Engineering and Technology,
R.T.M. Nagpur University, Nagpur.
Syllabus for B.Tech. Biotechnology
(First Semester)
Engineering Mathematics – I (BT (BGE) 1.01)
(Total Credits: 04)

Teaching Scheme
Lectures: 3Hours/ Week

Tutorial: 1 Hours / Week

Examination Scheme
Theory

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

(First Semester)

Applied Inorganic Chemistry (BT (BGE) 1.02)

(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: **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)

Applied Organic Chemistry (BT (BGE) 1.03)

(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 Aromatic hydrocarbon Preparation, properties and Industrial uses, and its structure determination of Benzene, Naphthalene.

Alcohol - monohydric alcohol. e.g. ethyl alcohol, di hydric alcohol. e.g. ethylene glycol, trihydric alcohol e.g. glycerol.-its study . Preparations, properties and Industrial uses.

Heterocyclic hydrocarbon- total synthesis, preparations, properties and uses of Pyrrole, Indigo.

Unit 2 Carbohydrates Industrial uses and structure determination of glucose, saccharin.

Acids and esters Preparations and properties and uses of Acetic acid, , Acetoacetic acid, Malonic acid and their esters.

Amines- Preparations and properties and uses of mono-, di -, tri- ethyl amines ,Aniline and diazotization with special reference to formation of azo dyes - e.g. Aniline yellow, Methyl Red, Congo Red.

Unit 3 Nitration, nitrating agents, Kinetics and Mechanism of aromatic nitration process, Equipments for nitration, typical industrial nitration process e.g. preparation of nitrobenzene, nitro acetanilide.

Unit 4 Halogenation, Thermodynamics and Kinetics of halogenation reactions. Apparatus and materials for construction. Technical preparation of chloral and vinyl chloride.

Unit 5 Sulphonation and sulphation: Sulphonating and sulphating agents. Mechanism of sulphonation Industrial Equipments: Technique and Technical Preparation of dodecyl Benzene Sulphonate, Sulphation of Lauryl Alcohol, Dimethyl ether.

Unit 6 Principles of Polymer Chemistry, Industrial Practices and applications, Techniques of Polymerization, Types of Polymerization Examples: Addition and Condensation Polymerization, Mechanism of Additional Polymerization. Study of Polymers e.g. PVC, PVA, Conducting Polymer- Polyaniline, Polypyrroles, Polythiophenes, .

Books Recommended:

1. Text book of Organic Chemistry- by P.L.Soni, H. M. Chawala
2. Text book of Organic Chemistry – By Arun Bahal, B.S. Bahal
3. Unit Processes in Organic Synthesis- by P. H. Groggins
4. Principles of Polymer Chemistry- by Vasant Gowarikar
5. Chemistry of Organic Natural Products Vol-1 and 2- by O. P. Agrawal

First Semester)

Applied Physics – I (BT (BGE) 1.04)

(Total Credits: 03)

Teaching Scheme
Lectures: 2 Hours/ Week
Tutorial: 1 Hours / Week

Examination Scheme
Theory
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

First Semester)

Applied Mechanics (BT (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 I Basics & Statics of Particles Basic concepts System of Forces, Resolution and composition of forces , system of parallel, concurrent and non concurrent co-planer forces, Resultant.

Equilibrium Of Rigid Bodies Free body diagram , Types of supports and their reactions, requirements of stable equilibrium, Moments and Couples, Varignon's theorem , Equilibrium of Rigid bodies in two dimensions.

UNIT II Centroid and Center of Gravity Centroid of plane and composite figures, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorems.

Simple lifting machines Velocity ratio, mechanical advantage and efficiency of simple machines, Law of machine, Differential wheel and axle, Screw Jack, Single and Double purchase crabs.

UNIT III Truss Analysis of simple plane trusses by method of joints and method of sections.

Friction Types of friction, Limiting friction, Laws of Friction, static and Dynamic Frictions, Motion of Bodies.

