Science and Technology,
R.T.M. Nagpur University, Nagpur.
Syllabus for B.Tech. Chemical Technology
(First Semester)

Maths –I: CT-BS-101T   **Total Credits: 02**
Teaching Scheme: Lectures: 2Hours/ Week,
Examination Scheme: T (U) : 35 Marks T (I) : 15 Marks
Duration of University Exam. : 02 Hours

UNIT -I : Linear Algebra-I : Matrices, Vectors,Vector Space, Rank of a Matrix, Linear Independence, Inverse of a Matrix, Linear Systems of Equations: Existence, Uniqueness, Solutions of Linear Systems: Gauss Elimination, Cramer's Rule, Gauss-Jordan Elimination.

UNIT -II : Linear Algebra-II : Linear Algebra: Eigenvalues, Eigen vectors of Matrix, Symmetric, Skew-Symmetric, and Orthogonal Matrices, Cayley Hamilton Theorem, Sylvester Theorem, Diagonalisation.

UNIT -III: Integral Calculus : Beta, Gamma functions, Double integration : Cartesian and polar co-ordinates, Change of order of integration, Change of variables between Cartesian and polar co-ordinates, Area as a double integral, Triple integration, Volume as a triple integral.

UNIT -IV: Vector Calculus : Vectors in 2-Space and 3-Space, Inner Product (Dot Product), Vector Product (Cross Product) Vector and Scalar Functions and Fields, Derivatives Curves. Arc Length. Curvature, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field.
Integral Calculus. Integral Theorems, Line Integrals, Path Independence of Line Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals

References
   1. Higher Engineering Mathematics by H. K. Das, Er. Rajnish Verma
   2. A text book of Engineering Mathematics by N. P. Bali, Manish Goyal
   3. A text book of Engineering Mathematics (Vol- I & II) by Dr. D. T. Deshmukh
   4. Higher Engineering Mathematics by B. S. Grewal

Physics CT-BS-102 T   **Total Credits: 02**
Teaching Scheme: Lectures: 2Hours/ Week
Examination Scheme: T (U) : 35 Marks T (I) : 15 Marks
Duration of University Exam. : 02 Hours

Unit 1: Quantum Mechanics: Planck's Hypothesis, Properties of Photons, Compton Effect, Wave – particle duality, De-Broglie Hypothesis, Matter Waves, Davisson-Germer Experiment; Bohr's Quantization condition.
Wave Packet & Wave Equations. Heisenberg's uncertainty principle, Wave function and its probability interpretation, Schrödinger's Time dependent & time independent equations, (No derivations). Solution of Schrödinger's equation for one dimensional infinite potential well.

Unit 2: Basic Semiconductor: Qualitative idea on the formation of electron energy bands in solids, Band-theory based classification of solids into insulators, semiconductors and conductors, Intrinsic semiconductors: Germanium and silicon, Doping and Extrinsic semiconductors.
PN- junction diode; Unbiased, Forward biased & Reverse biased mode, Zener diode: Forward and reverse bias characteristics, Avalanche breakdown, Applications: Half wave rectifier & Full wave rectifier, Transistors: PNP and NPN. Configuration: - CB, CE, Bipolar Transistor action, V-I

characteristics of i) Photodiode, ii) LED.

Unit 3: Lasers: Three quantum processes: Absorption, Spontaneous emission and Stimulated emission. Metastable state, Conditions for light amplification, Pumping schemes: Three level pumping scheme, Four level pumping scheme. Optical resonator, Laser beam characteristics, Ruby laser and He-Ne laser. Numericals.

Unit 4: Optical fibres: Structure, Propagation of light through a cladded fibre, Acceptance angle, acceptance cone, Fractional refractive index change, Numerical aperture, Modes of propagation; Types of Optical fibres: Single mode step index fibre, Multimode step index fibre, Graded Index fibre, V-number. Transmission Losses, Applications: Sensor, Numericals.

Books recommended:
Text Books:
1. Fundamentals of Physics: David Halliday, Robert Resnick and Jerle Walker, John-Wiley India(8e, extended)
2. A text book of Engineering Physics: M. N. Avadhanulu and Kshirsagar S. Chand & Co.
3. Electronic Engineering Materials and Devices: John Allision, (TMH edition, 10th reprint)
4. Concepts of Modern Physics: Baiser (Tata McGraw Hill).
4. Laser: M. N. Avadhanulu, S. Chand & Co.

