Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
MA0U10A	LINEAR ALGEBRA AND CALCULUS	BSC	3	1	0	4	2020

i) COURSE OVERVIEW:

This course introduces students to some basic mathematical ideas and tools which are at the core of any engineering course. A brief course in Linear Algebra familiarises students with some basic techniques in matrix theory which are essential for analysing linear systems. The calculus of functions of one or more variables taught in this course are useful in modelling and analysing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Solve systems of linear equations.	Apply
CO 2	Compute maxima and minima using partial derivatives.	Evaluate
CO 3	Compute areas and volumes of geometrical shapes using multiple integrals.	Evaluate
CO 4	Identify the convergence or divergence of an infinite series.	Evaluate
CO 5	Determine the Taylor and Fourier series expansion of functions and learn their applications.	Apply

iii) SYLLABUS

Basics of Linear Algebra – Solution of systems of linear equations, row echelon form, rank, eigen values and eigen vectors, diagonalization of matrices, orthogonal transformation, quadratic forms.

Partial Differentiation and Applications – Limit and continuity of functions of two or more variables, partial derivatives, chain rule, total derivatives, maxima and minima.

Multiple Integrals – Double and triple integrals, double integrals over rectangular and non-rectangular regions, changing the order of integration, finding areas and volume, mass and centre of gravity.

Infinite series - Convergence and divergence of Infinite series, geometric series and p-series, test of convergence, Alternating series, absolute and conditional convergence

Taylor series, Binomial series and series representation of exponential, trigonometric, logarithmic functions-Fourier Series- Euler's formulas, Fourier sine and cosine series, Half range expansions.

iv) a) TEXT BOOKS

1) H. Anton, I. Biven, S. Davis, *Calculus*, Wiley, 10th Edition, 2015.
2) Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 10thEdition, 2016.

b) REFERENCES

1) J. Stewart, *Essential Calculus*, Cengage,2ndEdition,2017.
2) G. B. Thomas and R. L. Finney, *Calculus and Analytic geometry*,9thEdition, Pearson, Reprint,2002.
3) Peter V. O'Neil,*Advanced Engineering Mathematics*, Cengage, 7th Edition 2012.

v) COURSE PLAN

Module	Contents	No. of hours
I	Linear Algebra: Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix, fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof) Eigen values and eigen vectors. Diagonalization of matrices, orthogonal transformation, quadratic forms and their canonical forms.	**12**
II	Multivariable calculus-Differentiation: Concept of limit and continuity of functions of two variables, partial derivatives, Differentials, Local Linear approximations, chain rule, total derivative, Relative maxima and minima Absolute maxima and minima on closed and bounded set.	**12**
III	Multivariable calculus-Integration: Double integrals (Cartesian), reversing the order of integration, change of coordinates (Cartesian to polar), finding areas and volume using double integrals, mass and centre of gravity of inhomogeneous laminas using double integral. Triple integrals, volume calculated as triple integral, triple integral in cylindrical and spherical coordinates (computations involving spheres, cylinders).	**12**
IV	Sequences and Series: Convergence of sequences and series, convergence of geometric series and p-series(without proof), test of convergence (comparison, ratio and root tests without proof); Alternating series and Leibnitz test, absolute and conditional convergence.	**12**
V	Series representation of functions: Taylor series (without proof, assuming the possibility of power series expansion in appropriate domains), Binomial series and series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence); Fourier series, Euler formulas Convergence of Fourier series (without proof), half range sine and cosine series, Parseval's theorem (without proof).	**12**
	Total hours	**60**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CY0U10A	ENGINEERING CHEMISTRY	BSC	3	1	0	4	2020

i) COURSE OVERVIEW:

The aim of the engineering chemistry program is to expose the students to basic concepts of chemistry and its industrial as well as engineering applications. It also let the students to familiarize with different topics such as new-generation engineering materials, storage-devices, different instrumental methods etc.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Explain the basic concepts of electrochemistry and corrosion toexploreits industrial functions in various engineeringfields.	Understand
CO 2	ExplainthevariousspectroscopictechniqueslikeUV-Visible,IR,NMRand itsapplications.	Understand
CO 3	Apply the knowledge of analytical method for characterizing achemical mixtureoracompound.UnderstandthebasicconceptofSEMforsurfacecharacterisation ofnanomaterials.	Apply
CO 4	Apply the knowledge of conducting polymers, isomerism andadvancedpolymers inengineering.	Apply
CO 5	Explain various types of water treatment methods used in industryand domesticpurposes.	Understand

iii) SYLLABUS

Electrochemistry – Cell prototypes, Nernst equation and its uses, different types of cells and applications of electrochemical series. Fundamentals of corrosion and its prevention.

