# Government Polytechnic, Mumbai

## *Department of Electrical Engineering*

# P-19 Curriculum (Sandwich Pattern)

# Semester-II (Course Contents)

# GOVERNMENT POLYTECHNIC MUMBAI

(Academically Autonoums Institute, Government of Maharashtra)

**Teaching and Examination Scheme (P19)**

**With effect from AY 2019-20**

**Programme: Diploma in Electrical Engineering (Sandwich Pattern)**                              **Term / Semester - II**

| Course Code | Course Title | Teaching Hours/Contact Hours | | | | Credits | Examination Scheme (Marks) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Theory | | | | | | |
| | | L | P | TU | Total | | TH | TS1 | TS2 | PR | OR | TW | Total |
| SC 19 110 | Engineering Mathematics | 4 | 0 | 0 | 4 | 4 | 60 | 20 | 20 | 0 | 0 | 0 | 100 |
| SC 19 106 | Applied Chemistry | 3 | 2 | 0 | 5 | 5 | 60 | 20 | 20 | 25* | 0 | 25 | 150 |
| EC 19 207 | Elements of Electronics Engineering | 4 | 2 | 0 | 6 | 6 | 60 | 20 | 20 | 25* | 0 | 25 | 150 |
| EE 19 203 | Computer Aided Electrical Drawing | 0 | 4 | 0 | 4 | 4 | 0 | 0 | 0 | 50* | 0 | 50 | 100 |
| EE 19 301 | Electrical and Industrial Measurement | 4 | 4 | 0 | 8 | 8 | 60 | 20 | 20 | 50* | 0 | 25 | 175 |
| EE 19 205 | C-Programming# (Spoken Tutorial) | -- | -- | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | -- |
| | **Total** | 15 | 12 | 03 | 30 | 30 | 240 | 80 | 80 | 150 | 00 | 125 | 675 |
| | Student Centered Activity (SCA) | | | | 05 | | | | | | | | |
| | Total Contact Hours | | | | 35 | | | | | | | | |

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal assessment, # indicates Self, on- line learning Mode, @ indicates on line examination

Note:  Duration of Examination--TS1&TS2 -1 hour, TH- 2 hours, PR/OR – 3 hours per batch, SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours

Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator,                Head of Department              In-Charge                          Principal
Curriculum Development,              Dept. of Electrical Engineering    Curriculum Development Cell
Dept. of Electrical Engineering

| Programme : **Diploma in CE/ME/CO/IF/EC/EE/IS(Sandwich Pattern)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: **SC19110** | | | | Course Title: **ENGINEERING MATHEMATICS** | | | | | | |
| Compulsory / Optional: **Compulsory** | | | | | | | | | | |
| Teaching Scheme and Credits | | | | Examination Scheme | | | | | | |
| L | P | TU | Total | TH (2 Hrs 30 Min.) | TS1 (1 Hr) | TS2 (1Hr) | PR | OR | TW | Total |
| **4** | **--** | **--** | **4** | **60** | **20** | **20** | **--** | **---** | **--** | **100** |

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test ,  # indicates Self, on- line learning Mode, @ indicates on line examination.

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at midterm and second skill test at the end of the term.

**Rationale:**

This subject is kept under the branch of sciences. This subject intends to teach student basic facts ,concepts, principles, and procedure of mathematics as a tool to analyze engineering problems and as such lays down foundation for understanding the engineering and core technology subject.

**Course Outcomes:** Student should be able to

| CO1 | Define the basic principles of function, limits, derivatives, complex number and relations between two variables. |
|---|---|
| CO2 | Apply rules, concept and properties to solve the problems |
| CO3 | Solve the given problems of integration using suitable method. |

**Course Content Details:**

| Unit No | Topics / Sub-topics |
|---------|---------------------|
| 1 | **1. Function**<br> 1.1 Definition of variable,constant,intervals such as open,closed,semi-open etc<br> 1.2 Definition of function,value of function and types of functions and simple examples<br>**Course Outcome: CO1     Teaching Hours : 10 hrs    Marks: 10 (R- 4, U-4, A-2)** |
| 2 | **2. Limits**<br> 2.1 Definition of neighbourhood,concept and definiton of limit<br> 2.2 Limits of Algebraic function<br> 2.3 Limits of Trigonometric Functions with simple examples<br>**Course Outcome:   CO1   Teaching Hours : 10 hrs   Marks: 10    (R- 2 , U-4 , A-4 )** |
| 3 | **3. Derivatives & Application of derivative**<br> 3.1 Definition of the derivative.<br> 3.2 Derivatives of standard function.( No proof by first principle)<br> 3.3 Differentiation of sum, difference, product and quotient of two or more functions<br> 3.4 Differentiation of composite function with simple example.<br> 3.5 Second order derivative.<br> 3.6 Geometrical Meaning of Derivative<br> 3.7 Tangents & Normals to the curve,<br> 3.8 Maxima & minima of the function<br> 3.9 Radius of curvature<br>**Course Outcome:   CO2   Teaching Hours :10 hrs    Marks:10 (R-4 , U- 4 , A-2 )** |
| 4 | **4. Integration & Application of integration**<br> 4.1 Definition of integration as antiderivative ,Integration of standard function<br> 4.2 Rules of integration(Integration of sum, difference,scalar multiplication) without proof<br> 4.3 Integration by substitution<br> 4.4 Integration of composite function<br> 4.5 Definiton of definite integral<br> 4.6 Properties of definite integral with simple problems<br> 4.7 Area under the curve<br> 4.8 Area bounded by two curves<br>**Course Outcome: CO3    Teaching Hours :10 hrs Marks:10 (R-4, U- 4 , A-2 )** |
| 5 | **5. Complex Number:-**<br> 5.1 Definition of complex number Cartesian ,Polar ,Exponential form of complex number<br> 5.2 Algebra of complex number :-Equality , addition ,Substraction ,Multiplication & Division with simple examples<br>**Course Outcome: CO2    Teaching Hours :10hrs   Marks:10    (R- 2 , U-4 , A-4 )** |
| 6 | **6. Numerical Analysis**<br> 6.1 Solution of Algebraic equations using –<br>    i) Bisectional method    ii) Regular – Falsi method ,<br>    iii) Newton- Raphson method<br> 6.2 Solution of simultaneous equation<br>    ( i ) Gauss elimination method<br>    ( ii ) Jacobi's method    ( iii ) Gauss-Seidal method<br>**Course Outcome: CO2    Teaching Hours : 10 hrs    Marks: 10    (R- 2 , U- 4 , A- 4 )** |

**Suggested Specifications Table (Theory):**

| Unit No | Topic Title | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|
| | | R Level | U Level | A Level | Total Marks |
| 1 | **Function** | 04 | 04 | 02 | 10 |
| 2 | **Limits** | 02 | 04 | 04 | 10 |
| 3 | **Derivatives & Application of Derivatives** | 04 | 04 | 02 | 10 |
| 4 | **Integration & Application of Integration** | 04 | 04 | 02 | 10 |
| 5 | **Complex Number** | 02 | 04 | 04 | 10 |
| 6 | **Numerical Analysis** | 02 | 04 | 04 | 10 |
| | **Total** | **18** | **24** | **18** | **60** |

**References/ Books:**

| Sr. No. | Title | Author, Publisher, Edition and Year Of publication | ISBN |
|---|---|---|---|
| 1 | Mathematics for Polytechnic Students | S.P.Deshpande, Pune Vidyavardhini Graha Prakashan | - |
| 2 | Mathematics for Polytechnic Students ( Volume I ) | H.K.Dass, S.Chand Prakashan | 9788121935241 |
| 3 | Companions to Basic Maths | G.V.Kumbhojkar, Phadke Prakashan | 10-B07951HJDQ 13-B07951HJDQ |
| 4 | Applied Mathematics | N.Raghvendra Bhatt late, Tata McGraw Hill Publication Shri R Mohan Singh | 9789339219567, 9339219562 |

