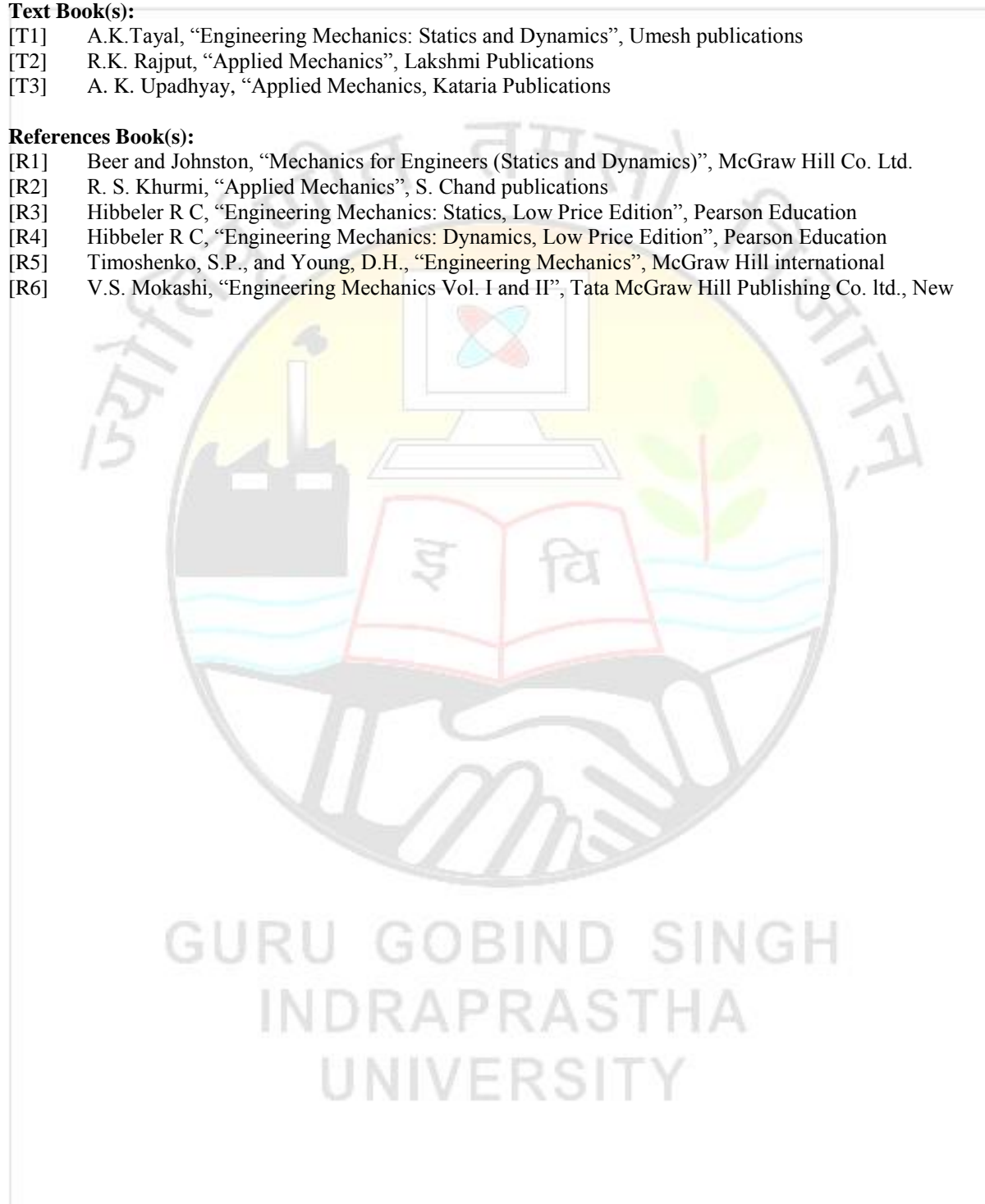
[T1, T2, T3][No. of Hours: 10]

**Text Book(s):**

- [T1] A.K.Tayal, "Engineering Mechanics: Statics and Dynamics", Umesh publications
- [T2] R.K. Rajput, "Applied Mechanics", Lakshmi Publications
- [T3] A. K. Upadhyay, "Applied Mechanics, Kataria Publications

**References Book(s):**

- [R1] Beer and Johnston, "Mechanics for Engineers (Statics and Dynamics)", McGraw Hill Co. Ltd.
- [R2] R. S. Khurmi, "Applied Mechanics", S. Chand publications
- [R3] Hibbeler R C, "Engineering Mechanics: Statics, Low Price Edition", Pearson Education
- [R4] Hibbeler R C, "Engineering Mechanics: Dynamics, Low Price Edition", Pearson Education
- [R5] Timoshenko, S.P., and Young, D.H., "Engineering Mechanics", McGraw Hill international
- [R6] V.S. Mokashi, "Engineering Mechanics Vol. I and II", Tata McGraw Hill Publishing Co. Ltd., New



**HUMAN VALUES & PROFESSIONAL ETHICS**  
**(General Elective-I)**

**Paper Code: ETVHS-513**

**Paper : Human Values & Professional Ethics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>2</b>

Non-University Examination Scheme (NUES)

Note: There will be no End-Term External University Examination. Marks are to be given on the basis of two internal sessional test of 30 marks each and one final Viva-voce project report Examination of 40 marks.

**Objectives:**

*This introductory course input is intended*

- a. *To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.*
- b. *To facilitate the development of a holistic perspective among students towards life, profession and happiness, based on the correct understanding of the Human reality and the rest of the Existence. Such a Holistic perspective forms the basis of value-based living in a natural way.*
- c. *To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with Nature.*

**UNIT-1: Introduction to Value Education**

1. Understanding the need, basic guidelines, content and process for value education.
2. Basic Human Aspirations: Prosperity and happiness
3. Methods to fulfil the human aspirations – understanding and living in harmony at various levels.
4. Practice Session – 1.

[T1], [R1], [R4][No. of Hrs. 07]

**UNIT-2: Harmony in the Human Being**

1. Co-existence of the sentient "I" and the material body–understanding their needs–Happiness & Conveniences.
2. Understanding the Harmony of "I" with the body–Correct appraisal of physical needs and the meaning of prosperity.
3. Programme to ensure harmony of "I" and Body-Mental and Physical health and happiness.
4. Harmony in family and society: Understanding Human-human relationship in terms of mutual trust and respect.
5. Understanding society and nation as extensions of family and society respectively.
6. Practice Session – 02

[T2], [R1],[R2][No. of Hrs. 08]

**UNIT-3: Basics of Professional Ethics**

1. **Ethical Human Conduct** – based on acceptance of basic human values.
2. **Humanistic Constitution and universal human order** – skills, sincerity and fidelity.
3. **To identify the scope and characteristics of people** – friendly and eco-friendly production system, Technologies and management systems.
4. Practice Session – 03.

[T1],[R4] [No. of Hrs. 07]

**UNIT-4: Professional Ethics in practice**

1. **Profession and Professionalism** – Professional Accountability, Roles of a professional, Ethics and image of profession.
2. **Engineering Profession and Ethics** - Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world.
3. **Professional Responsibilities** – Collegiality, Loyalty, Confidentiality, Conflict of Interest, Whistle Blowing
4. Practice Session – 04

[T1], [T2], [T3], [R3][No. of Hrs. 08]

**Text Books:**

- [T1] Professional Ethics, R. Subramanian, Oxford University Press.
- [T2] Professional Ethics & Human Values: [Subhash Bhalchandra Gogate](#), Vikas publication
- [T3] Professional Ethics & Human Values: Prof. D.R. Kiran, TATA Mc Graw Hill Education.
- [T4] Professional Ethics & Human Values: S.B. Srivastha, SciTech Publications (India) Pvt. Ltd. New Delhi.

**References:**

- [R1] Success Secrets for Engineering Students: Prof. K.V. SubbaRaju, Ph.D., Published by SMARTstudent.
- [R2] Ethics in Engineering Mike W. Martin, Department of Philosophy, Chapman University and Roland Schinzinger, School of Engineering, University of California, Irvine.
- [R3] Human Values: A. N. Tripathy (2003, New Age International Publishers)
- [R4] Value Education website, <http://www.universalhumanvalues.info>[16]
- [R5] Fundamentals of Ethics, Edmond G. Seebauer & Robert L. Barry, Oxford University Press.
- [R6] Human Values and Professional Ethics: R. R. Gaur, R. Sangal and G. P. Bagaria, Eecel Books (2010, New Delhi). Also, the Teachers' Manual by the same author.