Basics of Spectroscopy – Principles and applications of UV-Vis, IR and NMR spectroscopy, instrumentation of UV-Vis spectroscope, colorimetry, MRI technique.

Instrumental methods in chemistry and Engineering materials – TGA, DTA, and chromatography techniques; Basics of polymer chemistry, BS, ABS and Kevlar and conducting polymers, Classifications of nanomaterials, synthesis, SEM, CNT, graphene.

Stereochemistry and polymer chemistry– Different types of isomers with examples; Notations; Conformational analysis, Types of polymers, ABS, Kevlar and applications. Polyaniline and Polypyrrole - preparation properties and applications, OLED.

Water Technology–Types of hard water and its elimination, DO, BOD and COD and its significance, disinfection of water, reverse osmosis, sewage water treatment.

iv) (a) TEXT BOOKS

1) D. Harvey, N. Rutledge, *Industrial Chemistry*, ETP, first edition, 2018. ISBN:9781788820554

2) P.W. Atkins, JdePaula, *Atkins' Physical Chemistry*, Oxford University Press, 11'th edition 2014. ISBN:9780199697403

3) M. Arif, A. Fernandez, K. P. Nair, *Engineering Chemistry*, first edition, Owl Books,2015.

4) S. Chawla, *A text book of Engineering Chemistry*, second edition, DhanpatRai & Co.2013.

(b) REFERENCES

1) C. N. Banwell, E. M. Mc Cash, Fundamentals of Molecular Spectroscopy, McGraw-Hill,4th edition, 2001. ISBN:9780074620250

2) H. H. Willard, L. L. Merritt, Instrumental Methods of Analysis, CBS Publishers, 7thedition, 2005. ISBN:9788123909431

3) A. J. Peacock, A. Calhoun, C. Hanser, Polymer Chemistry: Properties and Application, Verlag GmbH & Company KG, 2012. ISBN:9783446433434

4) C. Binns, Introduction to Nanoscience and Nanotechnology, Wiley, 2010.V ISBN:9780471776475

v) COURSE PLAN

Module	Contents	No. of hours
I	**Electrochemistry and corrosion:** Introduction – Differences between electrolyticandelectrochemicalcells-Danielcell-redoxreactions-cell representation. Different types of electrodes (brief) -Reference electrodes- SHE - Calomel electrode - Glass Electrode –Construction and Working. Single electrode potential–definition- Helmholtz electrical double layer - Determination of E^0 using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF -Nernst Equation – Derivation – single electrode and cell (Numericals) –Application - Variation of EMF with temperature. Potentiometric titration-Introduction-Redox titration only.Lithiumion cell - construction and working. Conductivity- Measurement of conductivity of a solution(Numericals). Corrosion-Electrochemical corrosion –mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.	**12**

II	**Spectroscopic Techniques and applications:** Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels -Beer Lambert's law(Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions– Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications. IR-Spectroscopy–Principle-Number of vibrational modes- Vibrational energy states of a diatomic molecule and -Determination offorce constant of diatomic molecule (Numericals)–Applications. 1H NMR spectroscopy – Principle - Relation between field strength and frequency- chemical shift - spin-spin splitting (spectral problems)-coupling constant (definition) - applications of NMR- including MRI(brief).	**12**
III	**Instrumental Methods and Nanomaterials:** Thermal analysis–TGA-Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation(block diagram) and applications - DTA of $CaC_2O_4.H_2O$. Chromatographic methods-Basic principles and applications of column and TLC- Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications. Nanomaterials - Definition - Classification - Chemical methods of preparation -Hydrolysis and Reduction - Applications of nanomaterials – Surface characterisation -SEM – Principle and instrumentation(block diagram).	**12**
IV	**Stereochemistry and Polymer Chemistry**: Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Znotations). R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples. Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane. Copolymers-Definition-Types-Random, Alternating, Block and Graft copolymers-ABS-preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers -Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.	**12**