UNIT IV Dynamics of Particles Displacement velocity and Acceleration (rectilinear and rotary), Motion with uniform and variable acceleration and projectiles , D'Alembert's principle, kinetics of rectilinear translation and rotary motion of rigid body. Dynamic equilibrium in plane motion.

UNIT V Work, Power and Energy, Conservation of Momentum and Energy.

UNIT VI Transmission of power by belts Belt Drivers - Open, Crossed and compound belt drives, length of belt, tensions - tight side, slack side, Power transmitted and condition for maximum power. gears and epicyclic gear trains.

BOOKS RECOMMENDED

1. Engineering mechanics by Timoshenko and Young.
2. Applied Mechanics by Saluja,Satya Prakash.
3. Engineering mechanics by Beer and Johnson.
4. Engineering mechanics by Singer.
5. Engineering mechanics by R.S.Khurmi.
6. Engineering Mechanics by Kumar.
7. Engineering Mechanics by Shames.

First Semester)

Applied Inorganic Chemistry (BT (BGE) 1.06)

(Total Credits: 02)

Teaching Scheme

Practical: 3 Hours / Week

Examination Scheme

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 Organic Chemistry (BT (BGE) 1.07)

(Total Credits: 02)

Teaching Scheme

Practical: 3 Hours / Week

Examination Scheme

Practical

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

Duration of University Exam. : 06 Hours

LIST OF EXPERIMENTS

1) Separation of Organic Mixtures.
2) Elemental Analysis of C, H, N, Cl, Br, I etc.
3) Functional group detection for example : COOH, $CONH_2$, Primary Amine, Secondary Amine, Tertiary Amine , Carbohydrate, Phenols, Alcohols, etc.
4) Identification of Organic Compounds.

First Semester)

APPLIED PHYSICS- I PRACTICAL (BT (BGE) 1.08)

(Total Credits: 02)

Teaching Scheme

Practical: 3 Hours / Week

Examination Scheme

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.

First Semester)

ENGINEERING GRAPHICS (PRACTICAL (BT (BGE) 1.09)

(Total Credits: 02)

Teaching Scheme

Practical: 2 Hours / Week

Examination Scheme

Practical

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

Duration of University Exam. : 06 Hours

LIST OF EXPERIMENTS

NOTE – ONLY FIRST ANGLE METHOD OF PROJECTIONS SHOULD BE USED

Introduction to Engineering Drawing & Curves used in Engineering Practice:
Introduction, Use of various drawing instruments, Lettering, Types of lines used in drawing practice, Dimensioning, Types of Scales and representative fraction (R. F.) of scale.
Conic sections- Ellipse, Parabola, Hyperbola, Cycloid, Involute & Archimedean Spiral.

Projections of Points and Lines:
Basic principles of orthographic projection, reference planes, concepts of four quadrants, methods of orthographic projections: First angle projections and Third angle projections, conventions used to represent methods of orthographic projection.
Projections of points in all possible positions w.r.t. reference planes, projections of lines when it is perpendicular to one of the reference planes, when line is inclined to one & parallel to other reference plane, lines inclined to both reference planes. (lines in first quadrant only).

Projections of Planes:
Projection of planes when it is parallel to one of the reference planes, when it is perpendicular to one & inclined to other reference plane, when it is inclined to both reference planes.

Projections of Solids:
Projections of solids when axis is perpendicular to one of the reference planes, when axis is inclined to one & parallel to other reference plane, when axis is inclined to both the reference planes. (Projections of cube, right regular prisms, right regular pyramids, right circular cylinder, right circular cone, tetrahedron).

Orthographic Projections:
Conversion of pictorial view into orthographic views.

Isometric Projections:
Definition of Isometric view/projection, Isometric scale to draw Isometric projection, construction of Isometric view from given orthographic views.

