

SCHEME OF INSTRUCTION**B.E. (Biomedical Engineering)****I - SEMESTER***With effect from the Academic year 2018-2019*

S. No	Course Code	Course Title	Scheme of Examination		L	T	P	Hrs/Wk	Credits
			CIE	SEE					
1.	MT 101 BS	Engineering Mathematics- I	30	70	3	1	0	4	4
2.	CH 101 BS	Applied Chemistry	30	70	3	1	0	4	4
3.	EE 101 ES	Basic Electrical Engineering	30	70	3	1	0	4	4
4.	EC 101 ES	Electronic Devices and Circuits	30	70	3	0	0	3	3
5.	EG 101 HS	English	30	70	2	0	0	2	2
PRACTICALS									
6.	EC 151 ES	Electronic Devices and Circuits Lab	25	50	0	0	2	2	1
7.	CH 151 BS	Applied Chemistry Lab	25	50	0	0	3	3	1.5
8.	EG 151 HS	English Lab	25	50	0	0	2	2	1
Total			225	500	14	03	07	24	20.5

MT 101 BS

ENGINEERING MATHEMATICS – I
(Common to all branches)

Instruction	(3L+1T) Periods per week
Duration of University Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

- To introduce the concepts of sequences, series and their properties To Study Fourier Series and its applications.
- To introduce the concepts of functions of several variables and multiple integrals To study vector differential and integral calculus

Course Outcomes: The students will able to

1. Find the nature of sequences and series
2. Expand functions as a Fourier Series.
3. Use the knowledge of multiple integrals in finding the area and volume of any region bounded by given curves
4. Apply this knowledge to solve the curriculum problems

UNIT-I Sequences and Series:

Sequences, Series, General properties of series, Series of positive terms, Comparison tests, tests of Convergence D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence ; Fourier Series, Half range Sine and Cosine Series, Parseval's theorem.

UNIT-II Calculus of one variable:

Rolle's theorem, Lagrange's , Cauchy's mean value theorems (without proof) Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutives, Evaluation of definite and improper integrals, Beta, Gamma and Error functions.

UNIT-III Multivariable Calculus (Differentiation):

Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian , Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's method of multipliers.

UNIT-IV Multivariable Calculus (Integration):

Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals and applications-areas and volumes.

UNIT-V Vector Calculus:

Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals , Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

Suggested Readings:

1. R.K.Jain & S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition 2014.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9th Edition, , 2012.
3. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
4. G.B.Thomas , Maurice Weir and Joel Hass, *Thomas' Calculus* , Peterson, 12th Edition, 2010.
5. B.V. Ramana, *Higher Engineering Mathematics*, 23rd reprint, 2015.
6. N.P.Bali and M. Goyal, A text book of *Engineering Mathematics*, Laxmi Publications 2010.
7. H.K. Dass, Er. Rajnish Varma, *Higher Engineering Mathematics*, Schand Technical Third Edition.

CH 101 BS

APPLIED CHEMISTRY

Instruction	(3L+1T) Periods per week
Duration of University Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: To provide students with knowledge of engineering chemistry for building technical competence in Industry, Research and Development in the following fields:

- Thermodynamics and Electrochemistry
- Water chemistry and Corrosion
- Molecular Structure and Spectroscopy
- Engineering Materials
- Energy Sources and Nanomaterials

Course Outcomes: The concepts developed in this course will help in quantification of several concepts in chemistry that have been introduced at the 10+2 level. Technology is being increasingly based on the Electronic, Atomic and Molecular level modifications. The course will enable the student to:

1. Analyze microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces.
2. Rationalise bulk properties and processes using thermodynamic considerations.
3. Distinguishes the ranges of electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
4. Gains knowledge in causes of corrosion and its prevention.
5. Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also learns the techniques of softening of hard water and treatment of water for drinking purpose.

UNIT-I WATER CHEMISTRY AND CORROSION:

Water chemistry: Hardness of water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion exchange and Reverse Osmosis methods. Boiler troubles-scales and sludge's formation-causes, effects and prevention. Numerical problems Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by Chlorination.