V	Superconductivity & Photonics: Superconducting phenomena, Meissner effect and perfect diamagnetism, types of superconductors-Type I and Type II, BCS Theory (Qualitative), high temperature superconductors-applications of super conductivity Introduction to photonics-photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V characteristics, Optic fibre-principle of propagation of light, types of fibres-step index and graded index fibres, numerical aperture –derivation, fibre optic communication system (block diagram), industrial, medical and technological applications of optical fibre, fibre optic sensors-intensity modulated and phase modulated sensors.	**12**
	Total hours	**60**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U10B	ENGINEERING GRAPHICS	ESC	2	0	2	3	2020

i) COURSE OVERVIEW:

Aim of the course is to enable the student to effectively perform technical communication through graphical representation as per global standards. The student will be able to apply the principles of projection and will be introduced to the fundamentals of Computer Aided Drawing (CAD).

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Construct the orthographic projection of points and lines located in different quadrants.	Apply
CO 2	Prepare multiview orthographic projection of solids by visualizing them in different positions.	Apply
CO 3	Construct sectional views and develop surfaces of a given solid.	Apply
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projection to visualize objects in three dimensions.	Apply
CO 5	Convert pictorial views into orthographic views.	Apply
CO 6	Prepare multiview projection and solid models of objects using CAD tools.	Apply

iii) SYLLABUS

Introduction - Relevance of technical drawing in engineering field, BIS code of practice for technical drawing.

Orthographic projection - Projection of points and lines in different quadrants, traces of line. Projection of solids in simple position, axis inclined to one reference plane and axis inclined to both reference planes.

Sections of Solids - Sections of solids cut by different section planes, true shape of the sections

Development of Surfaces - Development of surfaces of solids and solids cut by different section planes.

Isometric Projection - Isometric view and projection of solids and their combinations.

Perspective Projection - Perspective projection of solids with axis perpendicular to the ground plane and axis perpendicular to picture plane.

Conversion of Pictorial Views - Conversion of pictorial views into orthographic views.

Introduction to Computer Aided Drawing - Creating 2D drawing and 3D models of various components using suitable modelling software.

iv) (a) TEXT BOOKS

1) Bhatt N.D, *Engineering Drawing*, Charotar Publishing House Pvt. Ltd, 53rd Edition, 2019.
2) John K.C., *Engineering Graphics*, Prentice Hall India Publishers, 1st Edition, 2009.
3) C. M.Agrawal, BasantAgrawal, *Engineering Graphics*, Tata McGraw-Hill, 1stEdition, 2012.

(b) REFERENCES

1) G. S. Phull, H. S.Sandhu, *Engineering Graphics*, John Wiley & Sons IncPvt. Ltd, 1st Edition, 2014.
2) P. I. Varghese, *Engineering Graphics*, V.I.P. Publishers,21st Edition, 2010.
3) Anil Kumar K.N., *Engineering Graphics*, Adhyuth Narayan Publishers, 4th Edition, 2009.

v) COURSE PLAN

Module	Contents	No. of hours
I	Introduction: Relevance of technical drawing in engineering field. Types of lines, dimensioning, BIS code of practice for technical drawing. Orthographic projection of points and lines: Projection of points in different quadrants, projection of straight lines inclined to one plane and inclined to both planes. Trace of line, inclination of lines with reference planes, true length of line inclined to both the reference planes.	**8**
II	Orthographic projection of solids: Projection of simple solids such as triangular, rectangle, square, pentagonal and hexagonal prisms, pyramids, cone and cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.	**9**
III	Sections of Solids: Sections of prisms, pyramids, cone, cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Locating the section plane when the true shape of the section is given. Development of surfaces: Development of surfaces of the above solids and solids cut by different section planes. Finding the shortest distance between two points on the surface.	**9**
IV	Isometric projection: Isometric view and projection of prisms, pyramids, cone, cylinder, frustum of pyramid, frustum of cone, sphere, hemisphere and their combinations.	**6**
V	Perspective projection: Perspective projection of prisms and pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane. Conversion of pictorial view: Conversion of pictorial view into orthographic views.	**5**

