Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Undergraduate Programme

B. Sc. Nanoscience and Technology Entire

Syllabus of the course

Choice based credit system syllabus

(To be implemented from academic year 2018-21)

Department of Nanoscience and Technology

CONTENT

Syllabus for B.Sc. I (Nanoscience and Technology (Entire))

Preamble:

B. Sc. Nanoscience and Technology (Entire) course is multidisciplinary .The goal of the syllabus is to make the study of Nanotechnology and its applications interesting and encouraging for the students for higher studies including research.

The new syllabus is based on a basic and applied approach with vigour and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research. It is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

In general, course objectives have been framed and the curriculum and syllabus have been structured in such a way that each of the subjects meet one or more of these objectives. Student outcomes describe what students are expected to know and be able to do that by the time of their graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the course. Further each subject paper in the course spells out clear objectives and outcomes which are mapped to the student outcomes. It isexpected to inspire and boost interest of the students towards applications of nanotechnology.

General Objectives of the Program:

1. To nurture academicians with focus and commitment to their subject
2. To shape good and informed citizens from the students entering into the program.
3. To create a skilled workforce to match the requirement of the society.
4. To impart knowledge of Science as one of the basic objective of this program.
5. To develop scientific attitude as one of the major objective so as to make the students open minded, critical and curious.
6. To develop skill in practical work, experiments , laboratory materials and equipments along with the collection and interpretation of scientific data for contribution to science.

Program Outcomes:

1. The students will graduate with proficiency in the subject of their choice.
2. The students will be eligible to continue higher studies in their subject.

3. The students will be eligible to pursue higher studies abroad.
4. The students will be eligible to appear for the examinations for jobs in government organizations.
5. The students will be eligible to apply for the jobs with a minimum requirement of B. Sc. Program.

Program Objectives of the Course:

1] The students are expected to develop an ability to work with multidisciplinary teams.
2] An ability to design and conduct experiments, as well as to analyze and interpret data.
3] The students are expected to use techniques, skills, and modern instrumental tools necessary for Research practices.
4] The students are expected to understand the fundamentals, principles concepts and recent developments in the subject area.
5] It is expected to inspire and boost interest of the students in Nanoscience to meet desired needs within realistic constraints such as economic, environmental, social, health , safety, manufacturability, and sustainability.

Program Specific Outcomes:

After successful completion of B.Sc. Nanoscience and Technology Entire Course, students will be able to :

* Understand various concepts in Physics, Chemistry and Biotechnology are able to implement it at nanoscale.
* To use the techniques, skills, and modern instrumental tools necessary for Research practices.
* To design and perform experiments in the labs to demonstrate the concepts, principles and theories learnt in the classrooms.
* Develop the ability to work with multidisciplinary approach.
* Identify their area of interest in academia, research and development.
* Perform job in various fields' like Research and Development, engineering, education, business, public service, etc. or be an entrepreneur with precision, analytical mind, innovative thinking, clarity of thought , expression, and systematic approach.

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B.Sc. Part I

1) **Title:** Nanoscience and Technology (Entire)
2) **Year of Implementation:** The syllabus will be implemented from June, 2018 onwards.
3) **Duration:** The course shall be a full time.
4) **Pattern:** Semester examination.
5) **Medium of Instruction:** English.
6) **Structure of Course:**

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE ,SATARA								
COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)								
B. Sc. NANOSCIENCE AND TECHNOLOGY(ENTIRE)								
B.Sc. I Semester I								
TEACHING SCHEME								
Sr. No.	Theory				Practical			
	Paper Code	No. of lectures/ Week	Clock Hours/ week	Credits	Paper Code	No. of lectures/ Week	Clock Hours/ week	Credits
1	BNTT -101	2	2	2	BNTP-111	3	3	2
2	BNTT -102	2	2	2				
3	BNTT -103	2	2	2	BNTP-112	3	3	2
4	BNTT -104	2	2	2				
5	BNTT -105	2	2	2	BNTP-113	3	3	2
6	BNTT -106	2	2	2				
7	BNTT -107	2	2	2	BNTP-114	3	3	2
8	BNTT -108	2	2	2				
9	BNTT -109	2	2	2	BNTP-115	3	3	2
10	BNTT -110	2	2	2				
11	BNTT - AECC-1	2	2	2				
	Total of SEM I	22	22	22		15	15	10
Total No. of Credits for Semester I = 32								