**\*PRACTICAL SESSIONS OF 14 HOME ASSIGNMENTS** will be followed by the students pursuing this paper. (Ref: Professional Ethics & Human Values: S.B. Srivastava, SciTech Publications (India) Pvt. Ltd. New Delhi. )

**CONTENT OF PRACTICE SESSION****Module 1: Course Introduction – Needs, Basic Guidelines, Content and Process of Value Education**

**PS-1:** Imagine yourself in detail. What are the goals of your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcoming in your life? Observe and analyze them.

**Expected Outcome:**

The students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course.

**PS-2:** Now a days there is lot of voice about techno-genie maladies such as energy and natural resource depletion, environmental Pollution, Global Warming, Ozone depletion, Deforestation, etc. – all these scenes are man-made problems threatening the survival of life on the earth – what is root cause of these maladies and what is the way out in your opinion?

On the other hand there is rapidly growing danger because of nuclear proliferation, arm race, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression and suicidal attempts, etc - what do you think the root cause of these threats to human happiness and peace – what could be the way out in your opinion?

**Expected Outcome:**

The students start finding out that technical education with study of human values can generate more solutions than problems. They also start feeling that lack of understanding of human values is the root cause of all the problems and the sustained solution could emerge only through understanding of human values and value based living. Any solutions brought out through fear, temptation or dogma will not be sustainable.

**PS-3:** 1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of following:

- a) What is naturally acceptable to you in relationship – feeling of respect or disrespect?
  - b) What is naturally acceptable to you - to nurture or to exploit others? Is your living the same as your natural acceptance or different?
2. Out of three basic requirements for fulfillment of your aspirations, right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time and efforts you devote for each in your daily routine.

**Expected Outcome:**

1. The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify the right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity, it will only develop assumptions.
2. The students are able to see that their practice in living is not in harmony with their natural acceptance at most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
3. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of the problems in their family and the lack of physical facilities in most of the cases; while they



have given higher priority to earning of physical facilities in their life ignoring relationship and not being aware that right understanding is the most important requirement for any human being.

## Module 2: Understanding harmony in human being – Harmony in myself!

**PS-4:** Prepare the list of your desires. Observe whether the desires are related with self “I” or body. If it appears to be related with the both, see which part of it is related to self “I” and which part is related to body.

### Expected Outcome:

The students are able to see that they can enlist their desires and the desires are not vague, also they are able to relate their desires to “I” and “body” distinctly. If, any desire appears to be related with both, they are able to see that feeling is related to “I” while the physical facility is related to the body. They are also able to see that “I” and “body” are two realities, and most of their desires are related to “I” and not with the “Body”; while their efforts are mostly connected on the fulfillment of the need of the body assuming that it will meet the needs of “I” too.

### PS-5:

1. {A}. Observe that any physical facilities you use, follows the given sequence with time; Necessary and tasteful – unnecessary & tasteful – unnecessary & tasteless.  
{B}. In contrast, observe that any feelings in you are either naturally acceptable or not acceptable at all. If, naturally acceptable, you want it continuously and if not acceptable, you do not want it at any moment.
2. List Down all your activities. Observe whether the activity is of “I” or of “body” or with the participation both “I” and “body”.
3. Observe the activities with “I”. Identify the object of your attention for different moments (over a period say 5 to 10 minute) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

### Expected Outcome:

1. The students are able to see that all physical facilities they use are required for limited time in a limited quantity. Also they are able to see that cause of feeling, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable eve for a single moment.
2. The students are able to see that activities like understanding, desires, thoughts and selection are the activities of “I” only; the activities like breathing, palpitation of different parts of the body are fully the activities of the body. With the acceptance of “I”, while activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs, etc. are such activities that require the participation of both “I” and “body”
3. The students become aware of their activities of “I” and start finding their focus of attention at different moments. Also they are able see that most of their desires are coming from outsides (through preconditioning or sensation) and are not based on their natural acceptance.

- PS-6:**
- 1.Chalk out the program to ensure that you are responsible to your body – for the nurturing, protection and right utilization of the body.
  - 2.Find out the plants and shrubs growing in and your campus. Find out their use for curing different diseases.

### Expected Outcome:

The students are able to list down activities related to a proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing the different diseases.

## Module 3: Understanding harmony in the family and society - Harmony in Human – Human relationship

**PS-7:** Form small groups in the class and in that group initiate the dialogue and ask the eight questions related to trust. The eight questions are-



S.No.	Intention (Natural Acceptance)	S.No.	Competence
1.a.	Do I want to make myself happy?	1.b.	Am I liable to make myself always Happy?
2.a.	Do I want to make the other happy?	2.b.	Am I liable to make the other always happy?
3.a.	Does the other want to make him happy?	3.b.	Is the other able to make him always happy?
4.a.	Does the other want to make me happy? What is answer?	4.b.	Is the other able to make me always happy? What is answer?

Let each student answer the question for himself and everyone else. Discuss the difference between intention and competence.

#### **Expected Outcome:**

The students are able to see that the first four questions are related to our natural acceptance i.e. intention and the next four to our competence. They are able to note that the intention is always correct, only competence is lacking. We generally evaluate ourselves on the basis of our intention and other on the basis of their competence. We seldom look at our competence and other's intention as a result we conclude that I am a good person and other is a bad person.

#### **PS-8:**

1. Observe that on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasion you are disrespecting by way of under evaluation, over evaluation or otherwise evaluation.
2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.

#### **Expected Outcome:**

The students are able to see that respect is right evaluation and only right evaluation leads to fulfilment of relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect) like gender biasness, generation gap, caste conflicts, class struggle, and domination through poor play, communal violence, and clash of isms and so on so forth.

All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.

#### **PS-9:**

1. Write a note in the form of a story, poem, skit, essay, narration, dialogue, to educate a child.  
Evaluate it in a group.
2. Develop three chapters to introduce "social science", its needs, scope and content in the primary education of children.

#### **Expected Outcome:**

The students are able to use their creativity for educating children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

### **Module 4: Understanding harmony in the nature and existence – Whole existence as Co – existence -**

**PS-10:** Prepare the list of units (things) around you. Classify them into four orders. Observe and explain the mutual fulfilment of each unit with other orders.

#### **Expected Outcome:**

The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them. They are also able to see that human beings are not fulfilling to their orders today and need to take appropriate steps to ensure right participation (in term of nurturing, protection and right utilization) in the nature.

#### **PS-11:**

1. Make a chart for the whole existence. List down different courses of studies and relate them

Scheme and Syllabi for B. Voc. (Power Distribution Management), w. e. f. batch 2015-16, approved in the 24th BOS of USET & AC Sub Committee Meeting of USET held on 31<sup>st</sup> July, 2015.

to different or levels in the existence.

2. Choose any one subject being taught today. Evaluate and suggest suitable modifications to make it appropriate and holistic.

**Expected Outcome:**

The students are confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also they are liable to make out how these courses can be made appropriate and holistic.

**Module 5: Implication of the above Holistic Understanding of Harmony at all Levels of Existence.**

**PS-12:** Choose any two current problem of different kind in the society and suggest how they can be solved on the basis of the natural acceptance of human values. Suggest the steps you will take in present conditions.

**Expected Outcome:**

The students are liable to present sustainable solutions to the problem in society and nature. They are also able to see that these solutions are practicable and draw road maps to achieve them.

**PS-13:**

1. Suggest ways in which you can use your knowledge of engineering / technology / management for universal human order from your family to world family.
2. Suggest one format of humanistic constitution at the level of nation from your side.

**Expected Outcome:**

The students are able to grasp the right utilization of their knowledge in their streams of technology / engineering / management to ensure mutually enriching and recyclable production systems.

**PS-14:** The course is going to be over now. Evaluate your state before and after the course in terms of-

- Thoughts
- Behavior
- Work and
- Realization

Do you have any plan to participate in the transition of the society after graduating from the institute?

Write a brief note on it.

**Expected Outcome:**

The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for happy and prosperous society.

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**LIFE SKILLS)**  
**(General Elective-I)**

**Paper Code: ETVHS-515**  
**Paper: Life Skills**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>2</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objectives and Pre-requisites:** Students should have studied subjects such as General languages, social studies and Moral education at school level. The objective of this subject is to prepare the students to become a good citizen and a professional useful to the society.

**Learning Outcomes:** The knowledge of this subject will give the student a value system which will help him in taking decisions in professional and social life for the benefit of society at large.