PRACTICAL:
Seven Half imperial size drawing sheets as detailed below:

Sheet No. 1: Lines, Lettering and Dimensioning
Sheet No. 2: Curves (Minimum four problems)
Sheet No. 3: Projection of straight lines (Minimum four problems)
Sheet No. 4: Projection of Planes (Minimum four problems)
Sheet No. 5: Projections of solids (Minimum four problems)
Sheet No. 6: Orthographic Views (To draw three principal views from given isometric View-minimum two problems)
Sheet No. 7: Isometric Views/Projection (minimum four problems on Isometric views/projections)

Text Books:

1. N.D. Bhatt, Elementary Engineering Drawing, Charotor Publishing house, Anand, India.
2. R.K. Dhawan- Engineering Drawing-
3. K. Venu Gopal- Engineering Drawing and graphics+ Autocad-
4. D. N. Johle- Engineering Drawing, Tata McGraw-hill Publishing Co. Ltd.
5. Pakhatkar- Engg. Drawing , Nirali Prakashan

Reference Books:

1. P.S. Gill, Engineering Graphics.
2. N.D. Bhatt, Machine Drawing, Charotor Publishing house, Anand, India.

First Semester)

COMMUNICATION SKILLS (BT (BGE) 1.10)

(Total Credits: 02)

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

Following points are to be discussed with the students before conducting the practicals.

A) Principals and Practice of letter writing: Business, Job and Bank Correspondence
B) Technical Report Writing
C) Grammar:
   1. Correction of Common Errors
   2. Exercise on rewrite as directed
   3. Correct use of words, idioms, phrases, prepositions, etc.
D) 1. Principles of Public Speaking
   2. Reading Comprehension

E) 1. Professional Communication Skills (Meaning, Significance, Types, Dimensions & Barriers)

2. Group Discussion and Personal Interview (Importance of GD, Modules of GD, How to prepare for GD, Meaning, types & techniques of PI, How to prepare for PI)

Books:

1. Public Speaking and Influencing Men in Business- Dale Carnegie
2. Professional Communication Skills-Bhatia and Sheik
3. Business Communication- K.K.Sinha
4. Communication Skills- Dr.P.Prasad
5. Technical Communication- Raman and Sharma
6. High School Grammar and Composition-Wren and Martin
7. Modern English Grammar Usage an Composition –N.Krishnaswamy

Communication Skills Laboratory Practical

Sr.No	Name of the Practical	Activity to be Taken	Medium of Practical
1	Barriers to Communication	1. Intro to various kinds of barriers 2. Activity class on semantic barriers	PPT Based, Activity Based
2	Reading Skills	1. Skimming, Scanning & Gist Reading 2. Comprehending Passages	PPT Based, Activity Based
3	Development of Word Power	1. IPA, Pronunciation techniques 2. Often wrongly pronounced words 3. Word Power, homophones, synonyms/antonyms	Software based PPT Based, Activity Based
4	Non-Verbal Communication	1. Kinesics in comm./Interviews 2. Activities/ role play	Software based PPT Based, Activity Based
5	Speaking Skills	1. Intro of effective way of speaking 2. Oral presentations Extempore/ Debate/JAM	PPT Based, Activity Based
6	Group Discussion	1. GD rules 2. GD of groups in 6	Software based PPT Based, Activity Based
7	Interview Techniques	1. Various types of interviews 2. Resume making 3. Mock Interviews(one to one)	Software based PPT Based, Activity Based
8	Use of Figurative Language	1. Intro phrases/idioms/proverbs 2. Idioms related to color/Number/animals/ parts of the body/Misc.	PPT Based, Activity Based
9	Listening Skills	Listening Barriers	PPT Based, Activity Based
10	Presentation Skills	1. Preparing visual aids/ PPTs 2. Writing references	PPT Based, Activity Based

First Semester)

COMPUTATIONAL SKILL PRACTICAL (BT (BGE) 1.11)

(Total Credits: 02)

Teaching Scheme

Practical: 2 Hours / Week

Examination Scheme

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].

****