• Student contact hours per week : 37 Hours	• Total Marks for B.Sc.-I (Including English) : **1350**
• Theory lectures and practical : 50Minutes Each	• Total Credits for B.Sc.-I (Semester I & II) :**64**
• **AECC1** - Ability Enhancement Compulsory Course (BNTT -AECC-1 & BNTT -AECC-2)-English **BNTE- B. Sc. Nanoscience and Technology Entire** . (for Semester I BNTT -101 to BNTT -110 and for Semester II BNTT -201 to BNTT -210) • Course list as per enclosed Annexure. ***Separate passing is mandatory for Theory, Internal and Practical.***	
• Practical Examination will be conducted at semester end for 50 Marks as per DSC course(subject).	
• Passing Criteria - minimum 40%	

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE ,SATARA

COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

B. Sc. NANOSCIENCE AND TECHNOLOGY(ENTIRE)

B.Sc. I Semester II

TEACHING SCHEME

Sr. No.	Theory				Practical			
	Paper Code	No. of lectures/ Week	Clock Hours/ week	Credits	Paper Code	No. of lectures/ Week	Clock Hours/ week	Credits
1	BNTT-201	2	2	2	BNTP-211	3	3	2
2	BNTT-202	2	2	2				
3	BNTT-203	2	2	2	BNTP-212	3	3	2
4	BNTT-204	2	2	2				
5	BNTT-205	2	2	2	BNTP-213	3	3	2
6	BNTT-206	2	2	2				
7	BNTT-207	2	2	2	BNTP-214	3	3	2
8	BNTT-208	2	2	2				
9	BNTT-209	2	2	2	BNTP-215	3	3	2
10	BNTT-210	2	2	2				
11	BNTT- AECC-2	2	2	2				
	Total of SEM II	22	22	22		15	15	10
Total No. of Credits for Semester I = 32								
Total No. of Credits for Semester I + II = 64								

Semester - I

Sr. No	Paper Code	Title of paper
1	BNTT-101	Mechanics and properties of matter I
2	BNTT-102	Mechanics and properties of matter II
3	BNTT-103	Atomic Structure and Bonding
4	BNTT-104	General Organic Chemistry and Aliphatic Hydrocarbons
5	BNTT-105	Cell Biology I
6	BNTT-106	Cell Biology II
7	BNTT-107	Differential Calculus I
8	BNTT-108	Differential calculus II
9	BNTT-109	Network analysis and analog circuits I
10	BNTT-110	Network analysis and analog circuits II
11	BNTT- AECC-1	English
12	BNTP-111	Physical Science Lab
13	BNTP-112	Chemical Science Lab
14	BNTP-113	Biotechnology Lab
15	BNTP-114	Mathematics Lab
16	BNTP-115	Electronics Science Lab

Semester - II

Sr. No	Paper Code	Title of papers
1	BNTT-201	Vectors and Electrostatics
2	BNTT-202	Electricity and magnetism
3	BNTT-203	Physical Chemistry
4	BNTT-204	Functional Organic Chemistry
5	BNTT-205	Mammalian Physiology I
6	BNTT-206	Mammalian Physiology II
7	BNTT-207	Differential Equation I
8	BNTT-208	Differential Equation II
9	BNTT-209	Linear Integrated Circuits
10	BNTT-210	Digital Electronics
11	BNTT -AECC-2	English
12	BNTP-211	Physical Science Lab
13	BNTP-212	Chemical Science Lab
14	BNTP-213	Biotechnology Lab
15	BNTP-214	Mathematics Lab
16	BNTP-215	Electronics Science Lab

B. Sc. Part – I Semester I
BNTT-101: Mechanics and Properties of Matter I
(Lectures: 30, Credit: 02)

Course Objectives :

1] To understand the fundamentals, principles, physical concept of mechanics.
2] To learn vectors, vector derivatives, scalars and ordinary& partial differential equations.
3] To study Newton's laws of motions and applications.
4] To study conservation of energy, centre of mass, motion of rockets and examples.
5] To study rotational motion and M.I. of various bodies.

Unit - I **[05Lectures]**

Vectors

Vector algebra, Scalar and vector products, Derivatives of a vector with respect to a Variable (velocity and acceleration).

Unit - II **[07Lectures]**

Ordinary Differential Equations :

Differential equations; ordinary and partial differential equations, 1st order homogeneous differential equations, 2nd order homogeneous differential equations with constant coefficients, problems, etc.

