PROPOSED SCHEME OF EXAMINATION FOR B. TECH (BIOTECHNOLOGY))
FIRST SEMESTER B. TECH (BIOTECHNOLOGY)

Sr. No.	Code Theory (T) Practical (P)	Subject	Board	Work Load (Hours)				Credit				Marks				Total Marks
				L	P	T	Total	L	P	T	Total	Theory		Practical		
												College Assessment	University	College Assessment	University	
1	BT -BSC -101T	Maths I	BGE	2	0	0	2	2	-	0	2	10	40	-	-	50
2	BT - BSC -102 T	Physics	BGE	2	--	0	2	2	-	0	2	10	40	-	-	50
3	BT - BSC -103 T	Chemistry-I	BGE	2	--	0	2	2	-	0	2	10	40	-	-	50
4	BT - BSC -104 T	Fundamentals of Reaction Mechanism	BGE	2	--	0	2	2	-	0	2	10	40	-	-	50
5	BT - GES -105 T	Engineering & Solid Mechanics	BGE	3	--	0	3	3	-	0	3	20	80	-	-	100
6	BT -HS -106 T	Communication Skill	BGE	2	-	0	2	-	-	0	Audit	50	--	-	-	50
7	BT - BSC -107 P	Physics Laboratory	BGE	0	2	0	2	0	1	-	1	-	-	25	25	50
8	BT - BSC -108 P	Chemistry I Laboratory	BGE	0	2	0	2	0	1	-	1	-	-	25	25	50
9	BT - BSC -109 P	Fundamentals of Reaction Mechanism Laboratory	BGE	0	2	0	2	0	1	-	1	-	-	25	25	50
10	BT -GES -110 P	Engineering & Solid Mechanics Laboratory	BGE	0	3	0	3	0	1.5	-	1.5	-	-	25	25	50
11	BT -HS -111 P	Communication Skill Laboratory	BGE	0	2	0	2	0	1	-	1		--	25	25	50
		Total		**13**	**11**	**0**	**24**	**11**	**5.5**	**0**	**16.5**	**110**	**240**	**125**	**125**	**600**

PROPOSED SCHEME OF EXAMINATION FOR B. TECH (BIOTECHNOLOGY)

SECOND SEMESTER B. TECH (BIOTECHNOLOGY)

Sr. No.	Code Theory (T) Practical (P)	Subject	Board	Work Load (Hours)				Credit			Marks					Total Marks
				L	P	T	Total	L	P	T	Total	Theory		Practical		
												College Assessment	University	College Assessment	University	
1	BT -BSC -201T	Maths II	BGE	3	0	0	3	3	0	0	3	20	80	-	-	100
2	BT - BSC -202 T	Properties of Matter	BGE	2	-	0	2	2	0	0	2	10	40	-	-	50
3	BT - BSC -203 T	Chemistry-II	BGE	2	-	0	2	2	0	0	2	10	40	-	-	50
4	BT -BSC -204 T	Organic Process Technology	BGE	2	-	0	2	2	0	0	2	10	40	-	-	50
5	BT -GES -205 T	Thermodynamics I	BGE	3	0	1	4	3	0	1	4	20	80	-	-	100
6	BT -GES -206 T	Electrical & Electronics Engineering	BGE	3	-	0	3	3	0	0	3	20	80	-	-	100
7	BT - BSC -207 P	Properties of Matter Laboratory	BGE	0	2	0	2	0	1	0	1	-	-	25	25	50
8	BT- BSC -208 P	Chemistry -II Laboratory	BGE	0	2	0	2	0	1	0	1	-	-	25	25	50
9	BT- BSC -209 P	Organic Process Technology Laboratory	BGE	0	3	0	3	0	1.5	0	1.5	-	-	25	25	50
10	BT-GES -210 P	Electrical & Electronics Engineering Laboratory	BGE	0	3	0	3	0	1.5	0	1.5	-	-	25	25	50
11.	BT -GES -211P	Engineering. Graphics	BGE	0	3	0	3	0	1.5	-	1.5	-	--	25	25	50
		Total		**15**	**13**	**1**	**29**	**15**	**6.5**	**1**	**22.5**	**90**	**360**	**125**	**125**	**700**