Corrosion-causes and its effects. Types of corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion and its types. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods- Sacrificial anodic and Impressed current cathodic protection methods. Surface coating methods: Hot dipping-Galvanizing and Tinning.

UNIT-II THERMODYNAMICS AND ELECTROCHEMISTRY:

Thermodynamics: Definition of thermodynamic functions- Enthalpy, Entropy, Free energy and their significance. Variation of free energy change with temperature and pressure. Concept of spontaneity. Criteria of spontaneity in terms of entropy and free energy. Carnot cycle-efficiency of heat engine. Numericals.

Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes-Calomel, Quinhydrone and Glass electrodes. Determination of P^H of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells- Nernst equation and its derivation. Application of Nernst equation to electrode potential and emf of cells. Numericals. Principles and applications of Potentiometric titrations.

UNIT-III MOLECULAR STRUCTURE AND SPECTROSCOPY:

Molecular Orbital Theory. Linear Combination of Atomic Orbitals(LCAO).Molecular Orbital energy level diagrams of diatomic molecules-O₂,N₂ and NO. Crystal field theory, Crystal Field Splitting of d-orbitals of transition metal complexes in Octahedral, Tetrahedral and Square planar geometries. Magnetic properties of complexes.

Basic principles of Spectroscopy and selection rules of Vibrational, Rotational and Electronic Spectroscopy and their applications.

UNIT-IV ENGINEERING MATERIALS:

Polymers: Introduction. Classification of polymers -Plastics, Fibres and Elastomers.

Preparation, properties and engineering applications of the following polymers:

Plastics: PVC and Bakelite

Fibers: Nylon 6:6, and Dacron.

Elastomers: Buna-S and Butyl Rubber.

Conducting polymers: Introduction. Mechanism of conduction in polymers. Intrinsic conducting polymers: Poly-acetylene and poly- aniline. Applications of conducting polymers.

Liquid Crystals: Introduction. Classification of liquid crystals. Thermotropic, Lyotropic liquid crystals. Chemical constitution and liquid crystalline behavior. Nematic, Smectic and Cholestric liquid crystals and their applications.

UNIT-V ENERGY SOURCES AND NANOMATERIALS:

Batteries: Primary batteries-Zn carbon battery. Secondary batteries-Pb- Acid battery and Ni-Cd battery. Lithium-ion batteries- advantages and applications.

Fuel cells: Concept of fuel cells and their advantages. Construction and working of H₂-O₂ and methanol-Oxygen fuel cells.

Solar cells: Concept of solar energy conversion, photovoltaic cells.

Nanomaterials: Introduction. Properties of nanomaterials. Synthesis of nanomaterials-Top down, Bottom up approach and Sol-gel method. Applications of nanomaterials.

Suggested Readings:

1. Jain & Jain, *Engineering chemistry*, Dhanpat Rai publishing Co.,16th Edition.
2. B.L.Tembe,Kamaluddin and M.S.Krishnan, *Engineering Chemistry*(NPTELWeb-book)
3. Prashanth Rath, *Engineering Chemistry*, Cengage Learning.
4. M.J.Sienko and R.A.Plane, *Chemistry: Principles and Applications*, MGH Publishers.
5. B.H.Mahan, *University Chemistry*, Pearson Publishing Co., 4th Edition.
6. C.N. Banwell, *Fundamentals of Molecular Spectroscopy*, TMH

EE 101 ES

BASIC ELECTRICAL ENGINEERING

Instruction	(3L+1T) Periods per week
Duration of University Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

- To understand the fundamentals of DC and AC electrical circuits.
- To understand the working principles of DC motor, DC generator, Transformers and single phase induction motors.
- To understand working principles of protection devices used in electrical circuits.

Course Outcomes: The students will able to

1. Analyze the performance of simple electrical circuits exciting with DC and AC excitations.
2. Apply different theorems to solve complicated electrical circuits to obtain the current, voltage and power.
3. Understand the main components, Characteristics, applications of different DC and AC electrical machines used in industry.
4. Understand the importance of protective devices and their rating used in electrical circuits.