Unit–III **[09Lectures]**

Laws of Motion:

Frames of reference, Newton's Laws of motion (with proof). Motion at nanoscale, problems, etc.

Momentum and Energy :

Conservation of linear and angular momentum, work and energy theorem, conservation of energy (Single particle), Dynamics of a system of particles (linear momentum, angular momentum and energy), Centre of mass, Motion of rockets (qualitative treatment only).problems, etc.

Unit - IV

Rotational Motion : **[09Lectures]**

Angular velocity, angular momentum and Torque, Kinetic energy of rotation and moment of Inertia, Moment of inertia of a spherical shell, solid cylinder (only about axis of symmetry), Motion of spherical Shell and solid cylinder rolling down on an inclined plane. Problems, etc.

Reference Books :

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw Hill.
2. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al., Tata McGraw-Hill 2007.
3. Physics, Resnick, Halliday and Walker, Wiley publications 8th edition . 2008.
4. Analytical Mechanics, G.R. Fowles and G.L. Cassiday., Cengage Learning 2005.
5. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, Pearson Education, 2008.
6. University Physics, Ronald Lane Reese, Thomson Brooks/Cole, 2003.
7. Additional Books for Reference Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.
8. University Physics. F.W Sears, M.W Zemansky, H.D Young Addison Wesley 13th edition , 1986.
9. Mathematical physics .B.S. Rajput Pragati publication,30th edition 2011.

Learning Outcomes:

Unit - I : After completion of the unit, Students will be able to :

1. Understand basic concepts like scalar and vectors, define scalar, vector and their product.
2. Describe day to day activities and to calculate basic concepts using vectors.

Unit - II : After completion of the unit, Students will be able to:

1. Understand about basic maths used to express physical things.
2. Understand physical significance of Newton's laws of motion.

Unit - III : After completion of the unit, Students will be able to :

1. Understand more about how system is conserved.
2. Understand motion of a particle and system of particles.
3. Define Centre of mass and center of gravity. Understand concept of motion of a rocket

Unit – IV : After completion of the unit, Students will be able to:

1. Learn using the solution of a problem in angular variables.
2. Determine the linear displacement, speed, and acceleration of a rotating particle or a point on a rotating body.
3. Understand the rolling motion of spherical shell and solid cylinder.

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BNTT - 102 : Mechanics and Properties of Matter - II
(Lectures: 30, Credits: 02)

Course Objectives :

1] It is expected to inspire and boost interest of the students towards Physics as the main subject.

2] To develop the power of appreciations, the achievements in Physics and role in nature and society.

3] To understand motion of particle in central force field, Kepler's laws and basic idea of GPS system.

4) To understand angle of contact and wettability of the liquid. Experimental determination of surface tension and examples

Unit - I Gravitation : [07Lectures]

Newton's Law of Gravitation, Motion of a particle in a central force field (motion in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statement only), Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS), Problems, etc.

Unit - II Oscillations : [06Lectures]

Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillations, Forced oscillations, Frequency of nanoscale matters, problems

Unit - III Elasticity : [09Lectures]

Bending of beam, Bending moment, Cantilever (without considering weight of cantilever), Beam supported at both the ends (without considering weight of beam).Torsional oscillation, Work done in twisting a wire, twisting couple on a cylinder Torsional pendulum- Determination of Rigidity modulus and moment of inertia, Determination of Y by Searles method. Determination of ç and ó, Elasticity of nanoscale matters, problems

Unit - IV Surface Tension : [08Lectures]

Surface tension (definition), Angle of contact and wettability, Relation between surface tension, excess of pressure and radius of curvature, Experimental determination of surface tension by Jaeger's method, Applications of surface tension, Hydrophobic and superhydrophobic nanostructured surface, problems

Reference Books :

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGrawHill.

2. Mechanics, Berkeley Physics, vol.1, C. Kittel, W.K night, et.al., Tata McGraw-Hill, 2007
3. Physics, Resnick, Halliday and Walker, Wiley publication, 8th edition . 2008
4. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. Cengage Learning 2005,
5. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, , Pearson Education 2008
6. University Physics, Ronald Lane Reese, , Thomson Brooks/Cole, 2003
7. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
8. University Physics. F.W Sears, M.W Zemansky, H.D Young, Addison Wesley, 13th edition , 1986
9. Physics: S. G. Sterling and Woodal, Longman's & Green Co. Ltd
10. The big ideas of Nanoscale Science & Engineering- S. Stevens and M. Sutherland, CRC Press.