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Proposed Scheme of Absorption for Old Scheme to New Scheme B. Tech. First Year B. Tech (Biotechnology)

Semester-I

As per RTM Nagpur University Old Scheme				As per RTM Nagpur University New Scheme			
Sub Code (Board) Theory/Practical	**Subject**	**Th/ Pr**		**Sub Code Theory/Practical**	**Board**	**Subject**	**Th/ Pr**
BT (BGE) 1.01	Engineering Mathematics I	Theory		BT-BSC-101T	BGE	Maths I	Theory
BT (BGE) 1.02	Applied Inorganic Chemistry	Theory		BT-BSC -103T	BGE	Chemistry-I	Theory
BT (BGE) 1.03	Applied Organic Chemistry	Theory		BT-BSC -104T	BGE	Fundamental of Reaction Mechanism	Theory
BT (BGE) 1.04	Applied Physics	Theory		BT-BSC -102T	BGE	Physics	Theory
BT (BGE) 1.05	Applied Mechanics	Theory		BT-GES -105T	BGE	Engineering Solid and Mechanics	Theory
BT (BGE) 1.06	Applied Inorganic Chemistry Laboratory	Practical		BT-BSC -108P	BGE	Chemistry I Laboratory	Practical
BT (BGE) 1.07	Applied Organic Chemistry Laboratory	Practical		BT-BSC -109P	BGE	Fundamental of Reaction Mechanism Laboratory	Practical
BT (BGE) 1.08	Applied Physics Laboratory	Practical		BT-BSC -107P	BGE	Physics Laboratory	Practical
BT (BGE) 1.09	Engineering. Graphics	Practical		--	--	--	--
--	--	--		BT-HS -106 T	BGE	HASS-I (Communication Skill/English)	Theory
BT (BGE) 1.10	Communication Skill Laboratory	Practical		BT-HS -111 P	BGE	HASS-I (Communication Skill/English)	Practical
--	--	--		BT-GES -110 P	BGE	Engineering Solid and Mechanics Laboratory	Practical
BT (BGE) 1.11	Computational Skill Laboratory	Practical		--	--	--	--

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Proposed Scheme of Absorption for Old Scheme to New Scheme First Year B. Tech. (Chemical Engineering)
Semester-II

As per RTM Nagpur University Old Scheme				**As per RTM Nagpur University New Scheme**			
Sub Code (Board) Theory/Practical	**Subject**	**Th/ Pr**		**Subject Code Theory/Practical**	**Board**	**Subject**	**Th/ Pr**
BT (BGE) 2.01	Engineering Mathematics II	Theory		BT-BSC-201T	BGE	Maths II	Theory
BT (BGE) 2.02	Applied Physical Chemistry-I	Theory		BT-BSC -203 T	BGE	Chemistry-II	Theory
BT (BGE) 2.03	Applied Physics II	Theory		BT-BSC -202 T	BGE	Properties of Matter	Theory
BT (BGE) 2.04	Basic Electrical Engineering	Theory		BT-GES-206 T	BGE	Electrical & Electronics Engineering	Theory
BT (BGE) 2.05	Basic Mechanical Engineering	Theory		--	--	--	--
BT (BGE) 2.06	Ethical Science	Theory		--	--	--	--
BT (BGE) 2.07	Applied Physical Chemistry Laboratory-I	Practical		BT-BSC -208 P	BGE	Chemistry II Laboratory	Practical
BT (BGE) 2.08	Applied Physics II Laboratory	Practical		BT-BSC -207 P	BGE	Properties of Matter Laboratory	Practical
BT (BGE) 2.09	Basic Electrical Engineering Laboratory	Practical		BT-GES-210 P	BGE	Electrical & Electronics Engineering Laboratory	Practical
--	--	--		BT-BSC-204 T	BGE	Organic Process Technology	Theory
--	--	--		BT-BSC -209 P	BGE	Organic Process Technology Laboratory	Practical
--	--	--		BT-GES-205 T	BGE	Thermodynamics I	Theory
--	--	--		BT-GES-211 P	BGE	Engineering Graphics	Practical
BT (BGE) 2.10	Workshop	Practical		--	--	--	--
	NCC/NSS			--	--	--	--