**E-References:**

1.  www.math-magic.com
2.  www.Scilab.org/-SCI Lab
3.  www.mathworks.com/Products/Matlab/-MATLAB
4.  www.wolfram.com/mathematica/-Mathematica
5.  https://www.khanaacademy.org/math?gclid=CNqHuabCys4CFdoJaAoddHoPig
6.  www.dplot.com/-Dplot
7.  www.allmathcad.com/-Math CAD
8.  www.easycalculation.com
9.  https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-maths
10. MYCBSEGUIDE

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | | | 1 | | | 1 | 1 | | 1 |
| CO2 | 3 | | | 1 | | | 1 | 1 | | 1 |
| CO3 | 3 | | | 1 | | | 1 | 1 | | 1 |

**CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3 | | | 1 | | | 1 | 1 | |
| CO2 | 3 | | | 1 | | | 1 | 1 | |
| CO3 | 3 | | | 1 | | | 1 | 1 | |

**CO Vs PO and CO Vs PSO Mapping (COMPUTER ENGINEERING)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | | | 1 | | | 1 | 1 | 1 | |
| CO2 | 3 | | | 1 | | | 1 | 1 | 1 | |
| CO3 | 3 | | | 1 | | | 1 | 1 | 1 | |

**CO Vs PO and CO Vs PSO Mapping (INFORMATION TECHNOLOGY)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | | | 1 | | | 1 | 1 | | 1 |
| CO2 | 3 | | | 1 | | | 1 | 1 | | 1 |
| CO3 | 3 | | | 1 | | | 1 | 1 | | 1 |

**CO Vs PO and CO Vs PSO Mapping (ELCTRONICS ENGINEERING)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | | | 1 | | | 1 | | 1 | 1 |
| CO2 | 3 | | | 1 | | | 1 | | 1 | 1 |
| CO3 | 3 | | | 1 | | | 1 | | 1 | 1 |

**CO Vs PO and CO Vs PSO Mapping (ELECTRICAL ENGINEERING)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | | | 1 | | | 1 | | 1 | |
| CO2 | 3 | | | 1 | | | 1 | | 1 | |
| CO3 | 3 | | | 1 | | | 1 | | 1 | |

**CO Vs PO and CO Vs PSO Mapping (INSTRUMENTATION ENGINEERING)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3 | | | 1 | | | 1 | 1 | 1 |
| CO2 | 3 | | | 1 | | | 1 | 1 | 1 |
| CO3 | 3 | | | 1 | | | 1 | 1 | 1 |

**Industry Consultation Committee:**

| Sr. No | Name | Designation | Institute/Organisation |
|--------|------|-------------|------------------------|
| 1 | Neelamkumar R. Sawant | State Head Technical Services for (Maharashtra and Goa) | JSW Cement ltd. Mumbai Head Office |
| 2 | Mrs. Deepawali S. kaware | Lecturer in Mathematics | Government polytechnic Vikaramgad |
| 3 | Mr. A.S.Patil | Lecturer in Mathematics | Government polytechnic Mumbai |
| 4 | Mr.V.S.Patil | Lecturer in Mathematics | Government polytechnic Mumbai |

Coordinator,                          Head of Departments

Curriculum Development,          Department of Science & Humanities

Department of Sci. & Humanities

I/C, Curriculum Development Cell       Principal

| Programme : **Diploma in   EE/IS ( Sandwich Pattern)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: **SC19106** | | | | Course Title: **Applied Chemistry** | | | | | | |
| Compulsory / Optional:  **Compulsory** | | | | | | | | | | |
| Teaching Scheme and Credits | | | | Examination Scheme | | | | | | |
| L | P | TU | Total | TH (2.30 Hrs.) | TS1 (1 Hr) | TS2 (1Hr) | PR | OR | TW | Total |
| **3** | **2** | **--** | **5** | **60** | **20** | **20** | **25**\* | **--** | **25** | **150** |

Abbreviations: L- Theory; P-Practical; TU-Tutorial; TH- Theory Paper; TS1 and TS2- Term Tests; PR- Practical Exam; OR-Oral Exam; TW: Term Work (progressive assessment), \* Indicates assessment by External Examiner else Internal assessment.

Note: For Minimum passing marks under various heads, refer, examination rule AR26.

**Rationale:**

The subject is included under category of basic sciences. The role is to understand the fundamental concepts and facts about infrastructure of physical matters and their interrelationship. This will provide input for better understanding of other foundation and technology subjects

**Course Outcomes:** Student should be able to

| CO1 | Apply the principles of chemistry under different engineering situations. |
|---|---|
| CO2 | Apply various applications of electrolysis and cells and batteries in engineering field. |
| CO3 | Adopt methods of prevention of corrosion for environmental and safety concerns. |
| CO4 | Select suitable Alloy, Lubricants, material for a particular use effectively. |

**Course Content Details:**

| Unit No | Topics / Sub-topics |
|---|---|
| **1** | **Atomic Structure**<br><br>1.1 Introduction of atom, Molecules, Fundamental Particles, Proton, Neutron, Electron. their mass, charge, location. And symbol Bohr's theory, Postulates, Structure of modern atom.<br>1.2 Atomic number and atomic mass number. Atomic weight Numerical based on atomic number & atomic mass number<br>1.3 Rules governing filling up of atomic orbitals.Quantum no.,Paulis Exclusion Principle, Aufbau's Principle ,Hund's rule.<br>  Electronic configuration of atoms up to atomic number 30<br>1.4 Valence and chemical bonding. Valence : Definition, & examples. Types of valance : Electrovalence & Co-valance<br>1.5 Electrovalent bond: Definition, Formation Formation of NaCl<br>1.6 Co-valent bond : Definition & formation<br>  Formation of following molecules<br>  Single bond :,Chlorine. Double bond : Oxygen,,<br>  Triple Bond : Nitrogen,,<br>1.7 Distinction between electrovalent and covalent compound.<br>**Course Outcome: CO1 Teaching Hours : 7 hrs Marks: 10 (R- 2, U-4, A-4)** |
| **2** | **Electrochemistry**<br>2.1 Definition of Electrochemistry, Electrolytes: Definition, Types.<br>  Differences between Atom and ion . Definition of ionization & electrolytic dissociation, Arrhenius theory, Degree of ionization with factors affecting it.<br>2.2 Terms related to Electrolysis Mechanism of electrolysis. Examples of: mechanism of Electrolysis of $CuSo_4$ by using Cu electrodes.<br>2.3 Faradays First law and its mathematical derivation.<br>  Faradays second law & its mathematical derivation, Numerical based on laws of Faraday.<br>2.4 Application of Electrolysis: Electroplating, Electrorefining.<br><br>**Course Outcome: CO2 Teaching Hours : 7 hrs Marks: 10 (R- 4 , U-4 , A-2 )** |
| **3** | **Cells And Batteries**<br>3.1 Conductor: Definition, types (metallic, electrolytic), Difference between them.<br>3.2 Ohms law, Charging and discharging of cells, Closed circuit voltage, Open circuit voltage, Electrochemical couple,Seperator,Electromotive force (E.M.F)<br>3.3 Cells: Definition, types (Electrolytic and Electrochemical), difference between them.<br>3.4 Classification of Electrichemical cell ( primary and Secondary)<br>  Definition and Difference between them.<br>3.5: Primary cells: Lachlance cell,Dry cell,Daniel cell<br>3.6 secondary cell : Lead acid storage cell or battery, Nickel cadmium cell or battery<br>3.7 Lead acid storage battery: construction,working,charging and discharging, electrical charecteristics, methods of charging storage batteries, indication of fully charged battery, Maintenance of Lead acid batteries, application of Lead acid storage batteries.<br>**Course Outcome: CO2 Teaching Hours : 7 hrs Marks: 10 (R- 4 , U-4 , A-2 )** |