Reference Books:
University Physics:Young and Freedman(Pearson Education)
Solid State Physics: C. Kittel
 Solid State Physics: R.L. Singhal
Quantum Mechanics: Schiff
LASERS: Theory and Applications: Thyagarajan K and Ghatak A.K.

Chemistry-I : CT-BS-103 T   **Total Credits: 02**
Teaching Scheme: Lectures: 2 Hours/ Week
Examination Scheme: Theory T (U) : 35 Marks T (I) : 15 Marks
Duration of University Exam. : 02 Hours

Unit I Co-ordination Chemistry and Chemical bonding: Introduction to co-ordination chemistry, explanation of terms like complex, ligands, co-ordination number, co-ordination sphere. Classification of ligands, chelates & its classification. Werner's coordination theory & its application to Co (III) and Pt (IV) ammine complexes.
Valence Bond Theory and its application to 6-coordinated complexes, Crystal Field theory and Crystal field splitting in Octahedral and tetrahedral complexes, MO theory, Structure, bonding and energy levels of bonding and shapes of many atom molecules like H_2, N_2, and CO.
(12)

Unit II Water: Sources, types of impurities and their effects, hardness of water & its estimation, Numerical on EDTA method, treatment of water for domestic & industrial purposes, sedimentation, coagulation, filtration, types of filters, Sterilization- chlorination, break point chlorination, Ozonization. Removal of hardness of water: Lime- soda process, Numerical on lime-soda process, Zeolite process, its advantages and disadvantages, comparison with L-S Process, Numerical based on zeolite process, Ion- exchange process, demineralization process. Boiler troubles:-Carry over- priming & foaming-causes & prevention, sludge & scales, Causes of scale formation and prevention methods, Corrosion & caustic embrittlement causes & prevention.
(12)

Unit III Cement: Raw materials, constitutional compounds& its properties, Process parameters, Manufacture of Portland cement by wet and dry process, setting and hardening of cement,

Cement additives & admixtures.

Refractories: Definition, requisites of good refractory material, properties of refractory, raw materials, manufacture of refractory products, application in industries. **(10)**

Unit IV Chromatography: Introduction, Classification, General and fundamental concepts of TLC, Column, HPLC, GC, Ion Exchange and their applications. **(06)**

Books Recommended:
1. A Text Book of Engineering Chemistry, by S.S.Dara, S.Chand & Co., New Delhi.
2. A Text Book of Engineering Chemistry, by Jain & Jain, Dhanpat Rai Publishing Co., New Delhi.
3. Industrial Chemistry by B.K.Sharma Goel Pub. House, Meerut.
4. Advanced Inorganic Chemistry, Vol.II, by Satya Prakash, G.D.Tuli, S.K.Basu & R.D.Madan.
5. Text of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria and Sons, New Delhi.
6. Analytical Chromatography by Dr. G. R. Chatwal, Himalaya Publication House.
7. Instrumental Methods Of Chemical Analysis By G. R. Chatwal, S. K. Anand, Himalaya Publication House.

Fundamentals of Reaction Mechanism: CT-BS-104 T   **Total Credits: 02**
Teaching Scheme: Lectures: 02 Hours/Week
Examination Scheme: Theory T (U): 35 Marks   T (I): 15 Marks
Duration of University Exam. : 02 Hours

Unit 1: Reactivity of organic molecules: factors influencing acidity, basicity and nucleophilicity of molecules with few examples. Introduction to Stereochemistry: Stereo-descriptors – R, S, E, Z. Enantiomers and Diastereomers. **(6L)**

Unit 2: Strategies for synthesis of organic compounds: Reactive intermediates, Mechanism of Addition, substitution, elimination, condensation, role of solvents. Technical preparation of bio-ethanol using molasses, enzymatic catalysis, commercial significance **(8L)**

Unit 3: **Mechanism and recent advancement (Green chemistry and catalysis etc.):** Basic principles of green chemistry, industrial significance, green catalysts. Technical preparation supported green route, Preparation of adipic acid, Acetanalide with mechanism, photo-halogenation of benzene etc **(6L)**

Unit 4: Nitration: Vant Hoffs factor for suitability of agents, Catalytic effect of sulfuric acid in industrial nitration, Mechanism of aromatic nitration process using Inductive and Mesomeric effect, examples, Equipments for nitration and safety aspects. Technical preparation of nitroglycerine **(6L)**