Course Outcomes:

Unit - I : After completion of the unit, Students will be able to:

1. Rate the effect of gravity on everything mathematically.
2. Understand how earth and other planet moves around the sun.
3. Also this unit will help them to understand motion of man made satellite around earth.

Unit - II : After completion of the unit, Students will be able to :

1. Understand oscillatory motion of particles, starting with basic simple harmonic motion.
2. Define difference between oscillatory, vibrational and harmonic motion
3. Calculate Equation for SHM

Unit - III : After completion of the unit, Students will be able to:

1. Learn about property of matter.
2. Understand concept of torsional pendulum to determine rigidity modulus and moment of inertia
3. Determine y, n and □

Unit - IV : After completion of the unit, Students will be able to:

1. Learn about various properties of liquid state of matter.
2. Understand applications of surface tension
3. Understand concept of wettability.

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BNTP-111: Physical Science Lab
(Credits-02)

Course Objectives :

1] In this course all the practicals are included in accordance with the theory syllabi.
2] This practical course will provide student better understanding of mechanics and concepts related to matter.

Experiments :

1] Measurement of length (or diameter) using Vernier caliper, Micrometer Screw gauge and travelling microscope
2] Simple Pendulum
3] Bifilar Pendulum
4] Viscosity by Poiseuille's method
5] To determine the Moment of Inertia of a Flywheel.
6] To determine the Moment of inertia of a disc using auxiliary annular ring.
7] Young's Modulus of a material of bar by vibration.
8] y/n of a Wire by Searle's method.
9] To determine 'g' by Kater's Pendulum.
10] To study the Motion of a spring and calculate (a) Spring Constant (b) Value of 'g'
11] Poisson ration for rubber using rubber tube.
12] ST by Jaeger's method.

Reference Books :

1. Engineering Practical Physics, S. Panigrahi&B.Mallick,Cengage Learning India Pvt.Ltd. 2015
2. AText Book of Practical Physics, InduPrakash and Ramakrishna,KitabMahal, New Delhi, 11th
3. Edition, 2011
4. B. L. Flint and H.T. Worsnop, Asia Publishing House, 1971,
5. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn,Heinemann Educational Publishers, 4th Edition, reprinted 1985

Course Outcomes :

1. This practical course will provide student better understanding of mechanics and concepts related to matter.
2. Understand theoretical concepts by performing experiments.
3. Student will learn to handle different instruments with ease.
4. Determine time period, value of 'g' using various pendulum.

BNTT-103: Atomic Structure and Bonding
(Lectures: 30, Credits: 02)

Course Objectives :

1] To study formation of atomic orbital through quantum approach.

2] To learn geometry, structure of ionic solids.

3] To study concept of covalent bonding, approach of molecule formation through VBT & VSEPR.

4] To study the formation of molecule from atomic orbitals, various diatomic molecules through VBT and MOT.

Unit : I **[08Lectures]**

Introduction to quantum Chemistry & atomic structure

Black Body radiation, photo electric effect, Compton effect, plank's theory, De Broglie's relationship, experimental verification of wave nature of electron, Schrodinger wave equation (no derivation expected), significance of wave function, probability distribution of electrons, Bohrs theory of hydrogen atom,quantization of energy, hydrogen spectrum, wave theory, Heisenberg's uncertainty principal, atomic orbital's & quantum numbers, Pauli's exclusion principal, Hund's multiplicity rule, aufbau principals, electronic configuration of elements.

Unit - II : **[08Lectures]**

Ionic Bonding

Ionic Bonding: General characteristics of ionic bonding, Formation of ionic bond, Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds, Born- Haber cycle and its applications, Fajan's rules, Radius ratio effect on geometry, calculation of radius ratio for ionic solid with octahedral geometry, Crystal structure of rock salt, CsCl,ZnS.

Unit - III : **[07Lectures]**

Covalent bonding

Introduction, Lewis theory, VB Approach, of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements, Concept of resonance and resonating structures in various inorganic and organic compounds.

Unit - IV : **[07Lectures]**

Molecular orbital theory

MO Approach: Rules for the LCAO method, bonding and antibonding. MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) N_2, N^{2+}, N^{2-}, O^{2+}, O^{2-} and heteronuclear diatomic molecules such as CO, NO. Comparison of VB and MO approaches.

