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| Programme Name/s | : Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele- communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Textile Technology/ Electronics & Computer Engg./ Textile Manufactures |
| Programme Code | : AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MU/ PG/ PN/ PO/ TC/ TE/ TX |
| Semester | : First |
| Course Title | : BASIC SCIENCE |
| Course Code | : 311305 |

I. RATIONALE

Diploma engineers have to deal with various materials and machines. This course is designed with fundamental information to help the diploma engineering students to apply the basic concepts and principles of physics and chemistry to solve broad-based engineering problems. The basic concepts and principles of sciences related to heat, electricity, magnetism, optics, semiconductors, engineering materials will help in understanding the technology courses where emphasis is on the applications of these in various technology domain applications

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

This course is to be taught and implemented with the aim to develop in the student, the course outcomes (COs) leading to the attainment of following industry identified outcome expected from this course: Apply principles of physics and chemistry to solve broad based relevant engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Use basic instruments to measure the physical quantities in various engineering situations.
- CO2 - Apply the basic principles of electromagnetics to solve given engineering problems.
- CO3 - Apply basic principles of thermometry and fibre optics to solve engineering problems.
- CO4 - Predict the structure, properties and behaviour of molecules and compounds based on the types of chemical bond.
- CO5 - Apply the concepts of electrochemistry and corrosion preventive measures in industry.
- CO6 - Use the appropriate engineering material and catalyst appropriately.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | | Credits | Paper Duration | Assessment Scheme | | | | | | | | | | Total Marks |
|-------------|---------------|------|-------------------|--------------------------|----|----|-------|-------|--------|---------|----------------|-------------------|-------|-----|-----|-------------|-----|----|----|----|-----|-------------|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | Theory | | | Based on LL & TL | | | | Based on SL | | | | | | |
| | | | | CL | TL | LL | | | Total | | | Practical | | SLA | | | | | | | | |
| | | | | | | | FA-TH | SA-TH | | | | FA-PR | SA-PR | Max | Min | Max | Min | | | | | |
| 311305 | BASIC SCIENCE | BSC | DSC | 4 | - | 4 | 2 | 10 | 5 | 1.5 | 30 | 70*# | 100 | 40 | 50 | 20 | 50@ | 20 | 50 | 20 | 250 | |

Total IKS Hrs for Sem. : 4 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

♦ **Candidate remaining absent in practical examination of any one part of Basic Science course i.e. Physics, Chemistry will be declare as Absent in Mark List and has to appear for examination. The marks of the part for which candidate was present will not be processed or carried forward.**