**UNIT-I**

**Introduction:** Definition and importance of Life Skills, Livelihood Skills, Survival Skills, Life Skills Approach, Life Skills based education, Life Skills Training- Implementation Models

[T1,T2][No. of Hrs. 07]

**UNIT-II**

Learning and Performance, Cognitive Development, Maturation, Adult Learning, Approaches to Learning Pillars of Education and Life Skills- Four Pillars: Learning to Know, Learning to Do, Learning to Live Together, Learning to be learning throughout Life

[T1,T2][No. of Hrs. 08]

**UNIT-III**

**Social Skills and Negotiation Skills:** Self Awareness, Empathy, Effective Communication, Interpersonal Relationships

**Thinking Skills:** Nature, Element of Thought, Types, Concept Formation, Reasoning, Creative and Critical Thinking

[T1,T2][No. of Hrs. 08]

**UNIT-IV**

**Coping Skills:** Coping with Emotions, Coping with Stress, Integrated use of thinking skills, social skills and coping skills

[T1,T2][No. of Hrs. 07]

**Text Books:**

- [T1] Rajasenan, N.V. (2010). Life Skills, Personality and Leadership, Rajiv Gandhi National Institute of Youth Development, TamilNadu
- [T2] Duffy, Grover,K., Eastwood, A. (2008). Psychology for Living-Adjustment, Growth and Behavior Today, Pearson Education

**Reference Books:**

- [R1] Debra McGregor, (2007), "Developing Thinking; Developing Learning - A Guide to Skills in Education", Open University Press, New York, USA
- [R2] Singh Madhu, (2003). "Understanding Life Skills, Background paper prepared for Education for All: The Leap to Equality"
- [R3] Nair. A. Radhakrishnan, (2010). "Life Skills Training for Positive Behaviour", Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
- [R4] Dahama O.P., Bhatnagar O.P, (2005). "Education and Communication for Development, (2nd Ed.)", Oxford& IBH Publishing Co. Pvt. Ltd. New Delhi

**PERSONALITY DEVELOPMENT & BEHAVIORAL SCIENCE (From USMS)**  
**(General Elective-I)**

**Paper Code: ETVHS-517**

**Paper: Personality Development & Behavioral Science**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>2</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objectives and Pre-requisites:** Students should have studied subjects such as General languages, social studies and Moral education at school level. The objective of this subject is to prepare the students to become a good citizen and a professional useful to the society.

**Learning Outcomes:** The knowledge of this subject will give the student a value system which will help him in taking decisions in professional and social life for the benefit of society at large.

**UNIT-I**

Definition and Basics of Personality, Understanding Traits and Types of Personality, Analyzing strength and weakness (SW), Body Language

[T1, T2][No. of Hrs. 07]

**UNIT-II**

Business Etiquettes and Public Speaking: Business Manners. Body Language Gestures, Email and Net Etiquettes, Etiquette of the Written Word, Etiquettes on the Telephone, Handling Business Meetings; Introducing Characteristic, Model Speeches, Role Play on Selected Topics with Case Analysis and Real Life Experiences.

[T1, T2][No. of Hrs. 08]

**UNIT-III**

How to Make a Presentation, the Various Presentation Tools, along with Guidelines of Effective Presentation, Boredom Factors in Presentation and How to Overcome them, Interactive Presentation & Presentation as Part of a Job Interview, Art of Effective Listening.

Resume Writing Skills, Guidelines for a Good Resume, How to Face an Interview Board, Proper Body Posture, Importance of Gestures and Steps to Succeed in Interviews. Practice Mock Interview in Classrooms with Presentations on Self; Self Introduction – Highlighting Positive and Negative Traits and Dealing with People with Face to Face.

[T1, T2][No. of Hrs. 08]

**UNIT-IV**

Coping Management, Working on Attitudes: Aggressive, Assertive and Submissive Coping with Emotions, Coping with Stress

[T1, T2][No. of Hrs. 07]

**Text Books:**

- [T1] McGraw, S. J., (2008), “Basic Managerial Skills for All, Eighth Edition”, Prentice Hall of India.  
 [T2] The Results-Driven Manager (2005). Business Etiquette for the New Workplace: The Results-Driven Manager Series (Harvard Results Driven Manager)

**Reference Books:**

- [R1] Pease, A. & Pease, B. (2006)., “The Definitive Book of Body Language”, Bantam Books.  
 [R2] Scannell, E. & Rickenbacher, C. (2010)., “The Big Book of People Skills Games: Quick, Effective Activities for Making Great Impressions, Boosting Problem-Solving Skills and Improving Customer Service”, McGraw Hill Education



**APPLIED MATHEMATICS LAB**

**Paper Code: ETVAS-557**  
**Paper: Applied Mathematics Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**Based on theory courses ETVAS-507 (10-12 experiments)**

1. Curve fitting using Method of Least squares.
2. Solution of algebraic and transcendental equation using Gauss- Seidal's iteration method.
3. Solution of algebraic and transcendental equation using Finite difference method.
4. Numerical integration using Trapezoidal Rule & Simpson's one third rule.
5. Solution of ordinary differential equations using Runge-Kutta method.
6. Calculation of probability using probability distributions.
7. Calculation of correlation coefficient.
8. Calculation of Numerical measures such as mean, variance, Skewness & Kurtosis.
9. Estimation of mean & variance using sampling & Hypothesis.
10. Calculation of Rank Correlation.
11. Analysis os samples using ANOVA.



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**DATA ANALYSIS AND DISCRETE MATHEMATICS LAB**  
**(Open Elective-I)**

**Paper Code: ETVCS-559**

**Paper: Data Analysis and Discrete Mathematics Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**List of Experiments:**

**Based on theory courses ETVAS-509 (10-12 experiments)**

**[Following lab experiments will be conducted using SPSS/ Weka/ Rapidminer]**

1. Illustration of Simple Linear Regression Analysis
2. Illustration of Multiple Linear Regression Model
3. Illustration of Multicollinearity
4. Illustration of Variable Selection and Model Building
5. Illustration of Logistic Regression Models
6. Discussion on the applicability of different graph-theoretic algorithm using three-four case studies (Theoretical)
7. Discussion on proof techniques using three-four illustrative examples

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**APTITUDE & LOGICAL REASONING LAB**  
**(Open Elective-I)**

**Paper Code: ETVAS-555**

**Paper: Aptitude & Logical Reasoning Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**Based on theory courses ETVAS-511 (10-12 experiments)**



**APPLIED MECHANICS LAB**

**Paper Code: ETVME-551**  
**Paper: Applied Mechanics Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**List of Experiments:**

1. Verification of the laws of polygon of forces.
2. To verify the forces in the different members of a jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find out centre of gravity of regular and irregular laminas.
5. To verify the principle of moments using the bell crank lever apparatus
6. To determine the coefficient of static friction between two surfaces
7. To find moment of inertia of a flywheel
8. To find the mechanical advantage, velocity ratio and efficiency in the case of inclined planes.
9. To find the mechanical advantage, velocity ratio and efficiency in the case of Screw Jack
10. To find the mechanical advantage, velocity ratio and efficiency in the case of worm and worm wheel
11. To find the mechanical advantage, velocity ratio and efficiency in the case of single winch Crab.
12. Graphical solutions for the following problems a. Resultant of Coplanar Non Concurrent force system:
  - i. One problem with resultant as a force
  - ii. One problem with resultant as a couple
 b. Equilibrium of Coplanar Non Concurrent force system: one Problem c. Friction: One Problem

**INSTRUCTIONAL STRATEGY**

This is a gateway subject to remaining course. While imparting theoretical instructions, teachers are expected to demonstrate the various apparatus and related concepts to the students by correlating theory and practical. It is further recommended that more emphasis should be laid in conducting practical work by individual students.

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**ELECTRICAL CIRCUIT THEORY LAB****Paper Code: ETVPD-551****Paper: Electrical Circuit Theory Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**List of Experiments:**

1. Familiarization with various electrical equipments
2. Verification of Kirchoff's laws.
3. To find the equivalent value of resistors connected in parallel.
4. To find the equivalent value of capacitors connected in series.
5. Verifications of Network Theorem- Thevenin Theorems.
6. Verifications of Network Theorem- Superposition Theorems.
7. Power Measurement by Two Wattmeter method to prove sum of two wattmeter reading equals total power.
8. Power measurement by 3 ammeters and 3 voltmeters.
9. Study of resonance.
10. Study of unbalanced circuits using symmetrical components.

**Learning Outcome**

After doing the course student should have good understanding of current flow and voltage in single phase circuits and associated concepts such as instantaneous voltage, current, waveforms etc. three phase circuits and associated concepts such as line current, phase current, balanced and unbalanced load should be clear to students. Basic understanding of graph theory is also expected.