Reference Books:

1. Principles of Inorganic Chemistry; By Puri, Sharma & Kalia, Vishal publication. Co., 33rd ed., 2017.
2. Inorganic Chemistry Gulati Shikha, Sharma Gulati JL and Manocha, Shagun,, 1stEdn., CBS Publishers & Distributors , (2017)
3. Valency and Bonding. Weinhold, F.; Landis, C. Cambridge. (2005)
4. Quantum Chemistry; By R. K. Prasad, New Age Publication.2006
5. Principles of Structure and Reactivity; By James H. Huheey, Keiter, Medhi; 4thedition Pearson Education India, 2006.
6. Concise Inorganic Chemistry Lee J. D,Wiley India, 5th Edn., 2008.
7. Principles of structure and reactivity, .Huheey J. E., Keiter E. A. and Keiter R. L., Pearson Education, 4th Ed. 2002.

8. "Principles of inorganic Chemistry", B.R.Puri, L.R.Sharma and K.C.Kalia,Mile. Stone Publishers and Distributor, Delhi, 31st edition, 2013.

Course Outcomes:

Unit - I : After completion of the unit, Students will be able to :

1. Explore conceptual fact of atom and molecule & formation of atomic orbital through quantum approach.
2. Energy level in atom using modern classical quantum mechanics.

Unit - II : After completion of the unit, Students will be able to:

1. Compare formation of solids through various types of bonds.
2. Formation and energetic of ionic bond &geometry, structure of ionic solids.

Unit - III : After completion of the unit, Students will be able to :

1. Formation of covalent bond & approach of molecule formation through VBT.
2. VSEPR theory and comparison between linear and nonlinear Molecule.

Unit - IV : After completion of the unit, Students will be able to

1. The formation ofmolecule from atomic orbitals &LCAO method, bonding, antibonding and nonbonding molecular orbitals.
2. Axial and lateral overlapping of atomic orbitals & various diatomic molecules through VBT and MOT.
3. Comparison between VBT and MOT & molecular orbital diagram of homonuclear and heteronuclear molecules.

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BNTT-104: General Organic Chemistry and Aliphatic Hydrocarbons
(Lectures: 30, Credits: 02)

Course Objectives :

1] To expose the students to various emerging new areas of Chemistry and apprise them with their prevalent in their future studies and their applications in various spheres of chemical sciences.

2] To enhance student sense of enthusiasm for chemistry and to involve them in an intellectually stimulating experience of learning in a supportive environment.

3] To study basic Fundamentals of Organic Chemistry- bond cleavage, Reactive Intermediates.

4] To study Concept of chirality, Geometrical isomerism.

5] To learn preparations & reactions in aliphatic hydrocarbons.

Unit - I : [08Lectures]

Fundamentals of Organic Chemistry :

Introduction, Cleavage of Bonds: Homolysis and Heterolysis. Organic molecular species: Nucleophiles and electrophiles. Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Reactive Intermediates: Generation, structure, stability and reaction of Carbocations, Carbanions and free radicals.

Unit - II : [08Lectures]

Stereochemistry :

Introduction, Type of stereoisomerism, optical isomerism: Concept of chirality (upto two Carbon atoms), Element of symmetry, optical isomerism in tartaric acid, 2, 3dihidroxybutanoic acid, enantiomerism, distereoisomerism and meso compound, Configuration: Geometrical isomerism Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

Unit - III : **[08Lectures]**

Aliphatic Hydrocarbons :

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation. **Alkenes:** (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis-alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO4) andtrans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuratio n-demercuration, Hydroboration- oxidation. **Alkynes:** (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$.

Unit - IV : **[06Lectures]**

Nano carbonaceous materials

Introduction, Type of nanomaterials, Concept of Nanocatalysis. Nanoscale carbon materials, carbonaceous materials-Bucky ball, graphene oxide, carbon Nanotubes, (Structure, properties and application)

Reference Books :

1. Organic Chemistry by Morrison & Boyd, Pearson Education India. 7th Edn, 2010
2. Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren,2nd Edition, Oxford Publisher, 2014.
3. Stereochemistry of Carbon compounds, by E. L. Eliel, Tata McGraw Hill Education, 2000

4. Stereochemistry Conformation & Mechanism by P.S. Kalsi, New Age International Publisher 8thEdn,2015
5. Organic Reaction Mechanism by V. K. Ahluwalia, Naroso Publishing House. 4thEdn 2011.
6. Carbon Nanomaterials; Yury Gogotsi, Taylor and Francis Group, 2017
7. Essentials of Nanotechnology Jeremy Ramsden, William Andrew, 2011.
8. Nanoscale materials in Chemistry, K J Klabunde, Wiley Interscience 2001
9. Advanced organic chemistry part- A. F. A. Carey and R. J. Sundberg, 5th Ed. Springer (2007)

Course Outcomes:

Unit - I : After completion of the unit, Students will be able to :

1] Concept of fundamentals of organic chemistry- Bond cleavage, Organic molecular species.