UNIT-I DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

UNIT-II AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III Transformers and 3-ph Induction Motors

Transformers : Electromagnetic induction, Faradays laws, Statically induced emf, Lenz law, BH characteristics, ideal and practical transformer, losses and efficiency, Auto-transformer and three-phase transformer connections.

Three Phase Induction motor: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, squirrel cage IM, slip-ring IM, Applications

UNIT-IV Single-phase induction motor & DC Machines Single-phase induction motor: Construction and principle of operation, Capacitor start & capacitor run motor, applications

DC Generators: Dynamically induced emf, Flemming's Right hand and Left hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications

DC Motors: principle of operation of DC Motor, Types of DC motors, applications

UNIT-V Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Readings:

1. J.B.Gupta, “*Fundamentals of Electrical Engineering and Electronics*” S.K.Kataria & Sons Publications, 2002.
2. J.B.Gupta, “*Utilization of Electric Power and Electric Traction*” S.K.Kataria & Sons Publications, 2010
3. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, “*Basic Elactrical Engineering*” Tata McGraw Hill, Publications, 2009
4. Hughes, “*Electrical Technology*”, VII Edition, International Student -on, Addison Welsey Longman Inc., 1995.

EC 101 ES

ELECTRONIC DEVICES AND CIRCUITS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

- The course facilitates the students to study the basic concepts and characteristics of electronic devices.
- To develop the ability of analyzing actual electronic circuits that implements the basic circuits.
- The students also learn about BJTs, MOSFETs and feedback Amplifiers.

Course Outcomes: The students will able to

1. Understand various diodes and their applications
2. Outline transistor characteristics and Design the biasing circuits like self biasing.
3. Analyze small signal low frequency amplifier circuits using h-parameters
4. Illustrate the construction, operation and characteristics of JFET and MOSFET, which can be used in the design of amplifiers.
5. Access feedback concept and various topologies

UNIT – I Semiconductors & diodes:

Energy bands, Intrinsic and Extrinsic Semiconductors, Mobility and Conductivity, Band structure of PN Junction, Quantitative Theory of PN Diode, Volt - Amp Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction, Zener Diode, Tunnel Diode, LED, Varactor Diode, Photo Diode.

Diode circuits: Diode as a rectifier-Half-wave, Full-wave and Bridge Rectifiers, Types of Filters, Capacitor and inductor filter, Zener diode as a voltage regulator, Ripple Factor and Regulation Characteristics.

UNIT-II Bipolar Junction Transistor:

NPN and PNP junction Transistors, Transistor current components, CB, CE and CC Configurations and their Characteristics, Saturation, Cutoff and Active Regions, Comparison of CE, CB and CC Configurations, Maximum voltage rating, The operating point, Fixed-bias, Emitter stabilized bias circuits, Voltage-divider bias, DC bias with voltage feedback, Stabilization, Bias compensation, Thermal Runaway, Thermal Stability, High frequency model of a Transistor.

UNIT – III Small Signal - Low Frequency Transistor amplifier Circuits:

Transistor as an Amplifier, Simplified CE and CC hybrid models. The h parameters of the three transistor configurations, Analysis of Transistor Amplifier Circuits using h-parameters. Linear analysis of a Transistor circuit, BJT transistor modeling parameters: Z_i , Z_o , A_v , A_i . Miller's theorem and it's duality. The CE amplifier with emitter resistance, Darlington pair, Analysis of Single Stage Amplifiers.

UNIT – IV Field Effect Transistors:

The Junction field effect transistor, Pinch off Voltage, Volt-ampere characteristics, Drain Saturation Current, Small Signal model of FET, MOSFET - Enhancement and Depletion Modes. The low Frequency common source and common drain amplifiers, FET biasing.

UNIT – V Feedback Amplifiers:

Concept of Feedback Amplifiers - Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers, Analysis of simple feedback amplifiers using BJT and FET, Design Considerations.