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**ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS LAB****Paper Code: ETVPD-553****Paper: Electrical Measurement & Measuring Instruments Lab**

L	T/P	C
0	3	3

**List of Experiments:**

Experiment 1:

**Errors in Measurement and Basic Statistical Sampling****OBJECTIVES:**

- a) To investigate sources of error in measurements
- b) To observe the value of statistical analysis

**EQUIPMENT & COMPONENTS**

- a) 30 composition resistors of the same color-coded value
- b) Digital Multi-meter

Experiment 2

**DC Current and Voltage Measurement****OBJECTIVES**

- a) To learn how to measure DC voltages and current through the circuit
- b) To learn how to use multi-meter properly

**EQUIPMENT & COMPONENTS**

- a) Digital Multi-meter
- b) Analog Multi-meter
- c) DC Power Supply (12 V)
- d) Resistors (100Ω, 1kΩ, 10kΩ)

Experiment 3

**Resistor Characteristics and Ohms Law****OBJECTIVES**

- a) To study characteristics of resistance
- To learn how to use Ohm's Law in circuit analysis.

**EQUIPMENT & COMPONENTS**

- b) Digital Multimeter
- c) Adjustable DC Power Supply
- d) Potentiometer
- e) Resistors

Experiment 4

**Oscilloscope****OBJECTIVES**

- a) To learn how to use oscilloscope properly,
- b) To measure amplitude, frequency and phase angle by using oscilloscope

**EQUIPMENT & COMPONENTS**

- a) Dual Trace Oscilloscope
- b) Digital Multi-meter
- c) Signal Generator
- d) Resistors
- e) Capacitor

Experiment 5

**AC Voltage Measurement****OBJECTIVES**

- a) To learn how to measure AC voltages,
- b) To become familiar with the use of AC voltmeters

**EQUIPMENT & COMPONENTS**

- a) Dual Trace Oscilloscope
- b) Digital Multi-meter
- c) Analog Multi-meter
- d) Signal Generator

Experiment 6

**Measurement Using DC Bridges****OBJECTIVES**

- a) To study resistance measurement techniques using DC Bridge circuits

## EQUIPMENT &amp; COMPONENTS

- b) Digital Multi-meter
- c) 12V DC power supply
- d) Potentiometer
- e) Resistors

## Experiment 7

**Measurement Using AC Bridges**

## OBJECTIVES

- a) To study impedance measurement techniques using AC Bridge circuits

## EQUIPMENT &amp; COMPONENTS

- a) Digital Multimeter
- b) Signal Generator
- c) Potentiometers
- d) Resistors, Capacitors and Inductors

## Experiment 8

**Measurement of Semiconductor Devices with Multi-meter**

## OBJECTIVES

- a) To learn how to test semiconductor devices by using the multi-meter

## EQUIPMENT &amp; COMPONENTS

- a) 1 analog multi-meter
- b) One Digital Multi-meter
- c) 1 P/N Junction diode, 1 NPN BJT

## Experiment 9

**Thermistor Characteristics and Temperature Controlled Circuits**

## OBJECTIVES

- a) To understand the characteristics of a thermistor,
- b) To construct a temperature-controlled switch circuit by using a thermistor

## EQUIPMENT &amp; COMPONENTS

- a) Set of thermistor
- b) 1 soldering iron

## Experiment 10

**Connection and use of Electronic and digital type energy meter in 1-Phase and 3-Phase circuits**

**Learning Objectives:** Students should have developed a good understanding of

1. Concepts of measurement and possible errors
2. Measurement of values for basic electrical elements such as resistance, capacitance and inductance
3. Use of current and potential transformer for measurement purpose
4. Power and energy measurement in electrical circuits.
5. Electronic measurement instruments including use of oscilloscope
6. Various transducers used for measuring non-electrical quantities

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**INSTALLATION COMMISSIONING AND MAINTENANCE OF ELECTRICAL EQUIPMENT LAB****Paper Code: ETVPD-555****L T/P C****Paper: Installation Commissioning and Maintenance of Electrical Equipment Lab 0 3 3****List of Experiments:**

1. Study and handling of tools and accessories for installing heavy equipment's.
2. Testing of electric equipment's before commissioning.
3. Study of commissioning of electrical equipment's.
4. Testing of industrial wiring.
5. Measurement of earth resistance.
6. Testing and maintenance of Batteries.
7. Battery charging by constant current and constant voltage methods.
8. Overhauling of electrical machines/Gadgets.
9. Repair and maintenance of domestic electrical appliances e.g. electric iron, fan, geyser, heat convactor, washing machine, room cooler etc.
10. Connection of single phase and three phase motors through appropriate starter and to change their direction on rotation.
11. Study of fire fighting system at VVIP buildings / Projects.

**Learning Outcome:**

After going through this course, students are expected to have developed a good understanding of installation, commissioning and maintenance related precautions & procedures for Distribution lines, transformers, sub-stations, domestic installations, industrial installations, fire fighting equipments and batteries are core constituent of any power distribution systems. Besides that pupils are also expected to have become familiar with regulatory framework for electrical installations.

**Text Books:**

- [T1] P.P Gupta, "Installation, Commissioning & Maintenance of Electrical Equipment", Dhanpat Rai Publications, New Delhi

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**VOCATION WORKSHOP-I**  
**(Discipline Specific)**

**Paper Code: ETVPD-557**  
**Paper: Vocation Workshop-I**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**Pre-requisite:** Students should have gone through basic concepts of electrical engineering such as wires, simple electrical circuits and safety procedures to be followed in workshop.

**Learning Objectives:** Students should have firsthand experience of tools and equipments and procedures practiced in electrical wiring. A good understanding of joints, distribution circuits and domestic wiring should also be imparted. Students are also to be made familiar with fault finding in wiring systems.

**UNIT – 1**

Introduction of Electrical Accessories & wiring materials used in workshop, Introduction of tools used in electrical workshop, Unsheathing of wire baring & bending ears of solid wires, Study of safety & shock treatments, Soldering of thimbles to standard wiring, Crimping of thimbles.

**UNIT – 2**

Wire Jointing: Straight married joint, T – joint, Western union joint, Britannia joint, Twist sleeve joint, Botled type joint  
 Type of wiring & to make different lamp control circuits in following wiring system: Cleat-wiring, Batten wiring, Conduit wiring

**UNIT - 3**

To make a main distribution board with four outgoing circuits for light & fan loads including main switch & fuses, To make a switch board containing at list two switches for fan regulator & socket, To make an extension board with two 5A sockets & one 15A socket controlled by their respective switches Also to provide a fuse and an indicators

**Unit - 4**

Testing of domestic wiring circuit with the help of Meggar, Fault finding and repair of a tube light circuit & CFL, Wiring & testing of alarm and indicating circuits using relay, push button & button & Balls, (Simple single phase circuits)

**Learning Objectives:** After going through this course in electrical workshop, students should be able to make distribution boards and simple electrical wiring circuits used in electrical installations. Students should be able to make joints and trouble shoot faults in domestic electric installations.

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**BASIC PROGRAMMING LAB**  
**(Common to all Disciplines except MC, SD, CT)**

**Paper Code: ETVCS-559**  
**Paper: Basic Programming Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>	
<b>0</b>	<b>2</b>	<b>2</b>	

**Objectives:** In order to enable the student's use of computer effectively in problem solving, this course offers the model programming language along with exposure to various application of computer. The knowledge of C language will be reinforced by the practical exercises.

**Pre-requisites:** Basic understanding about using Computers, using computers.

### **UNIT-I**

Introduction of "C" language- Structure of a "C" program, some simple "C" programs, procedure to execute a "C" program. Data type, constants and variables Character sets, Identifiers and keywords, Date type constants, variables, expression, statement, symbolic constants. Operators and expressions, Arithmetic operators, Relational and logical operators, Unary Operators, Assignment operators, Conditional operators.

[T1, T2][No. of Hrs. 08]

### **UNIT-II**

Data Input and output, Library functions, unformatted input output-getchar, putchar, gets, puts, getch and getche. Formatted input output-Scanf, printf, Control statements and loop structure,

**Branching:** The if-else statement,

**Looping:** while, do-while for. Nested control structure. Switch statement. Break. Continue, exit. Comma operator.

**Jumping:** go to statement,

**Function:** Inductions to function, need of functions, function definition, function declaration and prototype, passing arguments to function. Passing arguments by value, recursion, Arrays-Introduction to Arrays. array declaration, single and multidimensional array Examples: array order reversal, removal of duplicates from an ordered array, binary search, matrix multiplication.

[T1, T2][No. of Hrs. 08]

### **UNIT-III**

**Strings:** Introduction to strings, string constants, variables, input, output of string date, standard library string function strlen (), strcat () strcpy () strcmp (),Pointers-Introduction to pointers, address operator and indirection operator, declaring and initialize pointers, pointers in parameter passing, call by reference, pointers and one dimensional array, operation on pointers and one dimensional arrays, dynamic memory location malloc, calloc, structure and unions-Introduction to structure, declaration of structure, accessing structure, members initialization Arrays of structure, user defined data type (typedef), Introduction to unions.