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---------------------------------------------------|-------------------------------------------------------------------------|--------------------------------|
| | | | |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 1 | <p>TLO 1.1 Explain physical quantities and its types with examples.</p> <p>TLO 1.2 Differentiate between scalar and vector quantities with examples.</p> <p>TLO 1.3 Apply dimensional analysis to check correctness of equation and conversion of units in different systems .</p> <p>TLO 1.4 Estimate the errors in the measurement for the give problem.</p> <p>TLO 1.5 Explain the working of ancient astronomical instruments to measure distance , time and hour angle .</p> <p>TLO 1.6 Explain the procedure of measuring the dimension of a given object by using vernier calipers and screw gauge .</p> | <p>Unit - I Units and Measurements</p> <p>1.1 Unit, physical quantities: fundamental and derived quantities and their units Systems of units: CGS, MKS and SI .</p> <p>1.2 Scalar and Vector Physical Quantities.</p> <p>1.3 Dimensions, dimensional formula ,Applications of dimensional analysis; correctness of physical equations ,conversion factor for interconversion of units in different systems of units.</p> <p>1.4 Errors, types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures.</p> <p>1.5 Ancient astronomical instruments:Chakra, Dhanuryatra , Yasti and Phalaka yantra .</p> <p>1.6 Applications of Vernier calipers , Screw gauge .</p> | <p>Chalk and board Improved lecture, Tutorial Assignment Demonstration</p> |
| 2 | <p>TLO 2.1 Explain electric field, potential and potential difference.</p> <p>TLO 2.2 Explain magnetic intensity and flux with their units.</p> <p>TLO 2.3 Apply laws of series and parallel combination to the given electrical circuits.Explain the heating effect of electric current.</p> <p>TLO 2.4 Distinguish between conductors, semiconductors and insulators on the basis of energy bands.</p> <p>TLO 2.5 Explain the I-V characteristics and applications of p-n junction diode.</p> | <p>Unit - II Electricity, Magnetism and Semiconductors</p> <p>2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference.</p> <p>2.2 Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux .</p> <p>2.3 Electric current, Ohm's law, specific resistance, laws of series and parallel combination of resistance, conversion of galvanometer into ammeter and voltmeter, Heating effect of electric current .</p> <p>2.4 Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors, minority and majority charge carriers.</p> <p>2.5 p-n junction diode, Depletion layer I-V characteristics of p-n junction, static and dynamic resistance, applications of p-n junction diode ,: Half wave rectifier.</p> | <p>Chalk and board Improved lecture, Tutorial Assignment Demonstration Educational Games</p> |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 3 | <p>TLO 3.1 Convert temperature in different temperature scales.</p> <p>TLO 3.2 Compare different modes of heat transfer with examples.</p> <p>TLO 3.3 Inter-relate the characteristics of the three gas laws.</p> <p>TLO 3.4 Inter-relate the characteristics of the three gas laws.</p> <p>TLO 3.5 Explain total internal reflection in optical fiber.</p> <p>TLO 3.6 Differentiate between types optical fiber with applications.</p> | <p>Unit - III Thermometry and Fiber Optics</p> <p>3.1 Heat, temperature, temperature scale: Degree Celsius, degree Kelvin, degree Fahrenheit.</p> <p>3.2 Modes of heat transfer: Conduction , Convection and Radiation , Applications in daily life .</p> <p>3.3 Boyle's law, Charle's law, Gay Lussac's law, perfect gas statements equations and simple numerical.</p> <p>3.4 Law of thermal conductivity ,Newton's law of cooling.</p> <p>3.5 Law of refraction, total internal reflection.</p> <p>3.6 Optical fiber: Principle, construction and working Types of Optical fibers;Single mode step index, Multimode step index, Multimode graded index Applications of optical fibers.</p> | <p>Chalk and board Improved lecture, Tutorial Assignment Demonstration Flip classroom Educational Games</p> |
| 4 | <p>TLO 4.1 Explain the properties of given material based on the bond formation.</p> <p>TLO 4.2 Describe the molecular structure of given solid, liquid and gases.</p> <p>TLO 4.3 Describe the crystal structure of the given solids.</p> <p>TLO 4.4 Explain Properties of metallic solid.</p> | <p>Unit - IV Chemical bonding</p> <p>4.1 Indian Chemistry:-Philosophy of atom by Acharya Kanad.</p> <p>4.2 Electronic theory of valency: Assumptions , Chemical bonds: Types and characteristics of electrovalent bond, covalent bond, coordinate bond, hydrogen bond, metallic bond and Intermolecular forces of attraction.</p> <p>4.3 Molecular arrangement in solid, liquid and gases.</p> <p>4.4 Structure of solids: crystalline and amorphous solids ,Properties of metallic solid, Unit cell: simple cubic, body center cubic (BCC) , face centre cubic (FCC), hexagonal close pack crystals.