SECTION B (*To be conducted in CAD Lab*)		
	Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software (Minimum 2 exercises mandatory). Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software (Minimum 2 exercises mandatory).	**8**
	Total hours	**45**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U10D	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	ESC	4	0	0	4	2020

i) COURSE OVERVIEW

This course aims to equip the students with an understanding of the fundamental principles of electrical, electronics and communication engineering.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Apply fundamental circuit laws and principles of electromagnetism to solve simple DC electric circuits and magnetic circuits respectively.	Apply
CO 2	Describe the fundamentals of AC generation to perform simple AC circuit analysis.	Understand
CO 3	Describe the principles of passive components, semiconductor devices and its characteristics.	Understand
CO 4	Explain the working of electronic circuits, instrumentation, radio and cellular communication systems.	Understand

iii) SYLLABUS

Basic concepts of DC circuits: Ohm's Law and Kirchhoff's laws, Star-delta conversion, Analysis of DC circuits, Mesh analysis, Node analysis.

Magnetic Circuits: Basic Terminology, Simple Magnetic circuits, Electromagnetic Induction, Faraday's laws, Lenz's law, Self-inductance and mutual inductance.

Alternating Current fundamentals: Basic definitions, Average, RMS values, AC Circuits, Phasor representation, Analysis of simple AC circuits (R, L, C, RL, RC, RLC Series circuits) Three phase AC systems, Generation of three phase voltages, star and delta connections.

Introduction to Semiconductor devices: Evolution of electronics, Resistors, Capacitors, Inductors PN Junction diodes and Bipolar Junction Transistors.

Basic electronic circuits and instrumentation: DC power supply, Full wave bridge rectifier, Capacitor filter, Simple Zener voltage regulator, Amplifiers, Public Address system and Electronic Equipments.

Introduction to Communication Systems: Evolution of communication systems, Radio communication, Principle of antenna and Mobile communication.

iv) (a) TEXT BOOKS

1) William H. Hayt., Jr., Jack E. Kemmerly, Steven M. Durbin., *Engineering Circuit Analysis*, McGraw-Hill, 8th Edition, 2012.
2) Kothari D. P. and Nagrath I. J., *Basic Electrical Engineering*, Tata McGraw Hill, 2010.

3) Fitzgerald A.E., David Higginbotham E., Arvin Grabel, *Basic Electrical Engineering*, Tata McGraw Hill, 5th Edition,2009.
4) Boylested, R. L. and Nashelsky, L., *Electronic Devices and Circuit Theory*, Pearson Education, 10th Edition, 2009.
5) Wayne Tomasi and Neil Storey, *A Textbook on Basic Communication and Information Engineering*, Pearson, 5th Edition, 2010.

(b) REFERENCES

1) Paul Breeze, *Power Generation Technologies*, Newnes,3rd Edition, 2019.
2) Allan HambleyR., *Electrical Engineering: Principles & Applications*, Pearson Education,7thEdition, 2018.
3) Mittle V. N. and Arvind Mittal, *Basic Electrical Engineering*, McGraw Hill,2ndEdition, 2006.
4) N.N. Bhargava , D.C. Kulshreshtha , S.C. Gupta, *Basic Electronics and Linear Circuits*, Tata McGraw - Hill Education, New Delhi, 2nd Edition, 2014.

v) COURSE PLAN

Module	Contents	No. of hours
I	**DC circuits:** Review of Elementary concepts of DC circuits, Current and Voltage Division Rules, Star-delta conversion (resistive networks only-derivation not required), Numerical problems.	9
	Analysis of DC circuits: Mesh current method, Node voltage method. Solution of network equations by matrix method, Numerical problems.	
	Magnetic Circuits: Review of Magnetic Circuits, Series magnetic circuits with composite materials, Numerical problems.	
II	**Electromagnetic Induction:** Faraday's laws, Lenz's law, statically induced and dynamically induced emfs, Self-inductance and mutual inductance, coefficient of coupling (derivation not required), Numerical Problems.	9
	Alternating Current fundamentals: Generation of alternating voltages, Basic definitions, Average and RMS values of sinusoidal waveforms, Numerical Problems.	
	Power Generating Stations: Solar, Wind, Hydro-electric and Nuclear power stations, Basic concepts with block diagrams only.	