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

Maths –I: BT-BSC-101T **Total Credits: 02** **Teaching Scheme: Lectures: 2 Hours/ Week,**
Examination Scheme: T (U) : 40 Marks T (I) : 10 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

Reference Books :

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 BT-BSC-102 T **Total Credits: 02**
Teaching Scheme: Lectures: 2 Hours/ Week
Examination Scheme: T (U) : 40 Marks T (I) : 10 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:

Fundamentals of Physics: David Halliday, Robert Resnick and Jerle Walker, John-Wiley India(8e, extended)
A text book of Engineering Physics: M. N. Avadhanulu and Kshirsagar S. Chand & Co.
Electronic Engineering Materials and Devices: John Allision, (TMH edition, 10th reprint)
Concepts of Modern Physics: Baiser (Tata McGraw Hill).
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 : BT-BSC-103 T **Total Credits: 02**
Teaching Scheme: Lectures: 2 Hours/ Week
Examination Scheme: Theory T (U) : 40 Marks T (I) : 10 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 H2, N2, 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: BT-BSC-104 T Total Credits: 02
Teaching Scheme: Lectures: 02 Hours/Week
Examination Scheme: Theory T (U): 40 Marks T (I): 10 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: Stereodescriptors – 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, Actanalide with mechanism, photohalogenation 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

Engineering and Solid Mechanics: BT-GES-105 T Total Credits: 03
Teaching Scheme: Lectures: 03 Hours/Week
Examination Scheme: Theory T (U): 80 Marks T (I): 20 Marks
Duration of University Exam. : 03 Hours

Unit I: **Force:** Definition, Characteristics of a force, System of forces, Resolution and composition of forces. Resultant force: Definition, Analytical and graphical methods for resultant force in two dimensions, Moments and Couples, Varignon's theorem of moments. Equilibrium of rigid bodies: Principles of equilibrium, types of equilibrium, conditions of equilibrium, free body diagrams, Analytical and graphical methods for equilibrium of rigid bodies in two dimensions. (7 Lectures)

Unit II: **Support reactions**: Types of supports and loading in beams, determination of support reactions in cantilever, simply supported and overhang beams. Trusses and Frames: Types of frames, Analysis of simple plane trusses in equilibrium by the method of joints and method of sections. Friction: Frictional forces, types, limiting friction, coefficient of friction, angle of friction, laws of friction, Equilibrium of bodies lying on rough horizontal and inclined planes, wedge friction. (8 Lectures)

Unit III: **Centroid and Moment of Inertia:** Centroid of plane standard geometric figures and composite figures, Moment of inertia (second moment of area) of plane standard geometric figures and composite figures, parallel and perpendicular axis theorems, Radius of gyration. Simple lifting machines: Types of machines, efficiency of a machine, ideal machine, friction in machines, law of machine, Maximum M.A. and Maximum efficiency of a machine, reversible and non reversible machines, Differential wheel & axle, single and double purchase winch crabs. (8 Lectures)

Unit IV: **Simple stresses and strains** : Types of stresses and strains, modulus of elasticity, modulus of rigidity, bulk modulus, relation between elastic constants, stress-strain diagram for mild steel, lateral strain, Poisson's ratio, volumetric strain, triaxial loading in rectangular sections, stresses in bars of varying and composite sections, Temperature stresses and strains. (7 Lectures)

Unit V: **Stresses in beams**: Theory of simple bending, simple bending equation, bending stress, moment of resistance, assumptions in theory of simple bending, section modulus. Shear force and bending moment: Basic concepts, Shear force and bending moment diagrams for cantilever, simply supported and overhang beams for different loading conditions. Slope and defection of beams: Basic concepts, slope and deflection of cantilever and simply supported beams under standard loading conditions, Macaulay's method, simple problems. (8 Lectures)