[T1, T2][No. of Hrs. 08]

### **UNIT-IV**

Files-Introduction to file handling-fopen, fclose, fscanf, fprintf, getc, putc Additional feature of c: Enumerations, macro, c pre-processor.

[T1, T2][No. of Hrs. 06]

### **Text Book(s):**

- [T1] Byron C. Gottfried, "Programming with C", McGraw-Hill Education
- [T2] Yashwant Kanetkar, "Let us C", Infinity Science Press, 2008
- [T3] Moolish Cooper, "Sprit of C", Jaico Publishing House
- [T4] Herbert Schildt, "Teach yourself C", Tata Mc Graw hill

### **Reference Books:**

- [R1] Stephen G. Kochan, "Programming in C", Pearson Education
- [R2] Kerning & Ritchie, "C Programming Language", Prentice Hall; 2<sup>nd</sup> Edition
- [R3] Balaguruswamy, "Ansi C", Tata Mc Graw Hill

### **List of Experiments:**

1. Programming exercises on executing and editing c programs.
2. Programming exercises on defining variables and assigning values to variables.
3. Programming exercises on arithmetical, relational operators.
4. Programming exercises on arithmetic expression and their evaluation.
5. Programming exercises on formatting input/out using printf and scanf.
6. Programming exercises using if-statement.

7. Programming exercises using if-else statement.
8. Programming exercises on switch statement.
9. Programming exercises on do-while statement.
10. Programming exercises on for statement.
11. Programs on 1 dimensional array.
12. Programs on 2 dimensional arrays.
13. Programs on strings (Copying, Concatenation, Compare, Character frequency, string Length Count etc).
15. Simple programs using pointers.
16. Simple programs using structures.
17. Simple programs using files.



**POWER DISTRIBUTION SYSTEMS**

**Paper Code: ETVPD-502**  
**Paper: Power Distribution Systems**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objectives and Pre-requisites::** understanding of electrical circuit theory and electromagnetism

**Learning Objectives:** This is the one of the core subject for power distribution system, detailing types of power supply arrangements, switchgear & protective circuitry and energy metering. Though this subject does not cover the power distribution at length and depth, but gives enough idea of transformer, power distribution arrangements, distribution lines, switchgears, protections systems, faults and metering in brief.

**UNIT – I****Transformer**

(Brief and qualitative study, simple numerical can be given)

**Single phase transformers:**04 Periods

Principle of operation, constructional details, operation on no load, Transformer losses, Methods of cooling, Testing of transformers, polarity test, OC test, SC test, efficiency, voltage regulation, effect of load and load power factor, all day efficiency, parallel operation of transformers, Auto transformers, dry type transformers

**3-phase transformers**04 Periods

3-phase transformer connections, choice of transformer connections, oscillating neutral, 3-phase bank of single-phase transformers, Parallel operation of 3- phase transformers, Tap changing transformers, no load tap changing, on load tap changing

**UNIT – II****Various Distribution Systems – Configuration**

(Only brief and qualitative study)

08 Periods

DC 2 wire system, DC 3 wire system, AC single phase 2 wire system, AC three phase 3 wire and 4 wire systems, Primary and secondary distribution, Feeder loading, voltage drop in feeder lines, Ring and radial system, voltage drop with underground cable system, power loss estimation in distribution systems, power factor improvement using capacitors, optimum power factor for distribution systems

**UNIT – III****Distribution system – Construction**

(Only brief and qualitative study, no numerical)

05 Periods

Layout of HT and LT distribution system: Constructional feature of distribution lines and their erection. LT feeder, distribution and service mains, AC distributor fed at one end and determination of size of conductor

Construction of LT and HT underground power cable laying of cables, different methods, comparison of overhead and underground distribution systems

Estimation of LT and HT overhead distribution lines

**Substations:**05 Periods

Brief idea of substations; grid sub-station 220/132KV, outdoor power substations, indoor and pole mounted substations

Layout of 33/11 KV distributions substation and various accessories and equipment's  
 Estimation of 11 KV/440 V pole mounted substation

**UNIT – IV****Switchgear and protection in distribution system**05 Periods

Circuit Breakers, Fuses, Relays, Relaying schemes, installation, operation & Maintenance, auxiliaries

**Faults:**03 Periods

Common type of faults in lines, Location and testing of faults in underground cables

**Power Factor:**02 periods

Causes and disadvantages of low power factor, Economics of power factor improvements, Methods of improving power factor

**Distribution Metering & Efficient Energy Management**04 periods

Various components of tariff, Brief introduction to various types of energy meters, Detection of theft/tempering, unauthorized loads, IE rules &amp; DERC norms regarding distribution system performance

**Learning Outcome:**

After going through this course, students should have understanding of transformer, power distribution arrangements, distribution lines, switchgears, protections systems, faults and metering in brief.

**Text Books:**

1. 'Electric Power Distribution' by Amarjit Singh Pabla; McGraw Hill Education (India) Private Limited, New Delhi

**Reference Book:**

1. 'Electric Power Distribution System Engineering' by Turan Gonen; Special Indian Edition, CRC Press, Taylor & Francis Group
2. 'Electrical Distribution Systems' by Dale R Patrick & Stephen W Fardo; Special Indian Edition, CRC Press, Taylor & Francis Group





**INDUSTRIAL ELECTRONICS**

**Paper Code: ETVPD-504**  
**Paper: Industrial Electronics**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Pre-Requisite:** Understanding of basic semiconductor physics

**Learning Objectives:** Power distribution involves use of inverters and converters at many stages of power distribution. So understanding functioning of inverters and converters becomes very much required for technical personnel in power distribution companies. It is not only in load flow but in utilities also, that inverters and converters are used now a days. This course is designed with details of converters and inverters functioning.

**Unit 1**

10 Periods

- PN Junction, Diode, V- I characteristics of P-N junction diode, Need of rectifier, Types of rectifier, half wave rectifier, Full wave rectifier (Bridge and Centre tapped), Working, IP /OP waveforms for voltage and current, Types of filters: shunt capacitor, series inductor, LC filter,  $\pi$  filter (circuit diagram, operation)
- PNP & NPN junction transistors, operating principle (NPN only), Common emitter, common collector configurations (NPN Only), Characteristics in CE configuration (Circuit diagram, I/P and O/P characteristics, input resistance, output resistance, current gain ( $\alpha$  and  $\beta$ )) Transistor Biasing, Need of biasing, Transistor as an amplifier (CE configuration only), Current gain, Voltage gain, Transistor as a switch, FET, working principle, Characteristics of FET, Comparison of BJT and FET, MOSFET, working principle, Application of FET and MOSFET, Basic block diagram of DC power supply, Regulator IC's, IC's 78XX, 79XX (Functional Pin diagram), IC 723 as Identify the regulator

**Unit II****Phase-Controlled Converters**

10Periods

Conversion of 1-Phase and 3-Phase power to DC, Basic circuit diagram of 2-pulse, 3-pulse and 6-pulse converters

**DC To DC Converter**

Working principle and circuit diagram of Step-down & step-up choppers, Time ratio control and current limit control Working principle and circuit diagram of Buck, boost, buck- boost converter

Basic concept of SMPS

**Unit III****Inverters**

10 Periods

Working principle and circuit diagram of Single phase and three phase inverters  
 PWM techniques, Sinusoidal PWM

**AC To AC Converters**

Working principle and circuit diagram of Single phase AC voltage controllers  
 Working principle and circuit diagram of Single and Three Phase Cyclo-Converters

**Unit – 4**

10 Periods

- Number systems; Binary and Hexadecimal number, Binary addition, subtraction, multiplication and division, 1's and 2's compliment method of subtraction, Decimal to binary and vice versa, Concept of logic gates, Boolean Algebra and K map, Definition of SSI, MSI, SLI, VLSI, Basics of DTL, TTY, MOS IIL, ECL, C-MOS, Basic concepts of Codes, Conversion and Parity
- Concepts of latches and their type, Introduction to Flip Flops, Difference between latch and Flip-Flop, Concept of Shift register and their types, Concept of Counters and their classification, Idea of volatile and non – volatile memories, Idea of RAM, ROM, PROM, EPROM and EEPROM, General idea of A/D and D/A converters and their applications, Basic block diagram of Microprocessor

Scheme and Syllabi for B. Voc. (Power Distribution Management), w. e. f. batch 2015-16, approved in the 24th BOS of USET & AC Sub Committee Meeting of USET held on 31<sup>st</sup> July, 2015.