III	**Analysis of AC Circuits:** Transient Analysis of RL circuit, Steady state Analysis of RL circuit, Phasor representation of sinusoidal quantities, Complex forms. **Analysis of simple AC circuits:** Purely resistive, inductive and capacitive circuits; Analysis of RL, RC and RLC series circuits, active, reactive and apparent power. Illustrations using simple example.	**12**
	Three phase AC systems: Generation of three phase voltages, advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents, Power in three phase circuit, Numerical problems.	
IV	**Introduction to Semiconductor devices**	
	Evolution of electronics – Vacuum tubes to nano electronics (In evolutional perspective only)	**1**
	Resistors, Capacitors and Inductors: types, specifications, standard values, colour coding (No constructional features)	**2**
	PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown and Zener breakdown	**2**
	Bipolar Junction Transistors: PNP and NPN structures, principle of operation, relation between current gains in CE, CB and CC Configurations, input and output characteristics of common emitter configuration.	**5**
V	**Basic electronic circuits and instrumentation**	
	Rectifiers and Power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator	**3**
	Amplifiers: Concept of voltage divider biasing, circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, block diagram of Public Address system.	**5**
	Electronic Instrumentation: Block diagram of an electronic instrumentation system, functions of various equipments (multimeter, DSO and function generator)	**2**
VI	**Introduction to Communication Systems**	
	Evolution of communication systems: Telegraphy to 5G	**1**
	Radio communication: Principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver. **Principle of antenna:** Radiation from accelerated charge	**5**
	Mobile communication: Basic principles of cellular communications, principle and block diagram of GSM.	**4**
	Total hours	**60**

Suggested Simulation Assignments for Basic Electronics Engineering

(1) Plot V-I characteristics of Si and Ge diodes on a simulator.
(2) Plot Input and Output characteristics of BJT on a simulator.
(3) Implementation of half wave and full wave rectifiers.
(4) Simulation of RC coupled amplifier with the design supplied.
(5) Generation of AM signal.

Note: The simulations can be done on open tools such as Proteus, QUCS, KiCad, GNURadio or similar software to augment the understanding.

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
HS0U10A	LIFE SKILLS	HSC	2	0	2	-	2020

i) COURSE OVERVIEW:

This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underly personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Identify different skills required in personal and professional life.	Understand
CO 2	Apply well defined techniques to cope with emotions and stress and to provide an awareness of the self.	Apply
CO 3	Apply appropriate thinking tools and techniques for creative problem solving.	Apply
CO 4	Explain the importance of teamwork, team performance and team conflicts.	Understand
CO 5	Explain the basic mechanics of effective communication and demonstrate these through presentations.	Understand

iii) SYLLABUS

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO, Life skills for professionals, personality development, IQ, EQ, and SQ.

Self-awareness & Stress Management: Definition and need for self-awareness; Tools and techniques of SA, Stress, reasons and effects, the four A's of stress management, Techniques and Approaches, PATH method and relaxation techniques.

Critical Thinking & Problem Solving: Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats, Mind Mapping & Analytical Thinking.

Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

Leadership Skills: Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, Leadership Grid & leadership Formulation**.**

iv) (a) TEXT BOOKS

1. Remesh S., Vishnu R. G., *Life Skills for Engineers*, Ridhima Publications, 1st Edition,2016.

2. *Life Skills for Engineers*, Complied by ICT Academy of Kerala, McGraw Hill Education (India) Private Ltd., 2016.