| | |
|---|---|
| **4** | **Corrosion**<br><br>4.1 Definition of corrosion.Types of corrosion . Atmospheric & Electrochemical Corrosion.<br>4.2 Mechanism of atmospheric corrosion, types of oxide film formed,(stable,unstable,volatile,with examples)<br>4.3 Electrochemical corrosion/immersed corrosion Definition. Example.Factors Affecting , Atmospheric & Electrochemical Corrosion.<br>4.4 Protection of metals from Corrosion:- By protective coatings a)organic coating ( Paints and Varnishes),b)inorganic coating (Metallic Coating)<br>4.5 Different methods of Protective metallic coatings.<br>   A) Hot dipping (Galvanizing & Tinning)<br>   b) Sherardizing  c) Metal Spraying<br><br>**Course Outcome:  CO3   Teaching Hours :6 hrs  Marks: 10     (R-2,  U- 4 ,  A-4 )** |
| **5** | **Lubricants**<br><br>.1 Definition of lubricant, example , functions of lubricant, classification of lubricants (solid, semi-solid and liquid) examples. conditions under which each lubricant is used.<br><br>5.2 Lubrication: definition and types. conditions under which each lubricant is used.<br>Types of lubrications, Fluid film, Boundary, Extreme pressure lubrication. Definition, diagram & description of each type.<br>5.3 Characteristic of good lubricant<br>   A)  Physical Characteristics<br>     • Viscosity<br>     • Viscosity index<br>     • Oiliness<br>     • Volatility<br>     • Flash point & Fire Point<br>     • Cloud and  Pour point<br>B)  Chemical Characteristics<br>     • Acidity /Neutralization no.<br>     • Emulsification<br>     • Saponification value<br>**Course Outcome:  CO4   Teaching Hours :6 hrs  Marks: 10     (R- 4 , U-4 ,  A-2 )** |
| **6** | **Materials And Alloys.**<br><br>**Metallic**<br>6.1  Metals & their characteristics, (hardness, ductility, malleability, toughness, brittleness, tensile strength, weldability,casting, forging, soldering)<br>6.2  Physical and chemical properties and uses of following metals<br>   (Fe, Cu,Al,Cr,Ni,Pb,Zn,Ag,Sn).<br><br>**Non-Metallic**<br>6.3 Definition of non-metallic engineering materials<br>**6.4 Plastic:**<br>  definition , example Polymerization : definition different Types of Polymerization addition and condensation<br>  Addition polymerization : definition formation of polyethylene ,<br>  Condensation-polymerization : definition and examples, formation Of  nylon-66 |

Types of plastic: thermo softening ,thermo setting plastics,
Differences between them.
Compounding of plastic , Materials needed for it (pigments,fillers,Plasticizers
accelerators etc),  Properties and engineering applications

**6.5 Rubber**:
definition of rubber (elastomer).
Natural rubber : Basic unit in natural rubber(isoprene), Occurrence & Processing of Latex .
Drabacks of natural Rubber
Vulcanisation.: Definition. process, Chemical reactions
Synthetic  rubber: Importance,
Example Buna-S Buna-N, Butyl rubber, Thiokol, Neoprene)
Properties of rubber:
Elasticity,Tack, Rebound abrasion resistance
Uses of rubber

**6.6 Thermal insulating materials**
Definition, ExamplesThermocole, Glasswool.
Thermocole: Definition,. Preparation,Properties & uses
Glass wool. Definition,.Preperation,Properties & uses

**6.7  Alloys**
Definition of alloy: purposes of preparation of Alloy.
Preparation of binary alloy by fusion method.
Classification of alloy : Ferrous and non Ferrous  Alloy.

6.8 **Ferrous alloy :** Steel, Definition and classification based on % of C
(Mild carbon steel, medium carbon steel, high carbon steel, their properties &uses),

**6.9 Non-Ferrous Alloys**
Aluminum Alloys: Duralumin
Solders Alloys    :  Woods metal
Bearing Alloys   :  Babbitt metal

**Course Outcome:   CO4   Teaching Hours :12 hrs Marks: 10     (R- 2  , U-6   A-2  )**

**Suggested Specifications Table (Theory):**

| Unit No | Topic Title | Distribution of Theory Marks | | | |
|---------|-------------|---------|---------|---------|---------|
| | | R Level | U Level | A Level | Total Marks |
| 1 | **Atomic Structure** | 02 | 04 | 04 | 10 |
| 2 | **Electrochemistry** | 04 | 04 | 02 | 10 |
| 3 | **Cells And Batteries** | 04 | 04 | 02 | 10 |
| 4 | **Corrosion** | 02 | 04 | 04 | 10 |
| 5 | **Lubricants** | 04 | 04 | 02 | 10 |
| 6 | **Materials And Alloys** | 02 | 06 | 02 | 10 |
| | **Total** | **18** | **26** | **16** | **60** |

**List of experiments:**

| Sr. No. | Unit No | CO | List of Experiments | Hours |
|---|---|---|---|---|
| 1 | 1 | CO1 | Introduction of chemistry laboratory &safety measures. | 2 |
| 2 | 2 | CO2 | Determination of electrochemical equivalent of copper by using cu -electrodes | 2 |
| 3 | 4 | CO3 | To find out pH of different solutions using Lovibond comparator, pH paper, pH meter | 2 |
| 4 | 5 | CO4 | Determination of coefficient of viscosity of given oil ( Glycerin) by using Ostwald's Viscometer | 2 |
| 5 | 1 | CO1 | A Qualitative analysis of any three salt solutions. Basic radicals : $Cu^{++}$, $Fe^{++}$, $Fe^{+++}$, $Cr^{+++}$, $Mn^{++}$, $Ni^{++}$, $Zn^{++}$, $Ca^{++}$, $Ba^{++}$, $Mg^{++}$ $NH4^{+}$ **Acidic Radicals**: $Cl^{-}$, $Br^{-}$, $I^{-}$, $CO_3^{--}$, $SO_4^{--}$, $NO_3^{-}$ | 6 |
| 6 | 2 | CO2 | Determination of conductivity of different electrolytes by using conductivity meter. | 2 |
| 7 | 4 | CO3 | To Study Corrosion of Aluminum rod and iron rod in acidic and basic medium and plot a graph of rate of corrosion | 2 |
| 8 | 5 | CO4 | To find out acid value of given lubricant | 2 |
| 9 | 3 | CO2 | Construction of Daniel Cell and measure its E M F. | 2 |
| 10 | 4 | CO3 | Determination of percentage of moisture in given soil sample. | 2 |
| 11 | 6 | CO4 | Estimation of percentage purity of iron from the given alloy sample | 2 |
| 12 | 6 | CO4 | To find out the % of cu from the given alloy sample | 2 |
| 13 | 6 | CO4 | Preparation of phenol formaldehyde / Bakelite plastic | 2 |
| | | | **Total** | **30** |

**Note: Experiments No. 1 to 10 are compulsory and should map all units and COs.**
**Remaining experiments are to be perform on the basis of availability of time.**

**References/ Books:**

| Sr. No. | Title | Author, Publisher, Edition and Year Of publication | ISBN |
|---|---|---|---|
| 1 | Engineering Chemistry | M.M. Uppal, Khanna Publisher, Delhi | 978-81-7409-262-5 |
| 2 | Poytechnic Chemistry | V.P. Mehta, Jain Brothers, Delhi | 978-81-8360-093-X |
| 3 | Applied Chemistry | P.C. Jain, Monica Jain, Dhanpat Rai and Sons , Delhi | 13: 9788187433170 |
| 4 | Chemistry in Engineering and technology Volume 1 and 2 | J.C. Kurlacose, J. Jairam Tata Mcgraw hill. | 9780074517352 |