2] Preparations and reactions of reactive intermediates.

Unit - II : After completion of the unit, Students will be able to:

1) Basic concepts of stereochemistry.
2) Define types of stereoisomerism enantiomers, diasteromerism.

Unit - III : After completion of the unit, Students will be able to:

1) Basic idea of aliphatic hydrocarbons.
2) Preparations and reactions of alkane, alkene and alkynes.

Unit - IV : After completion of the unit, Students will be able to :

1) Basic idea of Nanoscience.
2) Structure Properties and application of Nano carbonaceous material.

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BNTP-112: Chemical Science Lab
Credits : 02

Course Objectives :

1] The aim of the practical course is to provide student with the skills that will be needed in future practical work.

2] To expose the students to the ability to perform accurate quantitative measurements with an understanding of the theory and interpretation of experimental results, perform calculations on these results.

3] To study organic estimation.

4] Organic Qualitative analysis of organic compounds.

Experiments :

1] Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.

2] Estimation of oxalic acid by titrating it with $KMnO_4$.

3] Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.

4] Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.

5] Determination of amount of acetic acid in commercial vinegar.

6] Determination of alkalinity of water using phenolphthalein and methylorange indicator.

7] Organic Qualitative analysis of organic compounds. Identification of at least three organic compound with reactions including one from acids, one from phenols, one from bases and one/two from neutrals from the list of compounds given below:

Acids: Oxalic acid, Benzoic acid and Cinnamic acid.

Phenols: Naphthol, Resorcinol.

Bases: Aniline, p Toluidine.

Neutrals: Acetone, Ethylacetate, Glucose, Chloroform, Chloro, m Dinitrobenzene Thiourea.

Note: A systematic study of an organic compound involves the following operations which should be taught in details with reactions the detection of elements and functional group. Preliminary tests and Physical examination.

- Physical constant.
- Detection of Elements.
- Detection of Functional group.

- A Search into the literature.
- Special Test.
- Summary.
- Result.

8] Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)

a] Identify and separate the components of a given organic binary mixture by paper chromatography.

b] Identify and separate the sugars present in the given mixture by paper chromatography.

Reference Books :

1. Elementary Practical Organic Chemistry, Part 1: Small scale Preparations, Vogel, A. I. Pearson (2011)
2. Practical Organic Chemistry, Mann, F.G. & Saunders, B.C. Pearson Education (2009)
3. Practical Organic Chemistry, Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. 5th Ed., Pearson (2012)
4. Comprehensive Practical Organic Chemistry Preparation and Quantitative Analysis, Ahluwalia, V.K. & Aggarwal, R. University Press (2000).
5. Comprehensive Practical Organic Chemistry: Qualitative Analysis, Ahluwalia, V.K. & Dhingra, S. University Press (2000).
6. Practical Organic Chemistry, Mann, F.G. & Saunders, B.C. Pearson Education (2009)
7. Practical Organic Chemistry, Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.5th Ed., Pearson (2012)

Course Outcomes :

1] The students should explain and summarize qualitative analysis of organic compounds. 2] The student should determine percentage of vinegar.

3] The students should summaries paper chromatographic results.

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BNTT-105: Cell Biology I
(Lectures: 30, Credits: 02)

Course Objectives :

1] To study fundamental principles of prokaryotic & eukaryotic cell.
2] To study different nanostructure cell organelles in body.
3] To study basic bimolecular interactions.
4] To study the ultrastructure of Mitochondriya and Cloroplast.
5] To study the Nucleic acid.

UNIT - I : [07Lectures]

Water, pH and Buffer, Bio molecular Interaction:

Introduction and classification of organisms by cell structure, cytosol, compartmentalization ofeukaryotic cells, cellfractionation.Cellular Nanomachinesand building blocks of life, Phospholipid membrane: Natural Biological Assembly at the Nano- Scale.