</p> | <p>Simulation, Model Display, Demonstration Chalk and board , PPT, ect</p> |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 5 | <p>TLO 5.1 Describe mechanism of electrolysis of CuSO₄ solution by using Cu and Pt rods</p> <p>TLO 5.2 Solve numerical based on Faraday's first and second law of electrolysis.</p> <p>TLO 5.3 Distinguish between primary and secondary cell</p> <p>TLO 5.4 Describe the phenomenon of the given type of corrosion and its prevention.</p> <p>TLO 5.5 Identify the different factors affecting rate of corrosion for the given type of material.</p> <p>TLO 5.6 Select the protective measures to prevent the corrosion in the given corrosive medium.</p> | <p>Unit - V Electro chemistry and Metal Corrosion, its prevention</p> <p>5.1 Electrolyte- Types of electrolyte, ionization and dissociation, Cathode, Anode, Electrode potential: oxidation and reduction, Mechanism of electrolysis :Electrolysis, Electrochemical series for cations and anions. Mechanism of electrolysis of CuSO₄ solution</p> <p>5.2 Faraday's laws of electrolysis: Faraday's first and second law, relation between electrochemical equivalent and chemical equivalent, Numerical. Applications of electrolysis: Electro-refining of copper and Electroplating.</p> <p>5.3 Difference between primary and secondary cell.</p> <p>5.4 Corrosion: Definition and Types of corrosion Dry corrosion: Mechanism, Types of oxide film, Wet corrosion :Mechanism hydrogen evolution in acidic medium, oxygen absorption in neutral or alkaline medium, Galvanic cell action by Daniel cell.</p> <p>5.5 Factors affecting the rate of corrosion.</p> <p>5.6 Corrosion control: Modification of environment, Use of protective coatings, coating of less active metal like Tin (Tinning), coating of more active metal like Zinc (Galvanizing), Anodic and cathodic protection, Choice of material-using pure metal and using metal alloy</p> | <p>Simulation, Demonstration, Flipped Classroom, Collaborative Learning, Case Study, On-site/Industrial Visit, chalk and board etc.</p> |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 6 | <p>TLO 6.1 Identify the ingredients of the given paints.</p> <p>TLO 6.2 List out salient properties of the given paint and varnish.</p> <p>TLO 6.3 Describe the properties of insulating materials for the given application.</p> <p>TLO 6.4 Differentiate the given types of structural polymers.</p> <p>TLO 6.5 Describe the polymerization process of the given polymer.</p> <p>TLO 6.6 Explain the properties and uses of the given polymer, elastomer and adhesive.</p> <p>TLO 6.7 Describe the application of relevant adhesives required for the given material.</p> <p>TLO 6.8 Suggest the lubricant for various types of machines in industry.</p> <p>TLO 6.9 Select the relevant catalyst for given application.</p> | <p>Unit - VI Engineering Materials and Catalysis</p> <p>6.1 Paints: Purposes of applying paint, Characteristics of paints, Ingredients of paints, Function and examples of each ingredient.</p> <p>6.2 Varnish: Types, Difference between paint and varnishes.</p> <p>6.3 Insulators: Characteristics, Classification, Properties and Application of Glass wool Thermocol.</p> <p>6.4 Polymer and Monomer : Classification on the basis of Molecular structure, on the basis of monomers (homo polymer and copolymer), on the basis of Thermal behavior (Thermoplastics and Thermosetting).</p> <p>6.5 Types Polymerization Reaction, Addition Polymerization, Condensation Polymerization, Synthesis, properties and application of Polyethylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde, Epoxy Resin.</p> <p>6.6 Adhesives: Characteristics, Classification and their uses</p> <p>6.7 Lubricants: Classification, properties and Applications.</p> <p>6.8 Catalysis: Types of catalysis homocatalysis, heterocatalysis.</p> <p>6.9 Catalyst: Types of Catalyst Positive, Negative and Auto-catalyst, Catalytic Promoter and Catalytic inhibitor, Industrial application of catalyst.</p> | <p>Simulation, Demonstration, On-site Visit, Chalk and Board, etc.</p> |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------|----------------|--------------|
| LLO 1.1 Use Vernier caliper to : Measure dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 1.2 Estimate the errors in measurement. | 1 | Measurements of dimensions of given object by Vernier caliper. | 2 | CO1 |
| LLO 2.1 Use Micrometer Screw gauge to: Measure dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 2.2 Estimate the errors in measurement. | 2 | Measurements of dimensions of given objects by micrometer screw gauge. | 2 | CO1 |
| LLO 3.1 Apply Ohm's law to solve circuit problems. | 3 | Determination of resistance by Ohm's law. | 2 | CO2 |
| LLO 4.1 Determine the specific resistance of given wire. | 4 | Determination of specific resistance of given wire. | 2 | CO2 |
| LLO 5.1 Verify law of series connection of resistors. | 5 | Determination of equivalent resistance in series connection of resistors. | 2 | CO2 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------|----------------|--------------|
| LLO 6.1 Verify law of parallel connection of resistors. | 6 | Determination of equivalent resistance in parallel connection of resistors. | 2 | CO2 |
| LLO 7.1 Use magnetic compass to draw the magnetic lines of forces of magnet of different shapes and determine neutral points. | 7 | Determination of neutral points by magnetic compass. | 2 | CO2 |