**Text Books:**

1. 'Industrial Electronics and Control' S K Bhattacharya, S Chatterjee; Tata McGraw Hill Education Private Limited, New Delhi



**POWER DISTRIBUTION SYSTEMS AUTOMATION****Paper Code: ETVPD-506****Paper: Power Distribution Systems Automation**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

***Pre-Requisite:*** Basic knowledge of electrical power distribution systems***Learning Objectives:***

- ❖ To gain the awareness of the problems and challenges of the existing distribution system
- ❖ To understand the need for Distribution Automation (DA) and appreciate its role in overcoming existing problems of distribution system
- ❖ To gain the knowledge of various aspects of Distribution Automation (SCADA, Substation/ Feeder Automation, Remote Metering)
- ❖ To attain the knowledge of Demand Side Management and appreciate its role in improving performance of Demand Side Management.

**UNIT-I**

**Distribution System Planning And Automation:** Basic Distribution Systems, Short-Term Load Forecasting, Long-Term Energy Forecasting, Technological Forecasting, Problems of existing Distribution System, Need for Distribution Automation, Characteristics of Distribution System, Distribution Automation (Objectives, Functions, Benefits), Feeder Automation, Communication Requirements for DA, Remote Terminal Unit (RTU), Communication Technologies for DA.

**[T1, T2][No. of Hrs. 10]****UNIT-II**

**SCADA System:** Introduction, Block Diagram, Components of SCADA, Functions of SCADA, SCADA applied to Distribution Automation, Advantages of DA through SCADA, Requirements and Feasibility, DA Integration Mechanisms, Communication Protocols in SCADA Systems.

**[T1, T2][No. of Hrs. 10]****UNIT-III**

**Substation Automation:** Introduction, Definition of Substation Automation, Functions of Substation Automation System, State and Trends of Substation Automation, Intelligent Affordable Substation Monitoring and Control, Advantages of an EEM (Enterprise Energy Management) Substation Automation Solution.

**[T1, T2][No. of Hrs. 10]****UNIT-IV**

**Feeder Automation:** Losses in Distribution Systems, System Losses and Loss Reduction, Network Reconfiguration, Improvement in Voltage Profile, Capacitor Placement in Distribution System for Reactive Power Compensation, Algorithm for location of capacitor.

**[T1, T2][No. of Hrs. 10]*****Learning Outcomes:***

- ❖ To be able to select appropriate Communication Technology for DA
- ❖ To be able to reduce loss and improve voltage profile using DA
- ❖ To be able to implement DSM

**Text Books:**

[T1] James Northcote-Green, Robert Wilson, "Control and Automation of Electrical Power Distribution Systems" CRC Press, Taylor and Francis Group, 607

**References Books:**

[R1] D. Bassett, K. Clinard, J. Grainger, S. Purucker, and D. Ward, "Tutorial Course: Distribution Automation", IEEE Tutorial Publication 88EH0280-8-PWR, 1988.

**ENVIRONMENTAL SCIENCE**  
**(Common To All Disciplines)**

**Paper Code: ETVEN-502**  
**Paper: Environmental Science**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objective:** The objective of this course is to make students environment conscious. They will be exposed through the fundamental concepts of environment and ecosystem so that they can appreciate the importance of individual and collective efforts to preserve and protect our environment. This course must raise various questions in student's mind that how our environment is inter dependent on various factors and how human being must care for their natural surroundings.

**UNIT-I**

**Environmental Studies: Ecosystems, Bio-diversity and its Conservation**

**(i) The Multidisciplinary Nature of Environmental Studies**

Definition, scope and importance of Environmental Studies, Biotic and a biotic component of environment, need for environmental awareness.

**(ii) Ecosystems**

Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structures and function of the following ecosystem:

- (a) Forest ecosystem
- (b) Grassland ecosystem
- (c) Desert ecosystem
- (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

**(iii) Bio-diversity and its Conservation**

Introduction to biodiversity - definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity : Habitat loss, Poaching of wildlife, man-wildlife conflicts, rare endangered and threatened species (RET) endemic species of India, method of biodiversity conservation: *In-situ* and *ex-situ* conservation.

[T1], [R3] [No. of hrs. 12]

**UNIT-II**

**Natural Resources: problems and prospects**

Renewable and Non-renewable Natural Resources; Concept and definition of Natural Resources and need for their management

- **Forest resources:** Use and over-exploitation, deforestation, case studies, timber extraction, mining, dams and their effects on forests and tribal people.
- **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems, Water conservation, rain water harvesting, watershed management.
- **Mineral resources:** Uses are exploitation, environmental effects of extracting and using mineral resources, case studies.
- **Food resources:** World food problems, changes causes by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- **Energy resources:** Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Urban problems related to energy, case studies.
- **Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

[T1], [R3] [No. of hrs. 11]



**UNIT-III****Environmental Chemistry and Pollution Control****(i) Chemistry of Environment**

(a) *Green Technology*: Principles of Green technology, Zero Waste Technology, Green Chemistry & Its basic principles, Atom Economy, Green Methodologies, clean development mechanisms (CDM), concept of environmental impact assessment,

(b) *Eco-Friendly polymers*: Environmental degradation of polymers, Biodegradable, Photo-biodegradable polymers, Hydrolysis & Hydrobiodegradable, Biopolymers & Bioplastics: polylactic acid, polyhydroxybutyrate, polycaprolactone,. Concept of bioremediation.

**(ii) Environmental Pollution**

Definition, types, causes, effects and control measures of (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution, (g) Nuclear hazards. Pollution case studies. Solid waste and its management: causes, effects and control measures of urban and industrial waste.

**Chemical toxicology**-Terms related to toxicity, impact of chemicals (Hg, As, Cd, Cr, Pb) on environment.

[T1], [R3] [No. of hrs. 11]

**UNIT-IV****Disaster Management, Social Issues, Human Population and the Environment****(i) Disaster Management**

Disaster management: floods, earthquake, cyclone and land-slides, nuclear accidents and holocaust, *case studies*.

**(ii) Social Issues, Human Population and the Environment**

Sustainable development, Climate change, global warming, acid rain, ozone layer depletion, Environmental ethics: Issues and possible solutions, Consumerism and waste products, Wasteland reclamation. Population growth, problems of urbanization, Environment Protection Act, 1986; Air (Prevention and Control of Pollution) Act, 1981; Water (Prevention and

Control of Pollution) Act, 1974; Wildlife Protection Act, 1972; Forest Conservation Act, 1980; Environmental management, system standards-ISO 14000 series.

[T1] [No. of hrs. 11]

**Text Book(s):**

[T1] E. Barucha, Textbook of Environmental Studies for Undergraduate Courses, Universities Press (India) Pvt. Ltd., 2005.

[T2] S. Chawla, A Textbook of Environmental Studies, McGraw Hill Education Private Limited, 2012

**References Books:**

[R1] G. T. Miller, Environmental Science, Thomas Learning, 2012

[R2] W. Cunningham and M. A. Cunningham, Principles of Environment Science: Enquiry and Applications, Tata McGraw Hill Publication, N. Delhi, 2003.

[R3] R. Rajagopalan, Environmental Studies: From Crisis to Cure, 2<sup>nd</sup> Edition, Oxford University Press, 2011.

[R4] A.K. De, Environmental Chemistry, New Age Int. Publ. 2012,.

[R5] A. Kaushik and C.P. Kaushik, Perspectives in Environment Studies, 4<sup>th</sup> Edition, New Age International Publishers, 2013

[R6] Environmental Engineering by Gerard Kiely, Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2010.

**ELECTRICAL ENGINEERING MATERIALS****Paper Code: ETVPD-508****Paper: Electrical Engineering Materials**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Pre-Requisite:** Basic concepts of matter, molecules, atomic structure along with electrostatics and electromagnetism

**Learning Objective**

Technical personnel in Power Distribution Companies have to deal with conductors, insulators and semiconductors on regular basis, as electrical installations consist of these at large. Fire fighting equipments and die-electrics are also used frequently in substations. Understanding various properties of these materials becomes necessary for technical personnel in supervisory and managerial level. This course is aimed at making students understand properties of these materials.

**UNIT – I**

10 Periods

Classification of electrical engineering materials, Properties of conductors, characteristics of a good conductor material, commonly used conductor materials, Electrical and mechanical properties of conductor materials for O/H lines and U/G cable – Trade names of conductors used for O/H lines. Conductor materials used for electric machine winding, Properties and applications of important resistor materials, Super conductivity

**UNIT – II**

10 Periods

Semiconductors, Types of semi conductors commonly used, Application of semiconductor materials, Simple idea and applications of thermistors, photoconductive cells, photovoltaic cells, varistors, LCD, LDR and strain-gauges, Merits of semiconductor materials used in Electrical Industry, Working principle and applications of Hall-Effect Generators and Piezo-electric materials

**UNIT – III**

10 Periods

Magnetic materials:

Soft and hard magnetic materials, Classification of magnetic materials according to relative permeability, Magnetization curve, Hysteresis and hysteresis loop – hysteresis loss, magnetostriction, Effects of impurities on Ferromagnetic materials, Low carbon electrical steel, properties of electrolytic and carbonyl steel.

