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Engineering and Technology,
R.T.M. Nagpur University, Nagpur.
Syllabus for B.Tech. Chemical Technology

(First Semester)
Engineering Mathematics – I (CT (BGE) 1.01)
(Total Credits: 04)

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Teaching Scheme	**Examination Scheme**
Lectures: 3Hours/ Week	**Theory**
Tutorial: 1 Hours / Week	**T (U)** : 80 Marks **T (I)** : 20 Marks
	Duration of University Exam. : 03 Hours

UNIT –I : Differential Calculus
> Successive Differentiation, Standard forms to find n-th derivatives, Leibnitz`s theorem , Expansion of function in power series (Taylor's and Maclaurin's Series), Tracings of curves in Cartesian and polar coordinates , Curvature, Radius of curvature in Cartesian and polar coordinates .

UNIT-II: Partial Differentiation
> Function of two variables, Partial derivatives, Euler's theorem , Chain rule, Total differentiation , Taylor's and Maclaurin's theorem , Maxima and minima of function of two function , Lagrange's method , Jacobins, Differentiation under integral sign .

UNIT- III : Statistics and Probability
> Curve fitting: Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Random variables: Discrete and continuous random variable, Probability distribution: Binomial, Poisson and Normal Distribution

UNIT- IV: Matrices
> Rank of matrix, Consistency of a system of equation, Eigen values, Eigen vector, Statement and verification of Caylay Hamilton theorem, Determination of the roots of algebraic equation by matrix method, Sylvester's theorem.

UNIT –V : 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 – VI : Complex Number
> Complex Numbers: Cartesian and polar forms of complex numbers, Demoivre's theorem and its application in solution of equation and expansion of $cos^n\theta, sin^m\theta, cos^n\theta.sin^m\theta$, hyperbolic functions and their inverse, logarithm of complex quantities. Separation of real & imaginary part.

Books Recommended:
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,Vol-II) by Dr. D.T. Deshmukh
4. Higher Engineering Mathematics by B.S. Grewal

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(First Semester)
Applied Physical Chemistry (CT (BGE) 1.02)
(Total Credits: 03)

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Teaching Scheme	**Examination Scheme**

Lectures: 2Hours/ Week   **Theory**

Tutorial: 1Hours / Week   **T (U)** : 80 Marks   **T (I)** : 20 Marks
                                              Duration of University Exam. : 03 Hours

Unit 1: Equation of State for ideal and real gases, Critical Phenomena, principal of corresponding states, compressibility factor, Principle of Equipartition of Energy, and Joule-Thomson effect.

Unit 2: The first law of Thermodynamics, reversible processes, enthalpy, heat capacity, isothermal and adiabatic processes, thermochemistry laws, standard heats of formation, the bomb calorimeter, flame and explosion temperatures.

Unit 3: The second law of thermodynamics, the Carnot theorem and Carnot Cycle, the refrigeration engine.

Unit 4: Entropy and irreversible processes. The free energy, work function and Gibbs Helmholtz equation, the criteria of Chemical Equilibrium.

Unit 5: Objectives of chemical Kinetics, elementary reaction steps and rate expressions, order of reaction. Factors influencing the reaction rates. Integrated rate expression with examples. Methods for determining the order of chemical reaction.

Unit 6: Radiation chemistry, photochemical reactions, laws of photochemistry, photochemical combination of hydrogen and chlorine.

Books Recommended:
Thermodynamics for chemists by S. Glasstone, D Van Nostrand Inc, New York.
Physical Chemistry by G.M. Barrow, Benjamin Publishers, New York.
Physical Chemistry by Sheehan, W.F. Prentics hall of India, Pvt Ltd., New Delhi 1963
Principles of Physical Chemistry by Puri and Sharma, S.Chand and Co. New Delhi
An Introduction to Chemical Thermodynamics by R P Rastogi and R R Mishra
Physical Chemistry through problems, S. Dogra and S. K. Dogra

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(First Semester)
Applied Inorganic Chemistry (CT (BGE) 1.03)
(Total Credits: 03)

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Teaching Scheme **Examination Scheme**
Lectures: 2 Hours/ Week **Theory**