Unit VI: **Torsion**: Theory of pure torsion, torsional moment of resistance, torsion equation, assumptions in the theory of pure torsion, polar modulus, power transmitted by solid and hollow circular shafts. Columns and struts: Axially loaded compression members, Euler's and Rankine's formula for buckling of columns, end conditions of column, buckling load, effective length of columns, slenderness ratio. (7 Lectures)

Suggested Text Books:

1. R. S. Khurmi, A Textbook of Engineering Mechanics, S. Chand & Co., New Delhi.
2. S. N. Saluja, A Textbook of Engineering Applied Mechanics, Satya Prakashan.
3. R. S. Khurmi and N. Khurmi, Strength of Materials, S. Chand & Co., New Delhi.
4. B. C. Punmia, Mechanics of Materials, Laxmi Publications (P) Ltd.

Suggested Reference Books:

1. F. L. Singer, Engineering Mechanics, Harper & Row Publishers.
2. S. Timoshenko and D. H. Young, Engineering Mechanics, McGraw Hill Publications.
3. Andrew Pytel and F. L. Singer, Strength of Materials, Harper & Row Publishers.

Communication Skills BT-HS-106 T **Total Credits: Audit Teaching Scheme :**
Lectures: 2Hour/ Week
Examination Scheme: Theory T (I) : 50 Marks

Unit I: Communication Skills: Introduction to Communication, Types of Communication, Barriers to communication and overcoming them **(03)**

UNIT-II: Listening and Reading Skills: Importance of Listening, Types of listening, Listening barriers and overcoming them, Importance of reading, Sources of Reading, Skimming, Scanning and Gist Reading, Comprehending Passage, Use of Figurative Language
(03)

Unit III: Speaking Skills: Effective Speaking Skills, Components of Public Speaking, Effective Presentation Strategies, Vocabulary Acquisition **(03)**

Unit IV: Group Discussion and Interview Techniques: Importance of Group Discussion, Techniques of Group Discussion, Types of Interviews, Interview Process, Interview Techniques
(03)

Books Recommended:

1. Technical Communication by Meenakshi Raman and Sangeeta Sharma, OUP
2. Public Speaking and Influencing Men in Business by Dale Carnegie
3. Professional Communication Skills by Bhatia and Sheikh
4. Communication Skills by Dr. P. Prasad
5. Communication Skills by Sanjeev Kumar and Pushpalata, OUP

Physics Laboratory BT -BSC-107 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 : BT -BSC-108 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 BT -BSC-109 P Total Credits: 1

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

Engineering and Solid Mechanics Laboratory: BT-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

List of Experiments

Suitable number of experiments from the below list will be performed.

1. Study of forces in the members of Jib crane.
2. Reactions of a beam.
3. Law of Moments.
4. Verification of Polygon law of forces.
5. Inclined friction plane.
6. Forces in single roof truss element.
7. Graphical method of analysis of forces.
8. Differential wheel & axle.
9. Single purchase winch crab.
10. Double purchase winch crab.
11. Study of Universal testing machine.
12. Deflection in beams.

Communication Skills BT-HS-111 P Total Credits: 01
Teaching Scheme Practical : 2Hours/ Week
Examination Scheme: P (U): 25marks, P (I): 25 Marks
Duration of University Examination. : 03 Hours

1. Barriers to Communication
2. Non-Verbal Communication
3. Listening Skills
4. Reading Skills
5. Use of Figurative Language
6. Speaking Skills
7. Presentation Skills
8. Development of Word Power
9. Group Discussion
10. Interview Techniques

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

Maths –II: BT-BSC-201 T **Total Credits: 03 Teaching Scheme:**
Lectures: 3 Hours/ Week
Examination Scheme: T (U) : 80 Marks T (I) : 20 Marks
Duration of University Exam. : 03 Hours

Unit I : Ordinary differential Equation and Higher Order Differential Equation :
Differential Equations: First order first degree differential equations: Linear, reducible to linear and exact differential equations. Higher order differential equations with constant coefficient, method of variation of parameters. Cauchy's and Legendre's homogeneous differential equations, simultaneous differential equations.