| LLO 8.1 Use P -N junction diode to draw forward bias and reverse bias I-V characteristics LLO 8.2 Find out static and dynamic resistance of given P N junction diode | 8 | Determination of static and dynamic resistance of given P N junction diode. | 2 | CO2 |
| LLO 9.1 Determine forbidden energy band gap in semiconductors | 9 | Determination of forbidden energy band gap in semiconductors. | 2 | CO2 |
| LLO 10.1 Use Joule's calorimeter to determine Joule's mechanical equivalent of heat | 10 | Determination of Joule's mechanical equivalent of heat by Joule's law. | 2 | CO3 |
| LLO 11.1 Determine the pressure-volume relation using Boyle's law | 11 | Determination of pressure-volume relation using Boyle's law. | 2 | CO3 |
| LLO 12.1 Use Newton's law of cooling to determine the rate of heat loss due to convection phenomena | 12 | Determination of the rate of heat loss due to convection by Newton's law of cooling. | 2 | CO3 |
| LLO 13.1 Use Searle's thermal conductivity apparatus to find coefficient of thermal conductivity of given material (Virtual Lab) | 13 | Determination of Coefficient of thermal conductivity. | 2 | CO3 |
| LLO 14.1 Determine the refractive index of glass slab using TIR phenomenon. | 14 | Determination of the refractive index of glass slab. | 2 | CO3 |
| LLO 15.1 Determine the Numerical Aperture (NA) of a given step index optical fibre | 15 | Determination of the Numerical Aperture (NA) of a given step index optical fiber. | 2 | CO3 |
| LLO 16.1 Identify cation in given ionic solutions by performing selective test | 16 | Identification of cation in given ionic solutions. | 2 | CO4 |
| LLO 17.1 Identify anion in given ionic solutions by performing selective test | 17 | Identification of anion in given ionic solutions. | 2 | CO4 |
| LLO 18.1 Identify states of matter of materials by using simulation. by Applying heating and cooling Techniques. LLO 18.2 Relate temperature-pressure diagram | 18 | Identification of states of matter. | 2 | CO4 |
| LLO 19.1 Determine the electrode potential of copper metal. by setting Electrochemical Cell LLO 19.2 Measure electrode potential of Cu Using Voltmeter. LLO 19.3 Measure the cell potential for various conditions. | 19 | Determination of electrode potential of copper. | 2 | CO5 |
| LLO 20.1 Determine the electrode potential of Iron metal. by setting Electrochemical Cell LLO 20.2 Measure electrode potential of Fe Using Voltmeter LLO 20.3 Measure the cell potential for various conditions. | 20 | Determination of electrode potential of Iron metal. | 2 | CO5 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------|----------------|--------------|
| LLO 21.1 Determine the voltage generated from chemical reaction using Daniel Cell. LLO 21.2 Set up Daniel Cell. Prepare Electrolyte Solution LLO 21.3 Measure voltage accurately | 21 | Determination of the voltage generated from chemical reaction using Daniel Cell. | 2 | CO5 |
| LLO 22.1 Prepare Electrolyte Solution of CuSO ₄ of known concentration LLO 22.2 Set up electrolysis apparatus LLO 22.3 Control various parameters of electrolysis. LLO 22.4 Determine electrochemical equivalent of Cu metal using Faraday's first law. | 22 | Determination of electrochemical equivalent of Cu metal using Faraday's first law. | 2 | CO5 |
| LLO 23.1 Prepare Electrolyte Solution of the given metal of known concentration LLO 23.2 Set up electrolysis apparatus LLO 23.3 Control various parameters of electrolysis LLO 23.4 Analyze the data obtained from the experiment. LLO 23.5 Verify Faraday second law | 23 | Determination of equivalent weight of metal using Faraday's second law. | 2 | CO5 |
| LLO 24.1 Prepare corrosive solutions LLO 24.2 Determine the extent of corrosion. | 24 | Preparation of corrosive medium for Aluminium at different temperature. | 2 | CO5 |
| LLO 25.1 Prepare corrosive solutions. LLO 25.2 Determine the extent of corrosion LLO 25.3 Compare the corrosion behaviour of Aluminum at different temperatures. | 25 | Determination of rate of corrosion at different temperatures for Aluminium. | 2 | CO5 |
| LLO 26.1 Determine the effect of temperature on viscosity for given lubricating oil using Redwood viscometer- | 26 | Determination of effect of temperature on viscosity for given lubricating oil using Redwood viscometer-I. | 2 | CO6 |
| LLO 27.1 Determine the steam emulsification number of given lubricating oil. LLO 27.2 Measure the steam flow duration | 27 | Determination of the steam emulsification number of given lubricating oil. | 2 | CO6 |
| LLO 28.1 Calculate the flash and fire point of given lubricating oils using Cleveland open cup apparatus | 28 | Determination of flash and fire point of given lubricating oils using Cleveland open cup apparatus. | 2 | CO6 |
| LLO 29.1 Determine the flash point of given lubricating oil using Abel's closed cup apparatus. | 29 | Determination of flash point of given lubricating oil using Abel's closed cup apparatus. | 2 | CO6 |
| LLO 30.1 Determine thinner content in oil paint. using electric oven | 30 | Determination of thinner content in oil paint. | 2 | CO6 |