1. **E-References:**
2.  www. chemistry.org          4.www.ferrofchemistry.com
3. www.chemistryclassroom.com          5.http;//hperchemistry.phastr.gsu.edu/hbase/hph.htm
**4.** www.youtube/chemistry          6.www.sciencejoywagon.com/
**7.** https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-chemistry

### CO Vs PO and CO Vs PSO Mapping (ELECTRICAL ENGINEERING)

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 1 | | | | 1 | 1 | | |
| CO2 | 3 | 1 | | | | | 1 | | | |
| CO3 | 3 | | | | 1 | | 1 | 1 | | |
| CO4 | 3 | | 1 | | 1 | | 1 | 1 | | 1 |

### CO Vs PO and CO Vs PSO Mapping (INSTRUMENTATION ENGINEERING)

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 1 | | | | 1 | 1 | 1 |
| CO2 | 3 | 1 | | | | | 1 | | |
| CO3 | 3 | | | | 1 | | 1 | 1 | |
| CO4 | 3 | | 1 | | 1 | | 1 | 1 | |

**Industry Consultation Committee:**

| Sr. No | Name | Designation | Institute/Organisation |
|---|---|---|---|
| 1 | Neelamkumar R. Sawant | State Head Technical Services for (Maharashtra and Goa) | JSW Cement ltd. Mumbai Head Office . |
| 2 | Mrs. Vaishali Gokhale | Lecturer in Chemistry | Govt. Polytechnic Pune. |
| 3 | Dr.Mrs. Smita Petkar Dhopate | Lecturer in Chemistry | Government polytechnic Nagpur. |
| 4 | Mrs J. V. Iyengar | Lecturer in Chemistry | Government polytechnic Mumbai. |
| 5 | Mrs. S. M. Patil | Lecturer in Chemistry | Government polytechnic Mumbai. |

Coordinator,                                          Head of Departments

Curriculum Development,                    Department of  Sci. & Humanities

Department of  Sci. & Humanities

I/C, Curriculum Development Cell                Principal

| Programme : **Diploma in Electrical Engineering (Sandwich Pattern)** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Course Code: EE 19 207 | | | | Course Title:  Elements of Electronics Engineering | | | | | |
| Compulsory / Optional: **C** | | | | | | | | | |
| Teaching Scheme and Credits | | | | Examination Scheme | | | | | |
| L | P | TU | Total | TH (2 Hr 30 Min) | TS1 (1 Hr) | TS2 (1Hr) | PR | OR | TW | Total |
| **04** | **02** | **--** | **08** | **60** | **20** | **20** | **50\*** | **--** | **--** | **150** |

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test ,   # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at mid-term and second skill test at the end of the term

**Rationale:**

It is necessary for the students of electronics and related branches to study and apply the basic principles, analyze and troubleshoot simple subsystems. To acquire this level of understanding, the basic knowledge of electronic devices and circuits is essential. This Course is one of the core subjects which are deals with construction, working principle, application of active components.

**Course Outcomes:** Student should be able to

| EC19 207.1 | Describe the Fundamentals of Diode |
|---|---|
| EC19 207.2 | Identify  different types of Diodes and their applications |
| EC19 207.3 | Illustrate the Transistor fundamentals and its Biasing techniques (BJT AND FET) |
| EC19 207.4 | Interpret the working of regulated power supply |
| EC19 207.5 | Interpret the Number system, Combinational circuits and Sequential circuits |

**Course Content Details:**

| Unit No | Topics / Sub-Topics |
|---|---|
| **1** | **Topic Title: Semiconductor Diode** <br><br> 1.1 Classification of component on the basis of energy band theory and effect of Temperature. <br> 1.2 Different types of Semiconductor and their materials. P-type and N-type |

| | |
|---|---|
| | Semiconductors.<br>Symbol, Construction, working principle, Forward and Reverse Biasing, V-I Characteristics and applications of following diodes: PN junction, Zener, LED, Photo diode.<br><br><br>**Course Outcome: EC19 207.1, EC19 207.2      Teaching Hours : 08 hrs**<br>**Marks:10 (R- 2, U-4,  A-4)** |
| **2** | **Topic Title: Diode Application**<br><br>2.1 Types of rectifier: Circuit, waveform and working of Half Wave, Full Wave Rectifier ( Bridge and Center tapped).<br>2.2 Parameters of rectifier: Average DC value of current and voltage , ripple factor, ripple frequency, PIV of diode, TUF, efficiency of rectifier.<br>Types of Filters: Waveform and working of Shunt Capacitor, series Inductor, and $\Pi$ filter.<br><br><br>**Course Outcome: EC19 207.2   Teaching Hours : 08 hrs    Marks: 10 (R- 2, U-4,  A-4)** |
| **3** | **Topic Title: Transistor Fundamentals**<br><br>3.1 Construction and working of PNP and NPN transistors.<br>3.2 Transistor configuration: CB, CE, CC.<br>3.3 Working and characteristics of transistors in CE mode.<br>3.4 BJT Biasing: DC load line, Operating point, stabilization, Concept of thermal runaway. Types of biasing: circuit and analysis of Fixed bias, base bias with Emitter feedback, Voltage divider bias.<br>3.5 Transistor as Switch and Single stage CE amplifier.<br>( circuit diagram and working)<br><br>**Course Outcome: EC19 207.3  Teaching Hours :12 hrs      Marks:12 (R- 4, U-8,  A-0)** |
| **4** | **Topic Title: Field  Effect Transistor**<br><br>4.1 Symbol, Construction, working and characteristics of JFET (N-channel and P-channel) and MOSFET (Depletion and enhancement Type)<br>4.2 FET Biasing: Source self bias , Drain to source bias.<br>4.3 Applications of FET<br>Comparison of FET with BJT.<br><br><br><br>**Course Outcome: EC19 207.3   Teaching Hours : 08        Marks:08 (R-4, U-4,  A-0)** |
| **5** | **Topic Title: Regulated Power Supply** |

Page 2

| | 5.1 Block diagram of DC regulated power supply.<br>5.2 Definition of load regulation and line regulation.<br>5.3 Zener diode as voltage regulator.<br><br>**Course Outcome: EC19 207.4    Teaching Hours : 04    Marks:04 (R-0, U-2, A-2)** |
|---|---|
| **6** | **Topic Title:Digital Electronics**<br><br>6.1 Number Systems:<br>   a)  Binary numbers, Octal numbers, Decimal number Hexadecimal numbers: Conversion of one number System to another system(including Fractional number)<br>6.2 Logic Gates and Families:<br>   a) AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR gate: Truth table, equation, symbol, IC numbers, Block diagram of logic IC's (Students must be made aware of pin diagram of logic gates.)(pin diagram should not be asked for exam)<br>   b) NOR & NAND as Universal gate.<br>6.3 Flip-flop:<br>   a) S-R Flip-flop using NOR and NAND.<br>   b) Types of triggering: Edge, level<br>   c) Clocked S-R flip flop, D flip flop, JK flip flop,  T flip flop.<br>      (Diagram, Symbol, Truth table, operation and application)<br>6.4 Counters:<br>   a)Classification of counters: Synchronous & Asynchronous/ripple (Circuit diagram, working and waveform)<br>8.5 MUX/DEMUX:<br>   a) Realization and working of 2 : 1, 4 : 1 , 8 : 1 multiplexer using logic gates<br>   b) Realization and working of 1 : 2, 1 : 4 , 1 : 8 De-multiplexer using logic gates.<br>8.6  **DAC: Types**, weighted resistor circuit and R-2R Ladder circuit, DAC IC 0808 specifications.<br>8.7. ADC : Block diagram, types and working of dual slope ADC, SAR ADC, ADC0808/0809 Specification.<br><br>**Course Outcome: EC19 207.5    Teaching Hours : 20    Marks:16 (R-4, U-8, A-4)** |