Unit II : Partial Differential Equations: First order Lagrange's Linear Partial Differential Equation, Solution of higher order linear homogeneous Partial Differential Equations and linear non-homogeneous Partial Differential Equations.

Unit III : Application of Partial Differential Equations : Method of separation of variables for Partial Differential Equations, Applications of Partial Differential Equations: (i) One dimensional wave equation, (ii) One dimensional heat conduction equation in Cartesian co-ordinates and polar co-ordinates and (iii) Two dimensional steady state heat conduction equation

Unit IV : Function of Complex Variables : Basic Concepts of Complex numbers, De-Moivre's Theorem, Calculus of Functions of Complex variables : Analytic functions, Cauchy –Riemann conditions in Cartesian co-ordinates and polar co-ordinates, methods for finding conjugate functions,

Unit V: Statistics and Probability : Fitting of straight line y=a+bx, parabola and Exponential curves by method of least squares, Lines of regression and Correlation, Rank correlation.
Random variables: Discrete and Continuous random variables, Probability distribution: Binomial, Poisson, Normal Distribution.

Unit VI : Fourier Series : Fourier series, expansion of function, Even and odd function, Half range fourier series, Change of interval, Harmonic analysis.

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. Applied Engineering Mathematics (Vol- I & II) by J. N. Wartikar
4. Higher Engineering Mathematics by B. S. Grewal
5. Text book of Engineering Mathematics by Bali, Iyenger (Laxmi Prakashan)

Properties of Matter BT-BSC-202 T **Total Credits: 02**
Teaching Scheme Lectures: 2 Hours/ Week Theory **Examination Scheme T (U) : 40 Marks T (I) : 10 Marks**
Duration of University Exam. : 02 Hours

Unit 1: VISCOSITY: Streamline flow, Turbulent motion, critical velocity, Viscosity, Coefficient of viscosity, Poiseulle's equation, Stokes's method, Ostwald viscometer, Numericals

Unit 2: SURFACE TENSION: Surface tension, Excess pressure inside a liquid drop and soap bubble,

Angle of contact, Searl's Torsion Balance method, Quincke's method, Interfacial surface Tension, Numericals.

Unit 3: Crystal structure and X-rays : Meaning of lattice and basis, Unit cell: primitive and non primitive unit cell; Cubic crystal structure: Body and Face centered cubic structures, SC, BCC and FCC unit cells. Unit cell characteristics: Effective number of atoms per unit cell, atomic radius, nearest neighbour distance, coordination number, atomic packing fraction, void space, density; Crystal planes and Miller indices, Inter-planar distance between adjacent planes, Tetrahedral and octahedral voids, Numericals.
Production of X-Rays: Coolidge tube, Origin of X-rays, Properties of X-rays, Applications of X-Rays, Bragg's law and Bragg's X-ray spectrometer. Numericals.

Unit 4: Interference in thin film: Plane Parallel thin film, wedge shaped thin film, Newtons rings, Applications: Determination of wavelengrh and Refractive index of liquid, test of surface finish. Antireflection coating, Numericals

TEXT BOOKS

1. Brijlal and Subramaniam N., Properties of Matter , Revised Edition, S.Chand and Company,2005.
2. Murugesan R., Properties of Matter and Acoustics, Revised Edition, S.Chand and Company, 2005.
3.Thiruvadigal,..J. D, Ponnusamy,S..Sudha.D and Krishnamohan M, "Physics for Technologists", Vibrant Publication, Chennai, 2013.
4. Dattu Joshi. R. "Engineering Physics",Tata McGraw- Hill,New Delhi.
5. Mathur D. S, Elements of Properties of Matter, 3rd Edition, S. Chand and Company.
6. Satyaprakash and Akash Saluja, Oscillations and Waves, Pragati Prakashan, 2002

REFERENCES

1. Landau L. D., Pitaevskii L P, Kosevich A M and Lifshitz E M, "Theory of Elasticity", Revised Edition, Butterworth-Heinemann, 2014
2. Landau L. D., Pitaevskii L P, Kosevich A M and Lifshitz E M, "Fluid Mechanics", Revised Edition, Butterworth-Heinemann, 2014.
3. "Laboratory Experiments in College Physics", C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.