Books Recommended:

1. Engineering Chemistry – By Baskar, Wiley
2. Engineering Chemistry –I By D. GrourKrishana, Vikas Publishing
3. Green Chemistry: Theory and Practice by Paul T. Anastas, J.C. Warner; Oxford University Press
4. Unit Processes in Organic Synthesis- by P. H. Groggins
5. Reaction and Reagents- By O.P. Agarawal
6. Monograph on green chemistry, Green chemistry Task Force Committee, DST

Electrical & Electronics Engineering: CT-GES-105 T   **Total Credits: 03**
Teaching Scheme: Lectures: 3 Hours/ Week
Examination Scheme: Theory T (U): 70 Marks   T (I): 30 Marks
Duration of University Exam. : 03 Hours

Unit 1: **DC Circuits:** Resistor, Inductor, Capacitor, Diode, Concept of Voltage and Current sources, resistance in series and parallel, Kirchhoff's Laws, Superposition Theorem, Thevenin's theorem, Norton's theorem, Star-Delta transformation, Analysis of simple circuit with DC excitation, Node and Mesh analysis.   (8L)

Unit 2: **AC Fundamentals**: Concept of AC current and voltages, difference between AC and DC, Periodic functions, Average & RMS values, Form factor and Peak factor, Steady state behaviour with sinusoidal excitation, Phosor representation, Phase and Phase difference concept.
                                                                        (8L)

Unit 3: **Steady State Analysis of AC circuits:** Consisting of R, L, C, RL, RC and RLC in series and parallel circuits, resonance.
Introduction to three phase AC circuits, star and delta connections, measurement of power in three phase ac circuits.   (6L)

Unit 4: **Transformer modelling and analysis:** Introduction, General theory of Transformer, Basic Principles, Construction phasor diagram for transformer under no load, Transformer on load, Balance of MMF on two sides, Phasor diagrams, Equivalent Circuit, Loses in transformer, Normal and All day Efficiency, Regulation, Open- circuits and short-circuits tests.
(8L)

Unit 5: Energy in Magnetic field and Principles of electromechanical Energy conversion:
Working of Thermal, Hydro and Nuclear power plants.   (4L)

Unit 6: Basic Electronics: BJT and its characteristics, CE and small signal model, MOSFET, SCR, Operational amplifier, Introduction to digital circuits.   (8L)

Suggested Text Books

1. B.L. Thereja, A Text Book of Electrical Technology, Vol. 1, 2 and 4, S. Chand & Co., New Delhi.
2. D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering, 3rd edition, Tata McGraw Hill, 2010.
3. D. C. Kulshrestha, Basic Electrical Engineering, Tata McGraw Hill, 2009.

Suggested Reference Books

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press,   2011.
2. E. Huges, Electrical and Electronics Technology, 10th edition, PEARSON, 2010.

3. Vincent Del Toro, Electrical Engineering Fundamentals, 2nd edition, Prentice Hall India 1989.

Physics Laboratory CT -BS-106 P   **Total Credits: 01**
Teaching Scheme   **Examination Scheme**
Lectures: 2 Hours/ Week   **P (U) : 25 Marks P (I) : 25 Marks**
Duration of University Exam. : 03 Hours

LIST OF EXPERIMENTS
1. To study the characteristics of a PN-junction diode in forward and reverse bias & determine its cut in voltage, static & dynamic resistance.

2. To study the characteristics of a Zener diode in forward and reverse bias & determine its breakdown voltage.
3. To determine the Energy gap Eg of semiconductor using PN junction diode in reverse bias mode.
4. To study the V-I characteristics of a Light Emitting Diode
5. To study the V-I characteristics of a Photo Diode
6. To study PN junction diode as Half wave and Full wave rectifier and calculate ripple factor and efficiency in each case
7. To study the input and output characteristics of a transistor in Common base mode & calculate input resistance and current gain α.
8. To study the input and output characteristics of a transistor in Common emitter mode & calculate input resistance and current gain β.
9. Study of Optical Fibre kit.
10. Demonstrations of Lasers.