**Suggested Specifications Table (Theory):**

| Unit No | Topic Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| 1 | Semiconductor Diode | 08 | 02 | 04 | 04 | 10 |
| 2 | Diode Application | 08 | 02 | 04 | 04 | 10 |
| 3 | Transistor Fundamentals | 12 | 04 | 08 | 00 | 12 |

| 4 | Field Effect Transistor | 08 | 04 | 04 | 00 | 08 |
| 5 | Regulated Power Supply | 04 | 00 | 02 | 02 | 04 |
| 6 | Digital Electronics | 20 | 04 | 08 | 04 | 16 |
| | **Total** | **60** | **16** | **30** | **14** | **60** |

**Legends:** R-Remember; U-Understand; A-Apply and above levels (Bloom's revised Taxonomy)
**Notes:** This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

**List of Experiments: Total 10-12 experiments(or turns) out of 15-16 experiments (or turns)**

| Sr. No. | Unit No | COs | Title of the Experiments | Hours |
|---------|---------|-----|--------------------------|-------|
| 1 | 1 | EC19 207.1 | To plot the V-I characteristic of semiconductor P-N diode. Find out static, dynamic resistance and knee voltage of P-N diode. | 02 |
| 2 | 1 | EC19 207.2 | To plot the V-I characteristic of Zener diode | 02 |
| 3 | 1 | EC19 207.2 | To plot the V-I characteristic of LED diode | 02 |
| 4 | 1 | EC19 207.2 | To plot the V-I characteristic of Photo diode | 02 |
| 5 | 2 | EC19 207.2 | To construct and test half wave rectifier with C Filter | 02 |
| 6 | 2 | EC19 207.2 | To construct and test full wave rectifier with LC filter | 02 |
| 7 | 3 | EC19 207.2 | To construct and test Bridge wave rectifier with $\pi$ filter | 02 |
| 8 | 3 | EC19 207.3 | To plot i/p and o/p characteristics of BJT and find out input resistance and o/p resistance of BJT in CE Mode | 02 |
| 9 | 3 | EC19 207.3 | To construct and test transistor as a switch and calculate rise time and fall time. | 02 |
| 10 | 4 | EC19 207.3 | To plot the characteristic of FET | 02 |
| 11 | 5 | EC19 207.4 | To construct and test Zener regulator. Find out load and line regulation | 02 |
| 12 | 6 | EC19 207.5 | Verify truth table of all gates | 02 |
| 13 | 6 | EC19 207.5 | Verify truth table of D and T flip-flop | 02 |
| 14 | 6 | EC19 207.5 | Design and Implement 3-bit asynchronous counter | 02 |
| 15 | 6 | EC19 207.5 | Verify truth table of 8:1 Multiplexer using IC 74151 | 02 |
| 16 | 6 | EC19 207.5 | Verify truth table of 1:8 DeMultiplexer using IC | 02 |
| | **Total** | | | |

**References/ Books:**

| Sr. No. | Book Title | Author | Publication |
|---|---|---|---|
| 1 | Electronic Devices and Circuit: An Introduction | Mottershead Allen | PHI Learning, New Delhi |
| 2 | Electronic Devices and Circuit Theory | Boylestead Robert, Louis Neshelsky | Pearson Education, 10th edition |
| 3 | Electronics Principles | Malvino, Albert Paul, David | McGraw Hill Education |
| 4 | Principles of Electronics | Mehta V.K., Mehta Rohit | S. Chand and Company |
| 5 | A text book of Applied Electronics | Sedha R.S. | S. Chand |
| 6 | Modern Digital Electronics | R.P.Jain | Tata McGraw Hill |

**CO Vs PO and CO Vs PSO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| EC19 207.1 | 3 | - | - | - | - | - | - | - | - | - |
| EC19 207.2 | 2 | 2 | 2 | - | - | - | 2 | 1 | - | - |
| EC19 207.3 | 2 | 2 | - | 1 | - | - | 1 | - | - | - |
| EC19 207.4 | 1 | - | 1 | 1 | - | - | 2 | 2 | - | 2 |
| EC19 207.5 | 3 | - | 2 | - | - | - | 2 | 1 | - | 1 |

**Industry Consultation Committee:**
1. Mrs. Salunke Suvarna (Sr. Controls engineer, Vanderlande industries software pvt ltd.Pune)
2. Mrs. Chavhan Monali ( Lecturer , Government Polytechnic, Vikramgadh)
3. Mrs. Puri Sanyogeeta ( Lecturer , Government Polytechnic, Mumbai)

Coordinator,                                         Head of Department

Curriculum Development,                              Department of _____

Department of _____

I/C, Curriculum Development Cell                     Principal

| Programme : Diploma in Electrical Engineering (Sandwich Pattern) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Code: EE19 203** | | | | **Course Title:  Computer Aided Electrical Drawing** | | | | | | | |
| **Compulsory / Optional: C** | | | | | | | | | | | |
| **Teaching Scheme and Credits** | | | | **Examination Scheme** | | | | | | | |
| L | P | TU | Total | TH (2 Hr 30 Min) | TS1 (1 Hr) | TS2 (1Hr) | PR | OR | TW | Total | |
| - | 4 | - | 4 | - | - | - | 50* | - | 50 | 100 | |

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test ,   # indicates Self, on- line learning Mode, @ indicates on line examination
**Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of  the term**

### Rationale:

The computer software's become the essential part of today's world to keep pace with rowing technology and demand for the timely product design. Computer aided drawing software allow engineer to increase productivity, improves the quality, accuracy of the drawing, saves time and easier for documentation. Objective of this course is to provide practice in freehand sketching of electrical drawing, use of computer based software to draw working electrical drawing. This course also provides practice to read and interpret working electrical engineering drawings.

### Course Outcomes: Student should be able to

| EE19 203.1 | **Make Use of Computer Aided Electrical Drawing Software** |
|---|---|
| EE19 203.2 | **Reproduce (Redraw) free hand proportionate sketches related to electrical engineering drawings** |
| EE19 203.3 | **Reproduce (Redraw) electrical engineering drawings using drafting software** |
| EE19 203.4 | **Read and interpret electrical drawings** |
| EE19 203.5 | **Print/Plot the drawing** |

### Course Content Details:

Following contents are to be explained in the practical hours

| Unit No | Topics / Sub-topics |
|---|---|
| **1** | **Introduction to CAD Software :** Explore the basic features, commands and general structure of the Electrical CAD software (open source/AutoCAD) environment**.** 1.1 Start and exit the session 1.2 GUI of electrical CAD software 1.3 On-line help 1.4 File types with extensions |

| | |
|---|---|
| | 1.5 Initial settings- limit, units etc. |
| | 1.6 Drawing command- line, circle, arc, square, spline, Array, Repeat Region,  part marking |
| | 1.7 Editing commands |
| | 1.8 View command |
| | 1.9 Dimensioning commands |
| | 1.10 Lettering , Text , title |
| | 1.11 Layer & layer properties |
| | 1.12 Print /Plot the drawing |
| | 1.13 Import export of File to other file formats |
| **2** | **Electrical and Electronics Symbols :** <br> 2.1 Concept of electrical symbols and  its importance <br> 2.2 Different electrical and electronics symbols as per IS: 2032 1976 or latest code <br> 2.3 Preparation and subsequent use of standard template for drawing in CAD |
| **3** | **Electrical Drawings :** <br> 3.1 Concept of Electrical drawings <br> 3.2 Types of Electrical drawings- Circuit diagram, wiring diagram, control circuit diagram , single line diagram, block diagram, layout diagram, schematic diagram  and  logic diagram |