Chemistry-II: BT-BSC-203 T **Total Credits: 02**
Teaching Scheme: Lectures: 2 Hours/ Week
Examination Scheme: Theory T (U) : 40 Marks T (I) : 10 Marks
Duration of University Exam. : 02 Hours

Unit 1: A] Gaseous state: Gas laws, kinetic theory of gas, collision and gas pressure, derivation of gas laws from kinetic theory, average kinetic energy of translation, Boltzmann constant and absolute scale of temperature. Maxwell's distribution of speeds. Kinetic energy distribution, calculations of average, root mean square and most probable velocities. Principle of equipartition of energy and its application.

B] Collision of gas molecules, Real gases: Collision diameter, collision number and mean free path; frequency of binary collisions; Deviation of gases from ideal behaviour; compressibility factor; Andrew's plots; van der Waals equation and its characteristic features. Existence of critical state. Critical constants in terms of van der Waals constants. Law of corresponding state, compressibility factor, and Joule-Thomson effect, Numericals. **[8L]**

Unit 2: Quantum mechanics: De Broglie equation, experimental verification, Compton effect, Heisenberg's uncertainty principle, Introduction of quantum mechanics, Postulates of quantum mechanics, Derivation of Schrodinger wave equation from postulates of quantum mechanics. wave function, normalized and orthogonal wave function, operators, properties of operators, eigen

function and eigen values, (problems on operators, eigen values), numericals.

B] Application of Schrodinger wave equation to simple systems: Particle in a one dimensional box: derivation of energy and normalization and orthogonality of wave function. Graphical representation of Ψ and its square Ψ2. Schrodinger wave equation for 3-dimensional box(without derivation, in terms of r, □ and Φ), degeneracy, Numericals**. [8L]**

Unit 3: A] Rate expressions, order and molecularity of reaction, Integrated rate expression with examples, Factors influencing the reaction rates, Arrhenius equation, Energy of Activation, Half life, Methods for determining the order of chemical reaction, Numericals.
B] Steady state approximation, kinetics of consecutive (chain) reactions, parallel reactions, opposing reactions with examples, Mechanism of chain reactions with examples, general catalytic mechanisms, acid-base catalysis, catalysis by enzymes, Michaelis-Menten Equation, Photochemical reactions of hydrogen and bromine, hydrogen and chlorine and decomposition of HI. **[8L]**

Unit 4: A**] Chemical equilibrium:** Chemical equilibria of homogeneous systems, derivation of expression of equilibrium constants, Relation between Kp, Kc and Kx, Le Chatelier's principle of dynamic equilibrium. Effect of change of concentration, pressure, temperature and catalyst on equilibrium constant, Numericals.
B] Thermodynamics of Equilibrium: Introduction, partial molar properties, Chemical Potential, Gibbs-Duhem equation; fugacity of gases Van't Hoff Reaction isotherm – isochore & isobar, Numericals **[6L]**

Reference Books-

1. F. Daniel,Mathematical preparation for physical Chemistry, Mc. Graw Hill publication.
2. Maron and Pruton, Principles of Physical Chemistry, 4th Ed. Oxford and IBH publication.
3. I.N. Levine, Quantum Chemistry, 5th edition (2000), Pearson Educ., Inc. New Delhi
4. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8 th Ed., Oxford University Press (2006).
5. Ball, D. W., Physical Chemistry, Thomson Press, India (2007).
6. Castellan, G. W., Physical Chemistr,y 4 th Ed. Narosa (2004).
7. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
8. Laidler, K. J. Chemical Kinetics Pearson Education: New Delhi (2004).
9. A A Pearson, R G Frost, Kinetics and Mechanism
10. House, J. E., Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004).
11. Lowe, J. P. & Peterson, K., Quantum Chemistry Academic Press (2005).