Tutorial: 1 Hours / Week **T (U) :** 80 Marks   **T (I)   :** 20 Marks
  Duration of University Exam. : 03 Hours

Unit I: **General Principles and Processes of Metallurgy:** Ore dressing, roasting, calcination, smelting, fluxes & slag. Types of furnaces, refining of metals. Metallurgical industries of iron, steel, copper.   **(6)**

Unit II: Co-ordinate covalent compounds (complexes): 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. Nomenclature of coordination compounds, bonding in complexes, brief description of Valence bond theory (VBT), application of VBT to 6- & 4-coordinated complexes, limitations of VBT. Crystal field theory, crystal field splitting in octahedral & tetrahedral complexes. Application of chelates in industries.   **(10)**

Unit III: 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, types, 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 IV: 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. Types of Portland cement.   **(5)**

Unit V: Glass: Definition & Chemistry of glass making , raw materials, composition & properties of different types of glass, manufacture of glass wares such as bottles, window glass, tubes.Safety glss & coloured glass.   **(5)**

Unit VI: Ceramics: Definition & types, Basic raw materials used, fabrication methods, drying & firing of ceramic products, glazing.   **(4)**
Refractories: Definition, requisites of good refractory material, classification & properties of refractory, raw materials, manufacture of refractory products, application in industries.   **(3)**

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.

First Semester)
Physics (CT (BGE) 1.04)
(Total Credits: 03)

Teaching Scheme **Examination Scheme**

Lectures: 2 Hours/ Week **Theory**

Tutorial: 1 Hours / Week **T (U) :** 80 Marks **T (I) :** 20 Marks

Duration of University Exam. : 03 Hours

UNIT – I **Viscosity** Streamline flow, Turbulent motion, Critical velocity, Viscosity, Coefficient of viscosity, Poiseulle's equation, Stoke's method, Ostwald viscometer, Numericals

UNIT – II **Surface tension** Surface Tension, Excess pressure inside a liquid drop and soap bubble, Angle of contact, Searl's Torsion balance method, Jaeger's method, Quincke's method, Interfacial surface tension, Numericals

UNIT – III **Interference** Plane parallel thin film, Wedged shaped thin film, Newton's rings, Applications: Determination of wavelength and Refractive Index of liquid, Test of surface finish, Antireflection coating, Dielectric mirror, Numericals .

UNIT – IV **Polarization of light** Types of polarization: Plane polarized light, circularly polarized light, elliptically polarized light and unpolarized light. Production of plane polarized light: Polarization by reflection, refraction, scattering, selective absorption, double refraction, Nicol prism. Polarizer and Analyzer, Optic axis, Principal section. Differences between: o-ray and e-ray, positive and negative crystals, HWP and QWP. Analysis of polarized light, Optical activity and specific rotation. Numericals .

UNIT – V **Lasers** Three quantumn 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.

UNIT – VI **Pumps and gauges** Rotary Oil Pumps:-Rotary –vane Oil Pump, Stationary vane rotary oil pump, Geissler pump, Diffusion-Condensation pump

Guages:- McLoed Vacuum Guage, Pirani Resistance Guage, Thermocouple Guage, Knudsen Guage.

Books Recommended

1.Elements of properties of matter By D.S.Mathur

2.Text book of Engineering Physics By Avadhanulu and Kshirsagar

Basic Mechanical Technology (CT (BGE) 1.05)
(Total Credits: 03)

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hours/ Week	**Theory**
Tutorial: 1 Hours / Week	**T (U) :** 80 Marks **T (I) :** 20 Marks
	Duration of University Exam. : 03 Hours

UNIT 1: Introduction to Production Technology, Fundamentals of metals and alloys, Properties testing and inspection, Ferrous metals and alloys, Non ferrous metals and alloys, heat treatment.

 UNIT 2: Pattern making and Foundry, Powder Metallurgy

UNIT 3: Welding, Smithing and Forging, Mechanical Working.

UNIT 4: Bench work and Fitting, Wood and Wood working, Plastic processing, Plumbing threaded fasterns and joints, Sheet metal works.

UNIT 5: Theory of cutting, tool driving mechanism and salient features if construction of machine tools, specification, types construction and operation on lathe, Drill and Grinders. Introduction to Capstan and Turrets.