**List of experiments: All experiments are compulsory**

| Sr. No. | Unit No | COs | Title of the Experiments | Hours |
|---|---|---|---|---|
| 1 | 1 | EE19 203.1 <br><br> EE19 203.5 | **Practice open source  Electrical CAD/AutoCAD software-** <br> Open sample examples, read and understand <br> Create new file <br> Practice basic drawing commands to draw <br> Line, circle arc, ellipse, triangle square and other geometric figures <br> Perform basic operations such copy , erase,  delete, undo , redo, mirror, zoom, offset <br> Prepare minimum 2 simple drawings using above commands. <br> Save drawing -with default extension and as pdf format <br> Print the drawing on A3/A4paper. | 6 |
| 2 | 1 | EE19 203.1 <br><br> EE19 203.5 | **Preparation of standard template for drawing in CAD**. <br> Standard template should include the name of students, enrolment no. of student, etc.  Draw minimum 4 simple geometric figures/patterns using draw and Edit commands in a prepared template. <br> Save and print drawing  on A3/A4 paper | 2 |
| 3 | 1 | EE19 203.1 <br> EE19 203.3 <br> EE19 203.5 | **Draw minimum 2 proportionate drawings on sketchbook** with creative imagination which includes  combinations of geometric pattern for  example Rangoli/Street light Pole/Decorative Garden lamp post <br> Redraw the above drawing using CAD software <br> Save and print drawing  on A3/A4 paper | 4 |

| 4 | 2 | EE19 203.1<br>EE19 203.2<br>EE19 203.3<br>EE19 203.5 | **Electrical and electronics symbols**/legends<br>Draw Electrical and electronics symbols/legends<br>as per IS: 1032 or Latest code  by free hand on sketch book<br>Draw same symbols by using drafting software<br>Save and print file | 4 |
|---|---|---|---|---|
| 5 | 3 | EE19 203.1<br>EE19 203.3<br>EE19 203.4<br>EE19 203.5 | **Layout of ceiling fans and luminaries**<br>Collect  electrical installation layout plan of ceiling fans and luminaries fitted in  a  residential/commercial office / classroom (any one)<br>Read, understand and redraw  the same using drawing software<br>Save and print the file on A3/A4paper. | 4 |
| 6 | 3 | EE19 203.1<br>EE19 203.3<br>EE19 203.4<br>EE19 203.5 | **Single line diagram of electrical installation of a residential,  commercial office  or educational classroom**<br>Collect drawings of  single line drawings of any one installation<br>Read and interpret the drawing.<br>Draw the same using drawing software<br>Save and print the file on A3/A4paper. | 4 |
| 7 | 3 | EE19 203.1<br>EE19 203.3<br>EE19 203.5 | **Visit to electrical laboratory and workshop**<br>Draw Panel layout g diagram like Distribution  panel in the laboratory/ electrical meter room/ workshop (any one) on sketch book<br>Draw the same  electrical  panel layout diagram at above place using drawing software,<br>Prepare and draw single line diagram of above panel layouts<br>Save and print the file on A3/A4paper. | 4 |
| 8 | 3 | EE19 203.1<br>EE19 203.3<br>EE19 203.5 | **Visit to 11 KV substation of the institute or near by  small scale industry**  having outdoor/indoor switch yard<br>☐Observe, and sketch,  outdoor/indoor switch yard , layout of equipment with specifications on sketch book<br>Draw the same using drawing software<br>Prepare and draw single line diagram of above panel layouts<br>Save and print the file on A3/A4paper | 6 |
| 9 | 3 | EE19 203.1<br>EE19 203.2<br>EE19 203.3<br>EE19 203.5 | **Trace wiring of any one of the following**<br>Star Delta semi - automatic Starter, DOL Starter<br>Draw using free hand on sketch book<br>Draw the wiring diagram of any one equipment using layer concept using drawing software<br>Save and print the file on A3/A4paper. | 4 |
| 10 | 3 | EE19 203.1<br>EE19 203.3<br>EE19 203.4<br>EE19 203.5 | **Single line diagram for different substation layouts.**<br>Collect single line diagram of any 132 KV or 400 KV substations.<br>Read and  interpret drawing.<br>Draw the same using drawing software<br>Save and print the file on A3/A4paper | 6 |
| 11 | 3 | EE19 203.1<br>EE19 203.3<br>EE19 203.5 | **Draw block diagram of any one type of power plan layout**<br> by free hand on sketch book.<br>Draw the same using drawing software<br>Save and print the file on A3/A4paper. | 4 |
| 12 | 3 | EE19 203.1<br>EE19 203.2 | **Draw diagram of  sequential operation of  control circuits**<br>used for functional  operation of electric motors/electric | 6 |

| | | EE19 203.3<br>EE19 203.5 | devices by free hand on sketch book. (At least two circuits)<br>Example- Operation of five electric motors working in tandem<br>☐Draw the same using drawing software<br>Save and print the file on A3/A4paper. | |
|---|---|---|---|---|
| 13 | 3 | EE19 203.1<br>EE19 203.3<br>EE19 203.4<br>EE19 203.5 | **Collect, read and interpret electrical control circuit for the operations of** – (any three)<br>Fridge, washing machine, air conditioner, machines used in metal turning workshop, APFC panel etc.<br>Redraw the electrical control diagram of any two using drawing software<br>Save and print file | 6 |
| 14 | 3 | EE19 203.1<br>EE19 203.3<br>EE19 203.5 | **Collect existing ladder diagram used for operation of any industrial process**<br>Draw ladder diagram of above using drafting software<br>Save and print the file on A3/A4paper | 2 |
| **Total** | | | | **60** |

## References/ Books:

| Sr. No. | Title | Author, Publisher, Edition and Year Of publication | ISBN |
|---|---|---|---|
| 1 | Libre CAD user manual | https://wiki.librecad.org/index.php/LibreCAD_users_Manual | ----- |
| 2 | Electrical Engineering Drawing | S. K. Bhattacharya, New Age International Publisher, Second Edition, Reprint 2005 | 81-224-0855-9 |
| 3 | Control of Electrical Machines | S. K. Bhattacharya, Brijinder Singh , New Age International Publisher, First Edition, 1996 | 8122409970 |
| 4 | Graphical Symbols used in Electro technology | IS: 2032 1976, Bureau of Indian Standards | ----------------- |
| 5 | Electrical Engineering Drawing Part 1 | SurjitSingh , Katariya S.K.Publisher,revised edition, 2001 | 10: 9350143054<br>13: 978-9350143056 |
| 6 | Electrical Engineering Drawing Part 2 | SurjitSingh , Katariya S.K.Publisher | 10: 9350143216<br>13: 978-9350143216 |
| 7 | Electrical Engineering Drawing | C. R. Dargan, Computech Publications Limited, 2nd edition 2010 | 8173180032,<br>9788173180033 |
| 8 | Practical Troubleshooting of Electrical Equipment and Control Circuits | Mark Brown, Jawahar Rawtani, Dinesh Patil, Elsevier Publsher, 2004 | 0080480284,<br>9780080480282 |
| 9 | Handbook of Electrical Motor Control Systems | Eswar, Tata McGraw-Hill Education, 1990 | 0074601113,<br>9780074601112 |

**E-References:**

1. https://wiki.librecad.org/index.php/LibreCAD_users_Manual
2. https://www.autodesk.in/campaigns/autocad-tutorials
3. https://www.youtube.com/watch?v=6gYLGt9DEqs An Introduction to AutoCAD Electrical
4. https://www.youtube.com/watch?v=Ua2IK-PCfUU for single line diagram
5. https://www.youtube.com/watch?v=Z05xuqhGNZ8 AutoCAD Electrical Tutorial | Panel Drawings

**CO Vs PO and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| EE19 203.1 | 3 | -- | 1 | 3 | 2 | 3 | 2 | 2 | 3 | -- |
| EE19 203.2 | 3 | -- | 1 | 2 | 2 | 2 | 2 | 2 | 3 | -- |
| EE19 203.3 | 3 | -- | 1 | 2 | 1 | 2 | 2 | 2 | 3 | -- |
| EE19 203.4 | 3 | -- | 1 | 2 | 1 | 2 | 2 | 2 | 3 | -- |
| EE19 203.5 | 3 | -- | 1 | 2 | 1 | 2 | 2 | 2 | 3 | -- |