Special purpose materials:

- i. Properties and uses of materials for – (i) fuse (ii) soldering, (iii) Contacts, (iv) structures, (v) fluorescence;
- ii. Galvanization, Annealing, Vulcanizing and stranding

Electrical carbon material

Characteristics of carbon brushes & graphite brushes

Dielectric Materials:

Dielectric strength, Factors affecting dielectric strength, dielectric loss, dissipation factor, Dielectric strength and Relative permittivity, Electrical Conduction through gaseous, liquid and solid dielectrics – Applications of dielectrics, Some commercially available capacitors for specific situation.

**UNIT – IV**

10 Periods

Insulating Materials:

Introduction

General properties of insulating materials according to structure composition and application –Effects of various factors on insulation resistance,

Electrical properties:

Scheme and Syllabi for B. Voc. (Power Distribution Management), w. e. f. batch 2015-16, approved in the 24th BOS of USET & AC Sub Committee Meeting of USET held on 31<sup>st</sup> July, 2015.

Insulation resistance, volume resistance, surface resistance, Effects of various factors on insulation resistance.

Mechanical properties:

Viscosity, porosity, solubility

Thermal properties:

Stability, melting point, flash point, volatility, thermal conductivity, Heat resistance

Chemical properties:

Resistance to external chemical effects, Hygroscopic, Ageing, Temperature rating of insulation, Effect of moisture on insulation

Table of General classification of insulating materials:

Fibrous Insulating materials, Types - Impregnating, coating, filling and bonding materials, Broad classification of ceramics used in electrical engineering, Porcelain, Factors affecting ceramics, Applications of Mica products and glass in electrical engineering.

Insulating Resins:

Natural and synthetic resins, Thermoplastic resins, short description and applications of (i) Polyethylene resins, XLPE and PVC; Thermosetting resins – types, short description and applications of silicon resins and epoxy resins.

Electrical properties and applications of insulating varnishes:

Types of varnishes, Coolants (Hydrogen cooling) in Electrical machinery, Properties and applications of Hydrogen, SF<sub>6</sub> and mineral oils in Electrical machines P.I. value of insulating oils and significance

#### **Learning Outcome:**

After going through this course, students should be able to answer various properties of

7. Electrical conducting material
8. Electrical insulating material
9. Semiconductor materials
10. Die-electrics materials
11. Materials used for fire-fighting
12. Magnetic materials

#### **Text Books:**

1. 'Electrical Engineering Material' by R K Shukla, Archana Singh; Tata McGraw Hill Education Private Limited, New Delhi
2. 'Introduction to Electrical Engineering Material' by C S Indulkar & S Thiruvengadam; S Chand & Co., India
3. 'Electrical Engineering Material' A J Dekker, Prentice Hall of India

#### **Reference Books**

1. 'Electrical Properties of Materials' by L Solymar & D Walsh; South Asia Edition, Oxford University Press

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**BASIC ELECTRONICS**  
**(Open Elective-II)**

**Paper Code: ETVEC-506**  
**Paper: Basic Electronics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: Objective of the paper is to facilitate the student with the basics of electronic aspects that are required for his understanding and applications in their respective field of study. The pre-requisites are, to have a basic understanding of Applied Physics and Mathematics.*

**UNIT-I**

**Evaluation of Electronics:** Introduction & Application Of Electronics, Energy Band Theory Of Crystals, Energy Band Structures In Metals, Semiconductors And Insulators, Theory Of Semiconductors; Classification Of Semiconductors, Conductivity Of Semiconductors, Carrier Concentration In Intrinsic & Extrinsic Semiconductors, Properties Of Intrinsic And Extrinsic Semiconductors, Variation In Semiconductors Parameters With Temperature, Fermi-Dirac Function, Fermi Level In A Semiconductor Having Impurities, Band Structure Of Open-Circuited P-N Junction, Drift And Diffusion Currents, Carrier Life Time, Continuity Equation (Elementary Treatment Only).

[T1][T2][T3][No. of Hours: 12]

**UNIT – II**

**Theory of p-n Junction Diode:** Diode Current Equation, Diode Resistance, Transition Capacitance, Diffusion Capacitance, (Elementary treatment only), Effect of Temperature on p-n Junction Diode, Switching Characteristics, Piecewise Linear Model,

**Special Diodes:** Zener Diode, Varactor Diode, Tunnel Diode, Photodiode, Light Emitting Diodes, Schottky Barrier Diode,

**Applications of Diodes:** Half-Wave Diode Rectifier, Full-Wave Rectifier, Clippers and Clampers (Elementary treatment only).

[T1][T2][T3][No. of Hours: 11]

**Unit – III**

**Bipolar Junction Transistor:** Introduction of transistor, construction, transistor operations, BJT characteristics, load line, operating point, leakage currents, saturation and cut off mode of operations, Eber-moll's model.

[T1][T2][T3][No. of Hours: 11]

**Unit – IV**

**Application of BJT:** CB, CE, CC configurations, hybrid model for transistor at low frequencies, Introduction to FETs and MOSFETs.

**Fundamentals of Digital Electronics:** Digital and analog signals, number systems, Boolean algebra, logic gates with simple applications, logic gates, karnaugh maps.

[T1][T2][T3][No. of Hours: 11]

**Text Book(s):**

- [T1] S. Salivahanan, N. Suresh Kr. & A. Vallavaraj, "Electronic Devices & Circuit", Tata McGraw Hill, 2008
- [T2] Millman, Halkias and Jit, "Electronic Devices and Circuits" McGraw Hill
- [T3] Boylestad & Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10<sup>th</sup> Edition.

**Reference Book(s):**

- [R1] Sedra & Smith, "Micro Electronic Circuits" Oxford University Press, VI<sup>th</sup> Edition
- [R2] Robert T. Paynter, "Introducing Electronic Devices & Circuits", Pearson Education, VII<sup>th</sup> Edition, 2006



**APPLIED PHYSICS****Paper Code: ETVPH-502****Paper: Applied Physics**

<b>L</b>	<b>T</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objective:** The objective of the paper is to facilitate the student with the basic understanding of Applied Physics aspects that are required for his understanding of electronics and Electromagnetics.

**UNIT-I**

**Interference:** Introduction, Interference due to division of wave front: Fresnel's Biprism, Interference due to division of amplitude: wedge shaped film, Newton's rings.

**Diffraction:** Introduction, Difference between Fresnel and Fraunhofer diffraction, Single slit diffraction, Transmission diffraction grating, Absent spectra.

**[T1][T2](No. of Hrs. 11)****UNIT-II**

**Polarization:** Introduction, Uniaxial crystals, Double refraction, Nicol prism, Quarter and half wave plates, Theory of production of plane, circularly and elliptically polarized lights, Specific rotation, Laurents half shade polarimeter.

**[T1][T2](No. of Hrs. 11)****UNIT-III**

**Electromagnetic Theory:** Gradient, Divergence, Curl, Gauss' law, Ampere's Law, Continuity equation, Maxwell's equations (differential and integral forms), Significance of Maxwell's equations, Poynting Theorem, Electromagnetic wave propagation in dielectrics and conductors.

**[T1][T2][No. of Hrs. 12]****UNIT-IV**

**Band Theory of Solids:** Introduction, Kronig-Penney model: E-k diagram, Effective mass of an electron, Intrinsic semiconductors: Electron concentration in conduction band, Hole concentration in valence band, Extrinsic semiconductor: p-type and n-type semiconductors, Fermi level, Hall Effect: Hall voltage and Hall coefficient.

**[T1][T2][No. of Hrs. 11]****Text Book(s):**

[T1] Arthur Beiser, 'Concepts of Modern Physics', [McGraw-Hill], 6<sup>th</sup> Edition 2009

[T2] A. S. Vasudeva, 'Modern Engineering Physics', S. Chand, 6<sup>th</sup> Edition, 2013.

**Reference Book(s):**

[R1] A. Ghatak 'Optics', TMH, 5<sup>th</sup> Edition, 2013

[R2] G. Aruldas 'Engineering Physics' PHI 1<sup>st</sup> Edition, 2010.

[R3] Feynman "The Feynman lectures on Physics Pearson Volume 3 Millennium Edition, 2013

[R4] Uma Mukhrji 'Engineering Physics' Narosa, 3<sup>rd</sup> Edition, 2010.