Suggested Readings:

1. *Integrated Electronics Analog and Digital Circuits and Systems*, Jacob Millinan and Christos C. Halkias, McGraw Hill, Edition, 1988.
2. *Electronic Devices and Circuits Theory*- Robert L Boylestad and Louis Nashelsky, Pearson Education.9th, Pearson publications, 2009.
3. *Electronics Principles*, Albert Paul Malvino, Tata McGraw Hill Edition 2001.

EG 101 HS

ENGLISH

Instruction	2 Periods per week
Duration of University Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	2

Course Objectives:

- Communicate clearly, accurately and appropriately.
- Learn different models of interpersonal communication.
- Learn to communicate grammatically.
- Learn to write essays, formal letters and technical reports.
- Comprehend the different types of texts.

Course Outcomes: The students will be able to:

1. communicate effectively
2. use effective body language
3. infer information from texts with workable ease
4. apply basic grammar of English in their communication
5. use appropriate and idiomatic expressions

UNIT – I Effective Communication:

Role and importance of communication; Features of human communication; Process of communication; Barriers to communication; Oral and Written Communication; Importance of listening, speaking, reading, and writing; Types of communication: Verbal – formal versus informal communication, one-way versus two-way communication, Non-verbal communication.

UNIT – II Personality Development and Interpersonal Communication:

Time management; Emotional Quotient; Teamwork; Persuasion techniques. Models of interpersonal development: Johari window, Knapp's model; Styles of communication.

UNIT – III Remedial English:

Tenses, Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés. (**Note:** *The focus is on appropriate usage*)

UNIT – IV Vocabulary Building and Written Communication:

Roots and affixes; Words often confused: Homonyms, Homophones, Homographs; One-word substitutes; Idiomatic usage: Idioms, Phrases, Phrasal Verbs; Synonyms; Antonyms; Paragraph writing; Précis writing; Essay writing; Official letters; E-mail etiquette; Technical report writing: Feasibility, Progress and Evaluation reports.

UNIT – V Reading Comprehension:

Unseen Passages, A.P.J.Abdul Kalam, Azim Premji, Sachin Tendulkar, Sathya Nadella, Sam Pitroda (**Note:** No descriptive questions to be set from this unit and only Reading Comprehension/s from unseen passages should be set in the Examination Question Papers).

Suggested Readings:

1. E. Suresh Kumar, *Engineering English*, Orient BlackSwan, 2014
2. *Language and Life A Skills Approach*, Orient Black Swan, 2018
3. Michael Swan, *Practical English Usage*. OUP, 1995
4. Ashraf Rizvi, M, *Effective Technical Communication*, Tata McGraw Hill, 2009.
5. Meenakshi Raman and Sangeeta Sharma. *Technical Communication: Principles and Practice*. OUP, 2011.

CH 151 BS

APPLIED CHEMISTRY LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	1.5

Course Objectives: The student will learn

- Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
- To determine the rate constant of reactions from concentrations as a function of time.
- The measurement of physical properties like surface tension and viscosity.
- Estimation of HCl and CH₃COOH by conductometric technique

Course Outcomes: The chemistry laboratory course use consists of experiments illustrating the principle of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants / products as a function of time.
2. Measure molecular /system properties such as surface tension ,viscosity, conductance of solutions, redox potentials and chloride content of water
3. Synthesize a small drug molecules

Water analysis:

- 1) Determination of total hardness of water by EDTA method
- 2) Determination of Chloride content of water
- 3) Determination of cell constant.
- 4) Estimation of HCl and CH₃COOH by conductometric titration

Potentiometric measurements:

- 5). Estimation of HCl by potentiometric titration.
- 6). Estimation of ferrous iron by potentiometric titration.

Kinetic Studies:

- 7).Determination of rate constant of acid catalyzed hydrolysis of methyl acetate.
- 8).Study of kinetics of Iodine-Clock reaction.

Synthesis of a drug molecule:

- 9).Synthesis of Aspirin.

Distribution Studies:

- 10).Determination of partition coefficient of acetic acid between Butanol and Water.

Physical constants:

- 11).Determination of a viscosity of a given liquid.
- 12).Determination of surface tension of a given liquid.