Chemistry-I Laboratory: CT -BS-107 P   **Total Credits: 01**
Teaching Scheme: Practical: 2 Hours / Week
Examination Scheme: Practical P (U) : 25 Marks, P (I) : 25 Marks
Duration of University Exam: 03 Hours

LIST OF EXPERIMENTS
1. Estimation of Total Hardness by Complexometric Method in a given Sample of water.
2. Estimation of Calcium and Magnesium hardness in a given sample of water.
3. Estimation of Nickel by Complexometric Method in a given Sample of water.
4. Estimation of total alkalinity in the given water sample.
5. Estimation of percentage of Copper in the given solution of copper sulphate by Iodometry Method.
6. Estimation of Strength of Potassium Dichromate using Sodium Thiosulphate by Iodometry Method .
7. Determination of strength of Ferrous Ammonium Sulphate using Potassium Dichromate and SDS as an internal indicator.
8. Estimation of strength of NaOH using oxalic acid.
9. Estimation of strength of HCl using Borax.
10. To determine the number of components in a mixture using TLC.

Fundamentals of Reaction Mechanism Laboratory CT -BS-108 P   **Total Credits: 01**
Teaching Scheme   **Examination Scheme**
Lectures: 2 Hours/ Week   **P (U) : 25 Marks P (I) : 25 Marks**
Duration of University Exam. : 03 Hours

LIST OF EXPERIMENTS

1. Identification of unknown organic compounds using preliminary investigations such as Phase, Color, odour, solubility in various solvents.

2. Identification of unknown organic compounds on the basis of aromatic and aliphatic as well as saturated and unsaturated nature.

3. To detect the elements (N, S and Cl) present in given unknown organic compounds using sodium extract.

4. Identification of unknown organic compound using Functional group detection and confirmatory tests (Phenols and Napthols)

5. Identification of unknown organic compound using Functional group detection and confirmatory tests (Carbohydrates; aldehydes and ketones)

6. Identification of unknown organic compound using Functional group detection and confirmatory tests (mono carboxylic acids)

7. Identification of unknown organic compound using Functional group detection and confirmatory tests (di- carboxylic acids)

8. Identification of unknown organic compound using Functional group detection and confirmatory tests (Amides)

9. Identification of unknown organic compound using Functional group detection and confirmatory tests (Nitro)

10**.** Detection of Melting points of few organic compounds using melting point apparatus.

List of Books

1. A Laboratory hand bbok of Organic Qualitative analysis and separations By V. S. Kulkarni and S.P. Pathak
2. Vogels textbook of Practical Organic Chemistry

Electrical & Electronics Engineering Laboratory: CT-GES-109 P   Total Credits: 01
Teaching Scheme: Practical: 2 Hours / Week
 Examination Scheme: Practical P (U): 25 Marks P (I): 25 Marks
Duration of University Exam: 03 Hours

About 8 to 12 experiments to illustrate the concepts learnt in Electrical and Electronics Engineering. Suitable number of experiments should be from the following categories:

1. Introduction to Electrical engineering, safety precautions, Familiar with AC & DC measuring devices and its use, voltmeter, ammeter, wattmeter, multimeter, oscilloscope, real life resistors, capacitors and Inductors.

2. DC Circuits- Ohms law, verification of KCL & KVL, Superposition theorem, Thevenin's theorem, Norton theorem.

3. Alternating current fundamentals and single phase AC circuits.

4. Three phase circuits.

5. Magnetic materials and their characteristics.

6. Single phase Transformer.

7. Characteristics of various electronics devices- BJT, UJT, FET, SCR, UJT as relaxation oscillator, etc.

8. Demonstration of various Logic gates.

Engineering Graphics: CT-GES-110 P   **Total Credits: 1.5**
Teaching Scheme: Practical: 3Hours / Week
 Examination Scheme: Practical P (U) : 25 Marks, P (I) : 25 Marks
Duration of University Exam: 03 Hours

Contents

1. Introduction to graphic science, dimensioning and sheet layout.

2. Curves used in engineering practice.

3. Projections of Points and straight Lines.

4. Projections of Planes.

5. Projections of Solids.

6. Orthographic projections.

7. Missing views (or interpretation of views).

8. Isometric projections.

Suggested Text Books
1. N. D. Bhatt, V. M. Panchal, Pramod R. Ingle, Engineering Drawing [Plane and Solid Geometry], 53rd edition, Charotar Publishing House Pvt. Ltd., 2014.

2. N.H. Dubey, Engineering Drawing, 15th multicoloured edition, Nandu Printers & Publishers Pvt. Ltd., 2015.