(b) REFERENCES

1. Shiv Khera, *You Can Win*, Macmillan Books, NewYork,2003.
2. Barun K. Mitra, *Personality Development & Soft Skills*, Oxford Publishers, Third impression, 2017.
3. Caruso, D. R. and Salovey P, *The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership*, John Wiley & Sons,2004.
4. Larry James, *The First Book of Life Skills*; Embassy Books, 1st Edition,2016.

v) COURSE PLAN

Module	Contents	No. of hours
I	**Overview of Life Skills**: Meaning and significance of life skills **Life skills identified by WHO**: Self- awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion. **Life skills for professionals:** positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ.	**6**
	Activities based on Creative thinking tools	
II	**Self-awareness**: Definition, need for self-awareness; Coping With Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback. **Stress Management**: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion-oriented, acceptance- oriented, resilience, Gratitude Training, Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques. **Morals, Values and Ethics**: Integrity, Civic Virtue, Respect for Others, Living Peacefully. Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Cooperation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.	**6**
	Case studies on Morals and Ethics	
III	**21st century skills**: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral	

	Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence. **Steps in problem solving**: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking Thinking Hats, Mind Mapping, Forced Connections.	**6**
	Problem solving using Mind map/Six Thinking Hats	
IV	**Group and Team Dynamics**: Introduction to Groups: Composition, formation, Cycle, thinking, clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.	**6**
	Group Discussion: Differences between group discussion and debate; Ensuring success in group discussions.	
V	**Leadership**: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.	**6**
	Presentation **Presentation Skills:** Oral presentation and public speaking skills; business presentations	
	Total hours	**30**

Life skills- Practical part- Total 15 hours

1. Activities based on Creative thinking tools - 3 hours
2. Case studies on Morals and Ethics - 3 hours
3. Problem solving using Mind map/Six Thinking Hats - 3 hours
4. Group Discussion: Differences between group discussion and debate; Ensuring success in group discussions - 3 hours
5. Oral presentation and public speaking skills; business presentations - 3 hours

vi) CONTINUOUS ASSESSMENT EVALUATION PATTERN

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hrs

Continuous Internal Evaluation : 50 marks
Evaluation : 50 marks
Attendance : 10 marks
Regular assessment : 15 marks
Series test (one test only, should include first three modules) : 25 marks

vii) CONTINUOUS ASSESSMENT EXAMINATION PATTERN

Group Discussion (Marks: 9)

Create groups of about 6 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation are as follows:

- Communication Skills : 3 marks
- Subject Clarity : 2marks
- Group Dynamics : 2 marks
- Behaviours & Mannerisms :2 marks

Presentation Skills (Marks: 6)

Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation are as follows:

- Communication Skills : 2 marks
- Platform skills : 2 marks
- Subject Clarity/Knowledge : 2 marks

viii) END SEMESTER EXAMINATION PATTERN

Evaluation

Total Marks: 50

Time: 2 hrs

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CY0U18A	ENGINEERING CHEMISTRY LAB	BSC	0	0	2	1	2020

i) COURSE OVERVIEW:

This course is designed to familiarize with the basic experiments in industrial chemistry and to accustom the students with the handling and analysing chemicals and standard laboratory equipments.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Apply different techniques of quantitative chemical analysis to generate basic experimental skills.	Apply
CO 2	Explain the use of spectroscopic techniques for analysing and interpreting the IR spectra and NMR spectra of some organic compounds.	Understand
CO 3	Use instrumental techniques for chemical analysis.	Apply
CO 4	Organize scientific experiments as a team and analyse the results of such experiments.	Evaluate
CO 5	Create an experiment by themselves and applying them to real world problems and data.	Create

iii) SYLLABUS

1. Estimation of total hardness of water by EDTA method.
2. Analysis of IR and 1H NMR spectra of organic compounds.
3. Determination of wavelength of absorption maximum and colorimetric estimation of Fe3+ in solution.
4. Determination of molar absorptivity of a compound.
5. Estimation of chloride in water by argentometric method.
6. Calibration of pH meter and determination of pH of a solution.
7. Potentiometric titration: Acid – base titration.
8. Estimation of dissolved oxygen in water by Winkler's method.

iv) REFERENCES

1) Mohapatra R. K., *Engineering Chemistry with Laboratory Experiments*, PHI Learning, New Delhi, 1st Edition, 2015.
2) George S. C., Jose R., *Lab Manual of Engineering Chemistry*, S. Chand & Company Pvt Ltd, New Delhi, 1st Edition, 2019.
3) Slowinski E., Wolsey W. C., *Chemical Principles in the Laboratory*, Cengage Learning, New Delhi, 11th Edition, 2008.