**Industry Consultation Committee:**

| Sr. No | Name | Designation | Institute/Organisation |
|---|---|---|---|
| 1 | Dr. Dilip Lulekar | HOD , Electrical Engineering | Govt. Polytechnic Nagpur |
| 2 | Mrs Swati Kadam | Manger, Electrical Engineering | Siemens |
| 3 | Dr. Vijay Rathod | Lecturer , Mechanical Engineering | Govt. Polytechnic Mumbai |
| 4 | Ishwar N. Khuspe (Curriculum Content Designer) | Lecturer In Electrical Engineering | Govt. Polytechnic Mumbai |

Coordinator,                                        Head of Department

Curriculum Development,                    Department of _____

Department of _____

I/C, Curriculum Development Cell            Principal

| Programme : **Diploma in Electrical Engineering (Sandwich Pattern)** | |
|---|---|
| Course Code: EE 19 301 | Course Title: Electrical and Industrial Measurement |
| Compulsory / Optional: Compulsory | |

| Teaching Scheme and Credits | | | | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| L | P | TU | Total | TH (2 hr 30 Min) | TS1 (1 Hr) | TS2 (1Hr) | PR | OR | TW | Total |
| **4** | **4** | **-----** | **8** | **60** | **20** | **20** | **50\*** | **------** | **25** | **175** |

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test ,   # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at mid term and second skill test at the end of the term

**Rationale:** The course Electrical & Industrial Measurement is an important subject in the field of Electrical Engineering. This subject deals with the technique of measuring. Voltage, current and wattage by the indicating type of instruments. The technique of measurement of Electrical power in single phase and three phase circuits will be studied here. Measurement of energy and calibration and adjustment of energy meters will be studied under this subject. Prior to above the working principle construction of all type of measuring instruments like indicating, integrating and recording type will also be studied here. Users of potentiometers and other resistance measuring instruments are included under this subject. The course also covers Concept, Classification, Construction and working of some of major transducers.

**Course Outcomes:** Student should be able to

| | |
|---|---|
| EE19 301.1 | Define terminology used in electrical measuring instruments. |
| EE19 301.2 | Demonstrate various constructional parts of electrical measuring instruments with working principles. |
| EE19 301.3 | Measure electrical quantities with various instruments. |
| EE19 301.4 | Select Instrument Transformers for measurement |
| EE19 301.5 | Explain calibration procedure of electrical measuring instruments. |
| EE19 301.6 | Select suitable transducer for particular application. |

**Course Content Details:**

| Unit No | Topics / Sub-topics |
|---|---|
| 1 | **Basic Concepts:**<br>1.1 Purpose of measurement & significance of measurement.<br>1.2 Various effects of electricity employed in electrical measuring instruments.<br>1.3 Characteristics of Instruments: <u>Static</u>- Accuracy, Precision, sensitivity, resolution, Static error, Repeatability, Drift, Dead zone. <u>Dynamic</u>- speed of response, Lag, Fidelity, Dynamic error.<br>1.4 Types of static error- Gross, Systematic, Random.<br>1.5 Classification of instruments based on –<br>    a) Electrical effects.<br>    b) Nature of operation. |

| | | |
|---|---|---|
| | c) Limits of permissible errors.<br>1.6 Different types of torque in Analog Instruments.<br><br>**Course Outcome: EE19 301.1      Teaching Hours :  6 hrs    Marks: 6 (R- 4, U-2,  A-0)** | |
| **2** | **Measurement of Current, Voltage and Resistance:**<br>2.1 Construction and principle of PMMC, MI & Electro-dynamometer type Instrument. Merits and demerits.<br>2.2 Methods of production of torque.<br>2.3 Extension of Range of Ammeter and Voltmeter. (Simple Numerical)<br>2.4 Different methods of Extension of Range of Ammeter and Voltmeter.<br>2.5 Errors and their compensation.<br>2.6 Calibration of Ammeter and Voltmeter.<br>2.7 Use and Advantages of Clamp on meter, Digital ammeters and voltmeters<br>2.8 Classification of Resistance- Low, Medium and High.<br>2.9 Methods of Measurements of Low, Medium and High Resistance (Potentiometer, Wheatstone's bridge and Megger)<br>2.10 Measurement of Earth resistance- Earth tester (Analog & Digital)<br>2.11 Advantages of Digital Multimeter,<br>2.12  Applications of CRO, Lissajous patterns on CRO, Power factor meter, clamp on meter and Frequency meter<br><br>**Course Outcome: EE19 301.2,3      Teaching Hours :14         Marks:16 (R-6,U-6,A-4 )** | |
| **3** | **Instrument Transformers:**<br>3.1 Construction, theory and errors in CT and PT.<br>3.2 Effect of secondary of CT open circuited.<br>3.3 Use of CT and PT for extension of ranges.<br><br>**Course Outcome: EE19 301.4      Teaching Hours: 6   Marks:4 (R- , U- , A- 4 )** | |
| **4** | **Measurement of Power:**<br>4.1 Concept of power in A.C. Circuit.<br>4.2 Principle and Construction of dynamometer type wattmeter<br>4.3 Errors and their compensation.<br>4.4 Poly phase wattmeter.<br>4.5 Measurements of power in 3 phase circuit for balanced and unbalanced load<br>4.6 Effect of power factor variation on wattmeter readings in two wattmeter method.<br>4.7 Measurement of reactive power in three phase balanced load by one wattmeter method and two wattmeter method.<br>4.8 Advantages of Digital Wattmeter<br><br>**Course Outcome: EE19 301.2,3      Teaching Hours: 8       Marks: 10 (R-4,U-4,A-2)** | |
| **5** | **Measurement of Electrical Energy:**<br>5.1 Concept of electrical energy.<br>5.2 Constructional feature & principle of working of single phase and three-phase induction type energy meter.<br>5.3 Constructional feature & principle of working of single phase and three-phase bidirectional (Import-Export type) energy meter.<br>5.4 Different types of errors and their compensation.<br>5.5 Calibration of energy meter.<br>5.6 Advantages of Electronic energy meter.<br>5.7 Tri vector meter- Construction, working and Applications.<br><br>**Course Outcome: EE19 301.2,3,5      Teaching Hours :8      Marks:4 (R- , U- 4 , A- )** | |

| 6 | **Transducers:**<br>6.1 Facts and concept of Instrumentation<br>6.2 Concept of Transducers<br>6.3 Classification of Transducers<br>    -Primary and Secondary Transducers<br>    -Electrical and Mechanical Transducers<br>    -Analog and Digital Transducers<br>    -Active and Passive Transducers<br>6.4 Construction and working principles of Transducers<br>    -Resistive, Inductive and capacitive transducers<br>    -Strain gauge (No derivation only formula)<br>    -Types of strain gauges:- unbounded, bounded, Semiconductor<br>    - Bourden tube, Bellows, Diaphragm.<br>    -LVDT<br>    -Piezoelectric transducer, photoconductive cell, photovoltaic cells,<br>    -load cell.<br>    -RTD, Thermistor, Thermocouple.<br>    -Pyrometers (Radiation, optical, Photoelectric) ultrasonic temperature Transducers.<br>    - Electromagnetic and turbine flow meter, ultrasonic flow meter. |
|---|---|
|  | **Course Outcome: EE19 301.6**    **Teaching Hours :18**    **Marks: 20 (R-8,U-6,A-6)** |