UNIT 6: Limits, fits and Surface Quality, Surface finishing processes, surface Coating of metals, Non traditional machining, introduction to numerical control of machine tools, processes planning and evaluation techniques CAD, CAM and CIM.

 BOOKS RECOMMENDED:-

 1) Elements Of Workshop Technology Vol -1 Manufacturing   -Hajra Choudhary
  Processes

 2) Elements Of Workshop Technology Vol 2 Machine Tools   -Hajra Choudhary

 3) A textbook of production technology (manufacturing   -P.C.Sharma
  processes)

 4) Introduction To Basic Manufacturing Process &   -Rajender Singh
  Workshop Technology

 5) A Textbook of Manufacturing Processes Workshop   -R S Khurmi, J K Gupta
  Technology

 6) Manufacturing Engineering and Technology   -Serope Kalpakjian

(First Semester)

Ethical Science (CT (BGE) 1.06)

(Total Credits: 02)

Teaching Scheme   **Examination Scheme**

Lectures: 2 Hours/ Week   **Theory**

Tutorial: -   **T (U)   : ---   T (I)   :** 50 Marks

Duration of internal Exam. : 02 Hours

(First Semester)
APPLIED PHYSICAL CHEMISTRY PRACTICAL (CT (BGE) 1.07)
(Total Credits: 02)

Teaching Scheme   **Examination Scheme**

Practical: 3 Hours / Week   **Practical**

                                                       P (U) : 25 Marks   **P (I) :** 25 Marks

                                                       Duration of University Exam.   : 06

Hours

LIST OF EXPERIMENTS

1. To determine the surface tension & Parachor value of liquid using Stalagmometer.
2. To Study the viscosity of pure liquid using Oswald's Viscometer.
3. To study the effect of addition of NaCl on the solubility of Benzoic acid.
4. To determine the heat of solution of an organic acid by the solubility method.
5. To study the distribution of Iodine between CCl_4 and water, and hence determine the partition co-efficient of Iodine between two.
6. To study the molecular condition of benzoic acid in Toluene by determining the partition co-efficient between Toluene and water.
7. To study the effect of addition of KCL on the solubility of Salicylic acid.
8. To study the kinetics of hydrolysis of Methyl acetate by a strong acid.
9. To study the kinetics of the reaction between Potassium Persulphate and Potassium-Iodide.
10. To study the miscibility of Phenol and water at various temperatures.
11. To determine the molecular weight of a compound using Rast's camphor method.
12. To study the relative strength of acids using method of kinetics.

(First Semester)

Applied Inorganic Chemistry (CT (BGE) 1.08)

(Total Credits: 02)

Teaching Scheme   **Examination Scheme**

Practical: 3 Hours / Week   **Practical**

                                                     P (U) : 25 Marks   **P (I) :** 25 Marks

                                                     Duration of University Exam.   : 06 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 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. Estimation of Strength of Ferrous ammonium sulphate using Potassium Dichromate and SDS as an internal indicator.

8. Estimation of Strength of Ferrous ammonium sulphate using Potassium Dichromate and Potassium Ferricyanide as external indicator.

9. Estimation of Strength of Hydrogen peroxide using $KMno_4$.

10. Estimation of Strength of HCl using Borax.

11. Estimation of Chloride ions in a given solution by Argentometry method.

12. Estimation of Al^{3+} using EDTA by back titration method**.**

(First Semester)
APPLIED PHYSICS- I PRACTICAL (CT (BGE) 1.09)
(Total Credits: 02)

Teaching Scheme   **Examination Scheme**

Practical: 3 Hours / Week   **Practical**

                               P (U) : 25 Marks   **P (I) :** 25 Marks

                               Duration of University Exam.   **:** 06 Hours

LIST OF EXPERIMENTS

1. To determine the coefficient of viscosity of liquid using Stoke's method.

2. Study of Ostwald's viscometer.

3. To determine the coefficient of viscosity of liquid using Poiseulle's method.

4. To determine the surface tension of liquid using Searl's Torsion Balance method.

5. To determine the surface tension of liquid using Jaeger's method.

6. To determine the surface tension of liquid using Quincke's method.

7. To determine the Interfacial surface tension between the two immiscible liquids.

8. To determine the radius of curvature of a plano convex lens using Newton's rings method.

9. To determine the principle refractive indices of double refracting Quartz prism.

10. Demonstration of Lasers.

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(Second Semester)
WORKSHOP (CT (BGE) 1.10)
(Total Credits: 02)