Text Books-

1. C.N. R. Rao, University General Chemistry. Mc. Millan Publication.
2. Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).

Organic Process Technology : BT-BSC-204 T **Total Credits: 02**
Teaching Scheme: Lectures: 2 Hours/ Week,
Examination Scheme: Theory T (U): 40 Marks T (I) : 10 Marks
Duration of University Exam. : 02 Hours

Unit 1: Introduction to unit processes, e.g. Nitration, Sulfonation, sigificance of kinetics and thermodynamics, feasibility aspects of chemical process, basic concept of flowsheet, nitration and sulfonation of benzene (**6L**)

Unit 2: (Mechanisms and recent advances (green chemistry, catalysis, etc.) Basic principles of green chemistry, industrial significance. Homogeneous and hetrogeneous catalysis with examples. Alkylation of benzene, transesterification of fatty acid to bio-diesel **(7L)**

Unit 3: Mechanisms and recent advances (green chemistry, catalysis, etc.) of following processes: Hydrogenation and alkylations, e.g. hydrogenation of nitrobenzene, petroleum hydrogenation, alkylation reactions of anilines, etc. and their flowdiagrams, Oxidation, e.g. oxidation of xylenes etc. (**8L**)

Unit 4: Recent developments in polymerisation (reaction mechanism and catalysis) Technical preparation of biodegradable plastics such as polylactic acid, rayon using waste biomass, zeolite resins and their applications in green detergents. (**5L**)

Books Recommended:

1. Chemical and Catalytic Reaction Engineering by Carberry, J.J. Dover books on chemistry
2. Engineering Chemistry by B.L.Tembe, Kamaluddin and M.S. Krishnan(NPTEL web book)
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, Wiley Publication
5. Monograph on green chemistry, Green chemistry Task Force Committee, DST
6. Zeolites: Molecular sieves Textbook by D.W.Breck

Thermodynamics-I : BT-GES-205 T **Total Credits: 04**
Teaching Scheme: Lectures: 3 Hours/ Week, Tutorial: 1 Hours/ Week
Examination Scheme: Theory T (U): 80 Marks T (I) : 20 Marks
Duration of University Exam. : 03 Hours

Unit 1: Introduction- Scope of thermodynamics, Dimensions and Units, Temperature, Pressure, Work, Energy, Heat. Energy conservation & first law of thermodynamics; State functions; Equilibrium; Phase Rule; Reversible process; Constant P,V, T processes; Mass and energy balances for open systems; Ideal gas law, Vander Waals. (8L)

Unit 2: Heat effects-latent heat, sensible heat, standard heats of formation, reaction and combustion. Statements of the second law; Heat engines, Carnot's theorem,; Thermodynamic Temperature Scales; Entropy; Entropy changes of an ideal gas; Mathematical statement of the second law; Entropy balance for open systems; Calculation of ideal work, Lost work. (8L)

Unit 3: Thermodynamic property of fluids, Maxwell relations, 2-phase systems, graphs and tables of thermodynamic properties. Properties of Steam, Use of steam tables, measurement of dryness fraction, entropy of steam, temperature entropy and mollier charts. (8L)

Unit 4: Application of thermodynamics to flow processes-pumps, compressors and turbines. (8L)

Unit 5: Thermodynamic analysis of steam power plants; Rankine cycle; Internal combustion engine, Otto engine; Diesel engine; Jet engine. (8L)

Unit 6: The Carnot refrigerator; Vapour-compression cycle; Absorption refrigeration; Heat pump,

Liquefaction processes. (8L)

Suggested Text Books

1. J. M. Smith, H.C. Van Ness and M.M. Abbott, Introduction to Chemical Engineering Thermodynamics, 7th edition, McGraw-Hill International Edition, 2005.
2. P. K. Nag, Engineering Thermodynamics, Tata McGraw-Hill Publications.
3. P. L. Ballani, Thermal Engineering, Khanna Publications.
4. M. J. Moran, H. N. Shapiro, D. D. Boettner and M. B. Bailey, Principles of Engineering Thermodynamics, 8th Edition, Willey.
5. Yunus A. Cengel, Michael A. Boles, Thermodynamics and Engineering approach, Tata McGraw-Hill Publications.