**Suggested Specifications Table (Theory):**

| Unit No | Topic Title | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|
| | | R Level | U Level | A Level | Total Marks |
| 1 | **Basic Concepts** | 4 | 2 | 0 | 06 |
| 2 | **Measurement of Current, Voltage and Resistance** | 6 | 6 | 4 | 16 |
| 3 | **Instrument Transformers** | 0 | 0 | 4 | 04 |
| 4 | **Measurement of Power** | 4 | 4 | 2 | 10 |
| 5 | **Measurement of Electrical Energy** | 0 | 4 | 0 | 04 |
| 6 | Transducers | 8 | 6 | 6 | 20 |
| | **Total** | **22** | **22** | **16** | **60** |

**List of experiments:**

| Sr. No. | Unit No | COs | Title of the Experiments | Hours |
|---|---|---|---|---|
| 1 | 1 | **EE19 301.1** | To demonstrate any one type of static error in given instrument | 02 |
| 2 | 2 | **EE19 301.2** | To study the constructional details of PMMC and MI instruments. | 04 |

| 3 | 2 | **EE19 301.3** | To measure high value of DC current by low range ammeter with shunt. | 04 |
|---|---|---|---|---|
| 4 | 3 | **EE19 301.4** | i) To measure high value of AC current by low range ammeter with CT. ii) To measure high value of AC voltage by low range voltmeter with PT. | 04 |
| 5 | 5 | **EE19 301.5** | To calibrate and use single phase energy meter. | 02 |
| 6 | 6 | **EE19 301.6** | To measure temperature using thermocouple. | 04 |
| 7 | 4 | **EE19 301.3** | To measure active and reactive power in three phase balanced load by one wattmeter method. | 04 |
| 8 | 4 | **EE19 301.3** | To measure active power in three phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading. | 04 |
| 9 | 2 | **EE19 301.3** | To measure high value of DC voltage by low range voltmeter with multiplier. | 04 |
| 10 | 2 | **EE19 301.3** | To measure medium resistance by Wheatstone's bridge. | 04 |
| 11 | 2 | **EE19 301.3** | To measure insulation resistance by Megger. | 04 |
| 12 | 2 | **EE19 301.3** | To measure Earth resistance by earth tester. (Substation / Earth pit.) | 04 |
| 13 | 5 | **EE19 301.5** | To calibrate and use three phase energy meter. | 04 |
| 14 | 6 | **EE19 301.6** | To plot characteristics of Thermistor | 04 |
| 15 | 6 | **EE19 301.6** | To plot characteristics of RTD. | 04 |
| 16 | 6 | **EE19 301.6** | To measure liner displacement by LVDT | 04 |
| | | **Total** | | **60** |

### References/ Books:

| Sr. No. | Title | Author, Publisher, Edition and Year Of publication | ISBN |
|---|---|---|---|
| 1 | Electrical & Electronic Measurement & Instruments | A.K. Sawhney Dhanpat Rai & Sons, India . 11th Edition Revised, 1995 | ISBN-10: 8177001000 ISBN-13: 978-8177001006 |
| 2 | Electrical Measurements and Measuring Instruments | Golding, E.W. and Widdis, F.C. Reem Publications Pvt. Ltd.; Third edition (2011) | ISBN-10: 8190630725 ISBN-13: 978-8190630726 |
| 3 | Fundamentals of Electrical Measurements | George G.Harrap & Co Ltd; 2nd Revised edition edition (19 July 1973) | ISBN-10: 0245519904 ISBN-13: 978-0245519901 |
| 4 | Basic Electrical Measurement | M.B. Stout , Prentice hall of India, India. 2nd Edition, 1965, | ASIN: B000PFNZKW |

### E-References:

1. https://ndl.iitkgp.ac.in/

2. https://www.electrical4u.com/electrical-engineering-articles/measurement/
3. https://nptel.ac.in (A Course on Electrical and Electronic Instruments, Prof.Avishek Chatterjee, IIT Kharagpur)
4. https://swayam.gov.in (Electrical Measurement and Electronic Instruments, Prof.Avishek Chatterjee, IIT Kharagpur)

**CO Vs PO and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| EE19 301.1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| EE19 301.2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| EE19 301.3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| EE19 301.4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| EE19 301.5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| EE19 301.6 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |

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| 3 | Mrs.S.S.Umare | LEE | Government Polytechnic Nashik |
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Coordinator,                                        Head of Department

Curriculum Development,                             Department of  Electrical Engineering

Department of Electrical Engineering

I/C, Curriculum Development Cell                    Principal

## Programme: Electrical Engg. (Sandwich Pattern)    Semester-II

## EE 19 205   C-Programming

1. **First C Program** (**Foss:** *C and Cpp - English*)

   **Outline:** 1) First C Program -Header Files --example: #include <stdio.h> -main() - Curly braces -printf() -semicolon ; -Compiling a C program --example: gcc filen..

2. **First Cpp Program**

   **Outline:** First C++ Program -Header files --example: #include <iostream> -main() - Curly braces -cout<< -semicolon ; -Compiling a C++ program --example: g++ filen..

3. **Tokens**

   **Outline:** 3) Tokens in C and C++ -Data types, constants, identifiers -Keywords -- example: if, break, else -Constants -Data types --example: int, float, char, double -F..

4. **Functions**

   **Outline:** Functions -What is a function -Syntax for declaration of a function - Function with arguments --example: return-type function-name(parameter); - Function without ar..

5. **Scope of Variables**

   **Outline:** Scope of Variables -Introduction -Syntax of declaring a variable --example: data-type var-name; -Syntax for initializing a variable --example: data-type var-name =..

6. **If and Else If Statement**

   **Outline:** Check the conditions in a program -What are Statements. -Syntax for if and -If-else Statement -Errors

7. **Nested If and Switch Statement**

   **Outline:** Nested if and switch statement -Nested if statement. -Switch statement. - Syntax for nested-if statement -Syntax for switch statement -break statement - Compariso..

8. **Increment and Decrement Operators**

   **Outline:** Increment and Decrement Operators -Increment Operator --example: ++ - Postfix increment --example: a++ -Prefix increment --example: ++a -Decrement Operator ..

9. **Arithmetic Operators**

   **Outline:** Arithmetic Operators -Arithmetic Operators -Addition Operator --example: a + b -Subtraction Operator --example: a - b -Multiplication Operator --example: a *..

10. **Relational Operators**

    **Outline:** Relational Operators -Double Equal to --example: a == b -Not Equal to -- example: a != b -Greater Than --example: a > b -Less Than --example: a < b -Gr..

## 11. Logical Operators

**Outline:** Logical Operators -And && -Or || -Not !

## 12. Loops

**Outline:** Loops -Loops -Syntax for while and do-while loop -Comparison of while and do-while loop -Syntax for -for loop -Errors

## 13. Arrays

**Outline:** Arrays -What are arrays -1-D Arrays -Syntax for Declaration of arrays --example: data type array_name [size]; -Syntax for Initialization of arrays --example: da..

## 14. Working with 2D Arrays

**Outline:** Working with 2-D Arrays -What are 2-D Arrays. -Range of arrays -Syntax for Declaration of 2-D arrays --example: data type array_name[row][column]; -Syntax for init..

## 15. Strings

**Outline:** Strings -What is a string -Syntax for declaring a string -Syntax for initializing a string -To read a string from keyboard

## 16. String Library Functions

**Outline:** String Library Functions What are string library functions. Types of string library functions -Strcpy -Strlen -Strcmp -Strcat

## 17. Working with Structures

**Outline:** Working with Structures -Introduction -Syntax of structures -Declaration and initialization -Declaration of structure variable -Accessing structure variables

## 18. Understanding Pointers

**Outline:** Understanding Pointers -Introduction -Syntax of Pointer --example: int *iptr; -Declaration --example: int a; (integer a) int *aptr; (pointer to an integer..

## 19. Function Call

**Outline:** Function call -types of function calls -function pass by value -function pass by reference

## 20. File Handling in C

**Outline:** Files in C -File handling functions -Opening a File closing a file --example: fopen, fclose -Reading data from a File