UNIT - II : [08Lectures]

Prokaryotic Cell structure and functions :

Typical bacterial cell Morphology, size & arrangement of bacteria Structures and functions of capsule and slime layer, flagella, Pilli, cell wall,cytoplasmic membrane, nucleus, ribosome's, mesosomes, and bacterial endospores.

UNIT - III : [09Lectures]

Eukaryotic Cell structure and functions :

Ultra structure and functions of cell organelles Cell wall, Plasma membrane, Mitochondria, Chloroplast, Endoplasmic reticulum(in protein segregation), Golgiapparatus(in protein secretion), Lysosome, Peroxisome, Ribosome's(in protein synthesis), Proteosomes.

Unit - IV : [06Lectures]

Nucleic acid :

Ultra structure of nucleus, Chromosomes-organization, chromatin-euchromatin and heterochromatin Nucleosome- unit of chromatin.

Nucleic Acids: The Genetic Information Media and a Template for Nanotechnological Applications.

Reference Books :

1. Lehninger Principles of Biochemistry by Nelson and Cox, W.H. Freeman and Company, 4thEdition
2. Cellular structure and function by A. Malcolm Campbell and Christopher Paradise-Momentumpress.
3. Molecular biology of the cell by Bruce Albert's- Gerald Sciencepublication.
4. Biochemistry by Lubert Stryer- W.H. Freeman and Company.
5. Cell and Molecular Biology: Concepts and Experiments, Karp, G. John Wiley & Sons. Inc.6th Edition, 2010.

Course Outcomes :

Unit - I : After Completion of this unit students will be able to

1] Know basic things regarding water properties, pH and buffer system.
2] Know nanostructure present in human body which is useful for in daily metabolism.

Unit - II : After Completion of this unit students will be able to

1] Know prokaryotic cell structure.
2] Know various functions of prokaryotic cell.

Unit - III : After Completion of this unit students will be able to

1] Know eukaryotic cell structure.
2] Know various functions of eukaryotic cell.

Unit IV: After Completion of this unit students will be able to

1] Know genetic information in the form of DNA.
2] Know heredity and species differentiation from gene.

****

BNTT-106: CELLBIOLOGY II
(Lectures: 30, Credits: 20)

Course Objectives :

1] To study membrane transport system.

2] To study movement of nanoparticle through membrane.

3] To study mechanism of cancer cell development and carcinogenesis process.

4] To study the Nanomedicine.

Unit - I : **[09Lectures]**

Cytoskeleton :

Membrane Vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments .Biological Nano-Motors: Kinesin and Dynein, Ion Channels: Nano-Pores of High Specificity.

Unit - II : **[08Lectures]**

Cell Membrane and Permeability :

Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport – Active and passive transport (Uniport, Symport and Antiport).

Unit - III : **[07Lectures]**

Extracellular Matrix :

Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction. Amyloid Fibrils as Self-Assembled Nano-Scale Bio Assemblies.

Unit - IV : **[06Lectures]**

Cancer

Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis of cancer. Basics of Stem cells, role of Nanotechnology in stem cells.

Reference Books:

1. Cell and Molecular biology by Gerald Carp John Wiley, publication 7th edition 2013.
2. Lodish-Molecular Biology of the Cell, W.H. Freeman and Company. 5th edition-
3. Principles of Biochemistry by Moran and Horton, Pearson publication, 5th edition
4. The Cell: a molecular approach by Geoffrey M. Cooper, ASM press 2007- 4th edition.

Course Outcomes:

Unit - I : After completion of this unit students will be able to

1] Understand cytoskeleton system.

2] Understand biological Nano-motors and it's functions.

Unit - II : After completion of this unit students will be able to :

1] Understand mechanism of membrane permeability.

2] Understand transport of Nanoparticle through the cell membrane. 3] Understand membrane transport system.

Unit - III : After completion of this unit students will be able to :

1] Know receptors and signal molecules

2] Know interaction between nanoparticle and cell bio molecules.

Unit - IV : After completion of this unit students will be able to :

1] Know mechanism of cancer formation.

2] Know treatment of cancer with the help of Nanotechnology.

****

BNTP-113: Biotechnology Lab (Credits: 02)

Course Objectives :

1] To study structure of prokaryotic and eukaryotic cell.
2] To study staining procedure and solution preparation.
3] To study mechanism and types of cell division.
4] To study classification of plant and animal kingdom.
5] To study membrane permeability.