Note :

i. A suggestive list of practical LLOs is given in the table, more such practical LLOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more for physics and minimum 12 or more for chemistry practical LLOs need to be performed, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. ii. Hence, the 'Process' and 'Product' related skills associated with each LLOs of the laboratory work are to be assessed according to a suggested sample of Performance Indicators (Weightage in %) as follows: 1) Preparation of experimental set up 20% 2) Setting and operation 20% 3) Safety measures 10% 4) Observations and Recording 10% 5) Interpretation of result and Conclusion 20% 6) Answer to sample questions 10% 7) Submission of report in time 10%.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Series and parallel resistances: Prepare models for combination of series and parallel resistances.
- Magnetic flux: Prepare models to demonstrate magnetic lines of forces of different types of magnet.
- Vernier Calipers: Prepare prototype vernier caliper of desired least count using card sheet.
- Conductivity: Collect different materials such as metal, plastics, glass etc. and prepare models.
- Gas laws: Prepare models to demonstrate Boyle's laws, Charles's Law and Gay Lussac's law using household objects.
- Carbon resistors: Determine the resistance and tolerance of carbon resistors using color codes and measure values.
- Thermal conductivity: Take different metallic plates of various metals and calculate rate of flow of heat.
- Temperature sensor : Use Temperature sensor IC LM 35 to measure temperature of given body in various temperature scales
- Mobile applications : Use mobile applications for measurements of different physical quantities.
- Optical Fiber and TIR: Prepare model to demonstrate total internal reflection and the propagation of light.
- Convert given galvanometer into ammeter of desired range.
- Convert given galvanometer into voltmeter of desired range.
- LDR: Use Light dependent resistor for measuring the intensity of light.
- Types of bonds: Prepare chart and models displaying different types of bonds with examples.
- Prepare a chart for showing different types of bonds or molecules.
- Crystal Structure: Prepare Models of SC, FCC, HCP, BCC.
- Ionization: Prepare chart displaying ionization phenomenon.
- Corrosion-Prepare Chart displaying images of observed corrosion processes in the surrounding.
- Adhesives: Prepare chart or model to demonstrate the applications of various adhesives.
- Polymer: Collect the samples of different polymers and list their uses.
- Collect information based on market survey of different Polymer and compare the following points. i) Structure ii) Properties.
- Collect information by library survey regarding engineering material used in various industries.