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U18B	ELECTRICAL AND ELECTRONICS WORKSHOP	ESC	0	0	2	1	2020

i) COURSE OVERVIEW:

- To expose the students to the commonly used accessories and components in electrical installations and to provide hands on experience of wiring of electrical circuits.
- To enable the students to familiarize, identify, construct, and debug the electronic components, devices and circuits. It also enables the students engineering skills by soldering practices of electronic circuits.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Identify electrical accessories, protective elements and their standard symbols and the tools used for electrical wiring.	Remember
CO 2	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings.	Apply
CO 3	Identify different types of batteries and different types of earthing.	Remember
CO 4	Explain the working and purpose of fuse, MCB, ELCB etc. and solar powered circuit.	Understand
CO 5	Identify and test various electronic components.	Understand
CO 6	Draw circuit schematics with EDA tools.	Apply
CO 7	Assemble and test electronic circuits on boards.	Apply

iii) SYLLABUS

Familiarization/Identification of electrical accessories and protective elements, wiring of circuits using PVC conduits, wiring of simple solar chargeable circuit and determination of its characteristics, Demonstration of power distribution arrangement and earthing schemes, Identification of different types of batteries.

Familiarization of electronic components, drawing of electronic circuit diagrams, Familiarization of testing instruments, testing of electronic components, Inter-connection methods, soldering practice, Printed circuit boards, Assembling of electronic circuits in PCB.

iv) REFERENCES

1) Singh R. P., *Electrical Workshop: Safety, Commissioning, Maintenance & Testing of*

Electrical Equipment, Dream tech Press, 3rd Edition, 2019.
2) John H. Watt, *Terrell Croft American Electricians' Handbook: A Reference Book for the Practical Electrical Manual*, McGraw-Hill, 9th Edition, 2002.
3) Navas K. A., *Electronics Lab Manual*, Volume 1, PHI Learning Private Limited, 5th Edition, 2015.

v) COURSE PLAN

Experiment No.	PART I ELECTRICAL WORKSHOP List of exercises/experiments	No. of hours
1	Familiarization/Identification of electrical components with specification (Functionality, type, size, colour coding, symbol, cost etc. of Wires, Cables, Connectors, Fuses, MCB, ELCB, Switches and other electrical installation equipments with ratings).	**2**
2	Wiring of one lamp controlled by one SPST switch and a plug socket (PVC conduit wiring).	**2**
3	Wiring of light/fan circuit controlled by two SPDT switches (Staircase wiring).	**2**
4	Wiring of a light circuit and a power circuit for domestic applications.	**2**
5	Wiring of simple solar chargeable circuit and determination of its characteristics.	**2**
6	Demonstration of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.	**2**
7	Understand the safety precautions to be observed in the workshop and learn about safety procedures of first aid in case of electrical hazards.	**2**
8	Video demonstration of Pipe and Plate Earthing Schemes.	**1**
	Total hours	**15**
	PART II **ELECTRONICS WORKSHOP** **List of Exercises / Experiments**	
1	Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. (Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.))	**2**
2	Drawing of electronic circuit diagrams using standard symbols and introduction to EDA tools, Interpret data sheets of discrete components and IC's, Estimation and costing.	**2**
3	Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.]	**2**

4	Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter]	**2**
5	Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general-purpose PCB, Crimping.]	**2**
6	Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design (using Proteus) and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]	**2**
7	Assembling of electronic circuit/system on general purpose PCB, test and show the functioning Fixed voltage power supply with transformer, rectifier diode, capacitor filter, Zener/IC regulator Square wave generation using IC 555 timer in IC base.	**3**
	Total hours	**15**