Colorimetry:

- 13) Verification of Beers law and Estimation of the given permanganate.
- 14) Verification of Beers law and Estimation of the given CuSO_4 .

Suggested Readings:

1. Senior Practical Physical Chemistry, B.D.Khosla, A.Gulati and V.Garg (R.Chand&Co.,Delhi)
2. An Introduction to Practical Chemistry ,K.K.Sharma and D.S.Sharma (Vikas publishing,N.Delhi)

EG 151 HS

ENGLISH LAB

Instruction	2 Periods per week
Duration of University Examination	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	1

Course Objectives:

- Learn IPA
- Learn minimal pairs and types of syllables
- Overcome the difficulties with sounds of English
- Learn to participate well in GDs, Debates and Presentations
- Communicate with appropriate body language and expressions

Course Outcomes: The students will be able to

1. produce the sounds of English effectively
2. use the word stress appropriately
3. apply the rhythm and intonation of English in their communication
4. articulate well in their communication
5. participate effectively in communication

1. Introduction to English Phonetics: Organs of Speech: respiratory, articulatory and phonatory systems; Sounds of English: Introduction to International Phonetic Alphabet; Minimal pairs; Syllable; Word Stress; Introduction of rhythm and intonation; Difficulties of Indians speakers with stress and intonation.
2. Speaking Activities: Self Introduction, Picture perception, JAM.
3. Group discussion, Debate, Presentation skills
4. Listening Activities: Listening to different types of materials for effective comprehension
5. Role play: Use of dialogues in a variety of situations and settings

Suggested Readings:

1. E. Suresh Kumar. *A Handbook for English Language Laboratories (with CD)*. Revised edition, Cambridge University Press India Pvt. Ltd. 2014
2. T. Balasubramanian. *A Textbook of English Phonetics for Indian Students*. Macmillan, 2008.
3. J. Sethi et al., *A Practical Course in English Pronunciation (with CD)*. Prentice Hall of India, 2005.
4. Hari Mohan Prasad. *How to Prepare for Group Discussions and Interviews*. Tata McGraw Hill, 2006.

EC 151 ES

ELECTRONIC DEVICES AND CIRCUITS LAB

Instruction	2 Periods per week
Duration of University Examination	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	1

Course Objectives:

- The course facilitates the students to understand the basic concepts and characteristics of electronic devices.
- To develop the ability of analyzing actual electronic circuits that implements the basic circuits.
- The students learn about diodes, BJTs, FET and feedback Amplifiers.

Course Outcomes: The students will be

1. Understand various components, test and measuring equipment along with their usage.
2. Illustrate the characteristics of various Diodes, BJT and FET.
3. Deduce rectifier circuits with and without filters.
4. Interpret other applications of diodes.
5. Demonstrate the characteristics of various feedback topologies.

Experiments:

1. Usage of Multimeter, CRO, Function generator, LCR meter, Power supplies and Bread board.
2. Characteristics of Semi-conductor Diodes (Si, Ge and Zener)
3. Static characteristics of Bipolar-junction Transistors CB configuration
4. Static characteristics of Bipolar-junction Transistors CE configuration
5. Characteristics of Field effect Transistors
6. Half-wave Rectifier with and without filters
7. Full-wave Rectifier with and without filters
8. Regulators:
 - a) Series and Shunt Regulators
 - b) Regulators ICs
9. Clipping and Clamping circuits using diodes
10. Frequency response of Single stage amplifier
11. Characteristics of Voltage series and Voltage shunt feedback amplifiers
12. Characteristics of Current series and Current shunt feedback amplifiers

Suggested Readings:

- 1) *Integrated Electronics Analog and Digital Circuits and Systems*, Jacob Millinan and Christos C. Halkias, McGraw Hill, Edition, 1988.
- 2) *Electronic Devices and Circuits Theory*- Robert L Boylestad and Louis Nashelsky, Pearson Education.9th, Pearson publications, 2009.
- 3) *Electronics Principles*, Albert Paul Malvino, Tata McGraw Hill Edition 2001.