Assignment

- Convert the units of a given physical quantity from one system of units to another.
- Measure room temperature of hot baths / bodies by using mercury thermometer and convert it into different scales.
- Prepare a chart to summarize units and measurements
- Enlist information like band gap, material used, dimension etc about different semiconductor devices.
- Give details about the explanation of concept like electrostatics, magnetic domain, current electricity.
- Demonstrate the variation of angle of refraction with respect to refractive index using online tools.
- Use a digital vernier caliper and micrometer screw gauge for measurements. (lab- based).
- Applications of optical fibers in civil, mechanical, electrical engineering etc.
- Applications of semiconductors in civil, mechanical, electrical engineering etc.
- Explain covalent bond, ionic bond, coordinate bond, hydrogen bond, intermolecular forces
- Draw Crystal structures of SC, BCC, FCC, HCP.
- Distinguish between paints and varnishes.
- Solve numerical based on Faraday's first and second law of electrolysis.
- Enlist various Adhesives with properties and applications.
- Compare between Thermoplastics and Thermosetting.
- State properties and applications thermocol and glass wool.
- Differentiate the given types of structural polymers and list out their applications.
- Demonstrate Mechanism of wet corrosion by waterline corrosion.
- Prepare chart showing mechanism of electrolysis of CuSO₄ solution by using Cu and Pt electrodes.
- Write properties and applications of solid, semisolid and liquid lubricant.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|------------------------------------------|---------------------|
|-------|------------------------------------------|---------------------|

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 1 | Vernier Calipers: Range : 0-150mm , Resolution: 0.1mm | 1 |
| 2 | Micrometer screw gauge : Range : 0-25mm, Resolution: 0.01mm, Accuracy ± 0.02 mm or better | 2 |
| 3 | Digital multimeter : 3 1/2 digit display, 9999 counts, digital multimeter measures: Vac, Vdc (1000V max) , DC A, AC A(10 amp max), Resistance (0 - 100 MOhm | 3,4,5,6 |
| 4 | Resistance Box: 4 decade ranges from 1 ohm to 1K, accuracy 0.1 % - 1 % | 3,4,5,6 |
| 5 | Battery eliminator : 0- 12 V ,2A | 3,4,5,6,8,9,10,12 |
| 6 | Boyle's apparatus: U tube manometer , barometer | 11 |
| 7 | Joule's calorimeter : well insulated "mechanical equivalent of heat apparatus" in wooden box, , digital / analog thermometer, | 10,12 |
| 8 | Electronic balance, with the scale range of 0.001g to 500gm pan size 100 mm; response time 3-5 sec.: power requirement 90-250 V, 10 watt | 19,20,21,22,23,24,25,30 |
| 9 | Electric oven inner size 18"x18"x18"; temperature range 100 to 2500 C. with the capacity of 40 lt. | 30 |
| 10 | Ammeter 0-2 amp voltmeter-0-5v DC | 19,20,21,22,23 |
| 11 | Redwood viscometer-I | 26 |
| 12 | Cleveland open cup apparatus | 28 |
| 13 | Abel's close cup apparatus | 29 |

IX. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|-------------------------------------------------------|-------------|----------------|-----------|-----------|-----------|-------------|
| 1 | I | Units and Measurements | CO1 | 7 | 2 | 3 | 4 | 9 |
| 2 | II | Electricity, Magnetism and Semiconductors | CO2 | 13 | 3 | 5 | 6 | 14 |
| 3 | III | Thermometry and Fiber Optics | CO3 | 10 | 2 | 4 | 6 | 12 |
| 4 | IV | Chemical bonding | CO4 | 6 | 2 | 3 | 4 | 9 |
| 5 | V | Electro chemistry and Metal Corrosion, its prevention | CO5 | 12 | 3 | 4 | 5 | 12 |
| 6 | VI | Engineering Materials and Catalysis | CO6 | 12 | 3 | 5 | 6 | 14 |
| Grand Total | | | | 60 | 15 | 24 | 31 | 70 |

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two unit tests of 30 marks (Physics 15 marks, Chemistry-15 marks) and average of two unit tests.
- For laboratory learning 50 marks (Physics 25 marks, Chemistry-25 marks).

Summative Assessment (Assessment of Learning)

- End semester assessment of 50 marks for laboratory learning (Physics 25 marks, Chemistry-25 marks).
- End semester assessment of 70 marks through online MCQ examination.

XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|-----------------------|----------------------------------------------|-----------------------|---------------------------------------|------------------------|------------------------------------------------------------------------|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 3 | 1 | | 2 | 1 | 1 | 1 | | | |
| CO2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | | | |
| CO3 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | | | |
| CO4 | 3 | 2 | | | 2 | | 1 | | | |
| CO5 | 3 | 2 | 1 | 1 | 2 | | 1 | | | |
| CO6 | 3 | 2 | | | 2 | 1 | 1 | | | |

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher |
|-------|-----------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1 | Narlikar J. V. ;Joshi , A. W. ; Mathur , Anuradha ; et al | Physics Textbook Part I - Class XI | National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083 |
| 2 | Narlikar, J.V.;Joshi , A. W. ; Mathur , Anuradha ; et al | Physics Textbook Part II - Class XI | National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660 |
| 3 | Narlikar J.V.;Joshi , A. W. ; Ghatak A.K. et al | Physics Textbook Part I - Class XII | National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314 |
| 4 | Narlikar, J.V.;Joshi , A. W. ; Ghatak A.K. et al | Physics Textbook Part II - Class XII | National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713 |
| 5 | Haliday, David; Resnik, Robert and Walker, Jearl | Fundamentals of Physics | John Wiley & sons, Hoboken, USA, 2014 ISBN : 812650823X |
| 6 | Jain and Jain | Engineering Chemistry | National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083 |
| 7 | Dara S. S. | Engineering Chemistry | National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660 |
| 8 | Bagotsky V.S. | Fundamental of electrochemistry | National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314 |
| 9 | Jain and Jain | Engineering Chemistry | National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713 |
| 10 | Aryabhata. | The Surya Siddhanta | Baptist Mission press ,Calcutta |
| 11 | Steeramula Rajeswara Sarma | The Archaic And The Exotic : Studies In The History Of Indian Astronomical Instruments | Published by Manohar Book Service, 2008 ISBN 10: 8173045712 / ISBN 13: 9788173045714 |

| Sr.No | Author | Title | Publisher |
|-------|---------------------------------|-----------------------------------|------------------------------------------------------------------------------|
| 12 | Anju Rawlley, Devdatta V. Saraf | Applied Chemistry with Lab Manual | Khanna Book Publishing Co. (P) Ltd. New Delhi, 2021, ISBN- 978-93-91505-44-8 |
| 13 | Dr. Hussain Jeevakhan | Applied Physics - II | Khanna Book Publishing, (2021), ISBN: 978-93-91505-57-8 |

XIII . LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| 1 | www.sciencejoywagon.com/physicszone | Electricity, Magnetism and Semiconductors , basic of fiber optics |
| 2 | https://phet.colorado.edu | Electricity, Magnetism and Semiconductors , Thermometry and basic of fiber optics |
| 3 | www.physicsclassroom.com | concepts of basic physics |
| 4 | http://nptel.ac.in/course.php?disciplineId=104 | concepts of basic physics |
| 5 | http://hperphysics.phy-astr.gsu.edu/hbase/hph.html | concepts of basic physics |
| 6 | https://www.youtube.com/results?search_query=amruta+university+physics+expts | concepts of basic physics |
| 7 | k. https://www.youtube.com/results?search_query=physics+class+11+chapter+1 | concepts of basic physics |
| 8 | l. https://www.youtube.com/watch?v=zRGh9_a1J7s | concepts of basic physics |
| 9 | https://iksindia.org | IKS physics |
| 10 | www.chem1.com | Chemistry instruction and education |
| 11 | ww.onlinelibrary.wiley.com | Materials and corrosion |
| 12 | www.rsc.org | Catalysis |
| 13 | www.chemcollective.org | Virtual Labs, simulation |
| 14 | https://www.ancient-origins.net/history-famous-people/indian-sage-acharya-kanad-001399 | IKS Philosophy of atom by Acharya Kanad. |
| 15 | https://phet.colorado.edu/en/simulations/filter?subjects=chemistry&type=html,prototype | Identify states of matter of materials by using simulation. |