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Teaching Scheme   **Examination Scheme**

Practical: 2 Hours / Week   **Practical**

                                                     P (U) : 25 Marks   **P (I) :** 25 Marks

                                                     Duration of University Exam.   **:** 06

Hours

Teachers/Instructors are expected to introduce the students with the tools & equipments used in

following workshop sections with their operations & safety precautions.

1. Fitting Shop

2. Carpentry

3. Welding

4. Smithy

Students are expected to prepare minimum four Jobs during practical periods of workshop.

Text/Reference Books:

1. Elements of Workshop Technology VOL- I by S.K. Hajra Choudhary, A.K. Hajra Choudhary, Nirjhar Roy

2. Elements of Workshop Technology VOL- II by S.K. Hajra Choudhary, A.K. Hajra Choudhary, Nirjhar Roy

COMPUTATIONAL SKILL PRACTICAL (CT (BGE) 1.11)

(Total Credits: 02)

Teaching Scheme	Examination Scheme

Practical: 2 Hours / Week   **Practical**

P (U) : --   **P (I) :** 25 Marks

Duration of Internal Practical Exam: 02 Hrs

LIST OF EXPERIMENTS

Practical 1 Multi-media
Creates a simple slide show with text, images, Inserts slides, Chooses appropriate slide design and layout, Add sounds, Creates a master slide template,Understands that a presentation is clear, concise and logical, Understands navigation buttons/hyperlinks,Recognises elements of a multi-media   presentation.

Practical 2 **Internets**
Understands purpose of a browser, understands the general structure of a web address, Equates URL with web address, uses and understands the features of a browser (back, forward, stop, search, refresh, history, home buttons, address bar, loading status), Understands key features of a web page (links, site map, feedback, email),Uses and understands hyperlinks buttons.

Practical 3 **Spreadsheets**
Understands the purpose/structure of a spreadsheet, Interprets data from an existing spreadsheet, Understands terminology - column, row, cell, cell range, Understands cell addressing, Understands   active   cell
Enters data (labels, values) in a cell, Formats data in a cell eg. bold, alignment, Generates appropriate   graphs   eg.   bar,   column,   line   etc.

Practical 4 Databases
Understands structure/purpose of a database, Understands strengths and weaknesses of databases,Understands basic terminology - fields, records, files,Opens and uses a commercial database   eg.   electronic   encyclopaedias
Locates specific information searching by subject, key word, author,Locates specific record(s) using   find   function
Uses relevant fields, Chooses appropriate data types for fields,Sorts data,Adds/deletes records,Edits data in an existing record

Practical 5 C Language**.**
Practical based on C language, Basic concept of C, data types, variables, constants, and there use in Program,
Program to find out the factorial, Fibonacci sequence.

Practical 6 IF Structure**.**
Write a program using IF ELSE structure,to find out the grade of the student when the marks of four subjects are given,the method of assigning grade is as follows:If per>=85 then grade A,if per<85   then B ,if per>70 & per>= 55 then C,If per<55 &per>=40 then D else E.

Practical 7 For & While Loop**.**

Write a Program in C to demonstrate the use of for and While loop.

Practical 8 Arrays
Write a program in C to search an item in an array using Linear & Binary search and also sort an array either in ascending or descending order and implement single dimensional arrays & two dimensional arrays.

Practical 9 Inheritance
Write a Program in C to demonstrate the use of Single, Multiple, Multilevel, Hybrid Inheritance.

Practical 10 Function
Write a Program in C to demonstrate the use of Function like Friend Function, Inline Function.

Books Recommended:
1. Fundamental of computers: Rajaraman V, Prentice Hall of India Ltd, New Delhi, 1990.
2. The C Programming Language: Dennis Ritchie & Brain Kernighan [Pearson].