Electrical & Electronics Engineering: BT-GES-206 T Total Credits: 03
Teaching Scheme: Lectures: 3Hours/ Week
Examination Scheme: Theory T (U): 80 Marks T (I): 20 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.

Properties of Matter Laboratory BT-BSC-207 P **Total Credits: 01**
Teaching Scheme Practical: 2 Hours/ Week **Examination Scheme**
P (U) : 25 Marks P (I) : 25 Marks
Duration of University Exam. : 03 Hours

1. Elementary analytical techniques: Method of linear least squares fit to the experimental data, error estimation, calculations involving idea of significant figures.

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

3. Study of Ostwald's viscometer.

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

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

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

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

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

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

10. Interference in thin films: Study of wedge shaped thin film.

Chemistry-II Laboratory: BT-BSC-208 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. Calibration of glass wares (Burette, pipette, volumetric flask etc.)
2. To determine the surface tension & Parachor value of liquid using Stalagnometer.
3. To Study the surface tension of liquids & to determine the concentration of given unknown solution using Stalagnometer.
4. To Study the viscosity of liquids & to determine the concentration of given unknown solution using Oswald's Viscometer.
5. To study the kinetics of the reaction between Potassium Persulphate and Potassium Iodide and to determine its energy of activation.
6. To study kinetics of saponification of ethyl acetate.
7. To study the relative strength of acids using method of kinetics.
8. To study the adsorption of acetic acid on charcoal and verify the Langmuir and Freundlich adsorption isotherm
9. To determine heat of ionization of weak acid by thermometric method.
10. To determine the heat of crystallization of $CuSO_4.5H_2O$ by thermometric method.
11. To determine the optical rotation of glucose / fructose /cane sugar by polarimeter.

12. To study the kinetics of inversion of cane sugar by polarimeter.

13. To study the kinetics of iodination of acetone.

14. To determine the molecular weight of a volatile substance by Victor-Mayer's apparatus.

Reference Books-

1. Experiments in general chemistry by C.N.R. Rao and Agrawal East West Press.
2. Experiments in Physical Chemistry by R.C. Das and Behere Tata Mc Graw Hill.
3. Experimental physical Chemistry by F. Daniel and others (International Student Edition)
4. B. Vishwanathan, P.S. Raghavan; Practical Physical Chemistry, Viva Books, 2010.

Organic Process Technology Laboratory BT -BSC-209 P Total Credits: 1.5
Teaching Scheme **Examination Scheme**
Lectures: 3 Hours/ Week **P (U) : 25 Marks P (I) : 25 Marks**
Duration of University Exam. : 03 Hours

LIST OF EXPERIMENTS

1. To prepare urea formaldehyde resin using bulk technique of polymerisation

2. To prepare phenol formaldehyde resin using solution technique of polymerisation.

3. To prepare Acetanilide from aniline using green route

4. To prepare p-bromo acetanilide from acetanilide.

5. To prepare 2-methoxy napthalene using unit process alkylation

6. To prepare p-nitro acetanilde from acetanilide using nitration

7. To prepare Oxalic acid from canesugar using oxidation process

8. To prepare Aspirin from salicyclic acid

9. Extraction of essential oil from biomass (demonstration)

10. Purification of organic compounds by recrystallisation.(demonstration)

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

3. Monograph on green chemistry, Green chemistry Task Force Committee, DST

Electrical & Electronics Engineering Laboratory: BT-GES-210P Total Credits: 1.5
Teaching Scheme: Practical: 3 Hours / Week **Examination Scheme: Practical P (U) : 25 Marks, P (I) : 25 Marks**
Duration of University Exam: 03 Hours

LIST OF EXPERIMENTS

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: BT-GES-211 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

LIST OF EXPERIMENTS

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.