[R5] H.K. Malik & A. K. Singh 'Engineering Physics' [McGraw-Hill], 1<sup>st</sup> Edition, 2009.



**POWER DISTRIBUTION SYSTEMS LAB****Paper Code: ETVPD-552****Paper: Power Distribution Systems Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**List of Experiments:**

1. Visiting a three phase distribution transformer installed in residential/commercial/industrial establishment. Identifying various components, specifications and cooling method, mounting and protection system for it.
2. Prepare a report on various counts (voltage level, conductor, overhead/underground, protection system etc.) for distribution system in practice by visiting
  - i. A residential area
  - ii. Commercial establishment
  - iii. Railway / Metro Rail network
  - iv. Industrial establishment
3. Preparing a report on various counts for LT substation supplying power in a residential locality
4. Power Factor Considerations
  - a. Making calculations for economic consideration towards low power factor at consumer end
  - b. Visiting a arrangement of power factor improvement in any commercial/institutional/industrial establishment
5. Connecting energy meter in the circuit and performing measurement
  - a. Electromechanical type energy meter
  - b. Electronic type energy meter
  - c. Digital display type energy meter
6. To Study various types of protective relays in lab / substations during visit  
 [Single Line to Ground Fault, Line To Line Fault; IDMT Over current relay (electro mechanical type; Percentage Differential Relay, Instantaneous relay, Thermal Relay & Fuse, Earth fault relay or over current relay, Over Voltage Relay and Under Voltage Relay, Under Voltage Relay (Electronics-Static Type), Over Voltage Relay (Electronics – Static Type)]

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**INDUSTRIAL ELECTRONICS LAB**

**Paper Code: ETVPD-554**  
**Paper: Industrial Electronics Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**List of Experiments:**

1. Familiarization with Diode and plotting basic characteristics of it.
2. Making of basic rectifier circuit and observing output using CRO
3. Familiarization with BJT and using NPN transistor with basic biasing circuit
4. Familiarization with MOSFET and IGBT and studying its operation, characteristics and safety precaution while using it
5. Study of Cyclo-Converters and its applications
6. Study of inverters and its applications in power distribution sector
7. Study of converters and its application in Power Distribution sector
8. Study of SMPS and its application as power supply in control circuits

**Learning Outcome:**

Students should have developed good understanding of circuit diagram, functioning and applications of inverters, converters, cyclo-converters as well as choppers.



**ENVIRONMENTAL SCIENCE LAB/ FIELD WORK**  
**(Common to All Disciplines)**

**Paper Code: ETVEN-552**

**Paper: Environmental Science Lab/ Field Work**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>2</b>

**List of Experiments**

1. Determination of pH, conductivity and turbidity in drinking water sample.
2. Determination of pH and conductivity of soil/sludge samples.
3. Determination of moisture content of soil sample.
4. Determination of Total Dissolved Solids (TDS) of water sample.
5. Determination of dissolved oxygen (DO) in the water sample.
6. Determination of Biological oxygen demand (BOD) in the water sample.
7. Determination of Chemical oxygen demand (COD) in the water sample.
8. Determination of Residual Chlorine in the water sample.
9. Determination of ammonia in the water sample.
10. Determination of carbon dioxide in the water sample.
11. Determination of nitrate ions or sulphate ions in water using spectrophotometer.
12. Determination of the molecular weight of polystyrene sample using viscometer method.
13. Base catalyzed aldol condensation by Green Methodology.
14. Acetylation of primary amines using eco-friendly method.
15. To determine the concentration of particulate matter in the ambient air using High Volume Sampler.

**P.S.:** For better understanding of various aspects of environment visits to local areas, depending upon easy access and importance may be planned to any nearby river, forest, grassland, hills and students should write a report based on their observations.

**Suggested Books:**

- [T1] [A. I. Vogel, G. H. Jeffery](#), *Vogel's Text Book of Quantitative Chemical Analysis*, Published by Longman Scientific & Technical, 5<sup>th</sup> Edition, 1989.
- [T2] [dst.gov.in/green-chem.pdf](http://dst.gov.in/green-chem.pdf) (monograph of green chemistry laboratory experiments).
- [T3] S. Chawla, *Essentials of Experimental Engineering Chemistry*, Dhanpat Rai & Co., 3<sup>rd</sup> Edition, 2008.
- [T4] S. Rattan, *Experiments in Applied Chemistry*, Published by S.K.Kataria & Sons, 2<sup>nd</sup> Edition, 2003.
- [T5] W. Cunningham and M. A. Cunningham, *Principles of Environment Science: Enquiry and Applications*, Tata McGraw Hill Publication, N. Delhi, 2003.
- [T6] A. Kaushik and C. P. Kaushik, *Perspectives in Environment Studies*, 4<sup>th</sup> Edition, New Age International Publishers, 2013.

**Note:- Any 10-12 Experiments out of the list may be chosen.**

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**CADD (ELECTRICAL) LAB**

**Paper Code: ETVPD-556**  
**Paper: CADD (Electrical) Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>2</b>

**Practical:**

**Pre-Requisite:** understanding of basic concepts of electrical engineering elements and circuits.

**Learning Objective:** Power distribution companies have to expand their distribution network, which involves creating new substations, distribution lines and other electrical installations. CADD software is extensively used for designing and drawing electrical installations now days. This course is aimed at grooming trainees with basic CADD capabilities.

**UNIT – I****10 Periods**

**CADD:** Introduction to Electrical CAD interface, Electrical Components and Wires, Design Methodologies, Project Files, Accessing Project Files, Add a Drawing to a Project File, Managing Drawings in Projects, Project Manager Drawing List

**Schematics I:** Single Wires/Components, Referencing, Ladders, Insert Wires, Edit Wires, 3- Phase Components, Source & Destination Signal Arrows, Insert Component, Parent/Child Components

**Schematics II:** Multi-wire and Circuits, Dashed Link Lines, 3-Phase Ladders

**UNIT – II****06 Periods**

**Circuits and Cables:** Cable Markers, Fan In/Out, Insert Saved Circuits, Save Circuits to Icon Menu, Circuit Clipboard, Circuit Builder, Copy Component, Align, Delete Component, Attribute Editing Commands

**UNIT – III****10 Periods**

**Panels:** Panel Drawings, Insert Footprint (Icon Menu), Insert Footprint (Schematic List), Insert Component (Panel List), Edit Footprint, Assign Item Numbers, Insert Jumpers, Terminal Strip Editor, PLC Symbols, Insert PLC (Parametric), Insert PLC (Full Units), Insert Individual PLC I/O Points

**UNIT – IV****14 periods**

**Wiring:** Point-to-Point Wiring Drawings, Insert Connectors, Edit Connectors, Schematic Symbols, Naming Convention, Icon Menu Wizard

**Database and Plotting:** AutoCAD Electrical Databases, Project Database, Catalogue Database, Footprint Lookup Database, PLC Database, Plot Project, Export to Spreadsheet, Update from Spreadsheet, Copy Project, Verify Drawings.

**Learning Outcome:** trainees should develop reasonably good understanding of drawing electrical circuit schematic using CADD software and basic concepts of electrical installations' design

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**VOCATION WORKSHOP-II**

**Paper Code: ETVPD-562**  
**Paper: Vocation Workshop-II**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>3</b>

**Practical:**

**Pre-Requisite:** Basic understanding of mechanical workshop practices and electrical engineering concepts

**Learning Objectives:**

Star-Delta starters and Contactor control circuits are used very frequently in power distribution systems. Earthing of electrical installations is also a mandatory requirement for electrical installations. Power Cable Jointing and fault finding in power distribution systems are frequently occurring incidence. This course is designed to give first hand experience to pupils in these topics.

**UNIT 1:**

Wiring, Testing & Faults – detecting of the following contractor control circuits operating on 3-phase supply, Remote control circuits, Time delay circuits, Inter locking circuits, Sequential operation control circuits

**UNIT 2:** - To carry Out – Pipe Earthing for a small house or a small 3 – phase motor, Installation of a 3-phase motor with main switch & starter; dismantling, assembling & repair of DOL starter & star delta starter

**UNIT 3**

Fault Finding- in single phase & three phase circuits, use of various types of motors & their rectification, fault finding in service line, connecting and reading electronic type energy meters.

**UNIT 4**

Power cable – jointing (Demonstration, if Kit not available), Laying of under-ground cable (Demonstration), testing of power cables (Demonstration)

**Learning Objectives:**

After going through this course students should be able to

1. Construct Star-Delta starters, their wiring and fault finding.
2. Construct various types of Contactor control circuits
3. Make Earthing of electrical installations
4. Practice Power Cable Jointing and fault finding in power distribution systems

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