Experiments :

1] Study of structure of any Prokaryotic cell.
2] Staining – Gram staining and Negative staining
3] Study of structure of Eukaryotic Plant cell. (T.S. of Dicot and Monocot)
4] Study of classification of kingdom animalia.
5] Study of classification of kingdom plantae.
6] Determine the pH of soil sample and fruit juice.
7] Preparation of Buffer. (Phosphate buffer and Acetate buffer) 8] Study of plasmolysis and de-plasmolysis.
9] Cell division in onion root tip/ insect gonads.(Mitosis)
10] Cell division in onion root tip/ insect gonads.(Mitosis)
11] Study the effect of temperature and organic solvents on semipermeable membrane.
12] Study of Botanical garden.

Reference Books :

1. Practical hand book of Biochemistry and Molecular biology by Gerald D. Fasman.
2. Mitosis and meiosis- volume no.61, methods in cell biology.
3. Biology practical handbook- Target publication.

Course Outcomes :

After completion of this experimental course students will be able to

1) Identify any bacteria.
2) Differentiate prokaryotic and eukaryotic cell.
3) Differentiate Gram positive and Gram negative bacteria.
4) Understand solution preparation of required concentration, pH scale, different buffer systems and its role, membrane permeability, cell division mechanism.

****

BNTT-107: Differential Calculus I
(Lectures: 30 Credits: 02)

Course Objectives :

1] To study differential calculus.

2] To study limit and continuity of real valued function.

UNIT - I : [09Lectures]

Limit and continuity of real valued function

Definition of limit of function of one variable, Left Hand side limit and right hand side limits. Theorems on limit (only statement), Continuous function and their properties. Classification of discontinuity. (Firstkind and second kind) and types of discontinuities. a) Removable discontinuity b) jump discontinuity of first kind and second kind. Differentiability of a function. $\sin x, \cos x\, e^x, \log\left(l+x\right)^m, \sin\left(ax+b\right)e^x, \cos\left(ax+b\right)e^x$

UNIT - II : [07Lectures]

Differential calculus

Successive differentiation, order derivative of standard functions, Leibnit'z Theorem (with proof)

UNIT - III : [08Lectures]

Mean value Theorem

Rolle's Theorem (with proof), Geometrical interpretation of Rolle 's Theorem, Mean value theorem, Taylor's theorem with Lagrange's and Cauchy form remainder, Taylor's series (only statement), Maclaurin's series of functions.

Unit - IV : [06Lectures]

Indeterminate Forms

L'Hospital Rule, the form and examples, L'Hospital rule the form and examples. L' Hospital Rule the form and examples, Maxima and minima for function oftwo variables.

Reference books:

1. Differential calculus Shanti Narayan ,DR. P.K. Mittal; S Chand Pub
2. ATextbook of calculus and differential equations H. T. Dinde, A. D. Lokhande
3. ATextbook of AdvancedCalculus.
4. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc.,2002.
5. G.B. Thomas and R.L. Finney, Calculus, Pearson Education,2007.
6. Jamnadas and Com. Bombay, 1982

Course Outcomes:

Unit - I : After completion of this unit students will be able to

1] Compare the ideas of limit and continuity.

2] Understand classification of discontinuity

3] Explain the notion of continuity as related to function

Unit - II : After completion of this unit students will be able to

1] Understand the rules of differentiation

2] The derivatives of given functions and Leibniz theorem

Unit - III : After completion of this unit students will be able to

1] Understand mean value theorem and compute it

2] Calculate Cauchy's theorem

Unit - IV : After completion of this unit students will be able to

1] Understand and calculate problems related to indeterminate forms

2] Compute Mean value theorem L'Hospital Rule

****

BNTT - 108 : Differential Calculus - II
(Lectures : 30, Credits : 02)

Course Objectives :

1] To study partial differentiation.

2] To study various functions and integrals related to calculus.

UNIT - I : **[06Lectures]**

Partial Differentiation :

Introduction, Chain Rule without proof and its examples, Euler's Theorem on Homogeneous Functions and its examples, Application to the partial derivative.

UNIT - II : **[09Lectures]**

Jacobian Definition of Jacobian and examples, Properties of Jacobian

If J is Jacobian of u, v with respect to x, y, and J' IS Jacobian of x, y, with respect to u, v, then JJ'=1

$$\frac{\partial(p,q)}{\partial(x,y)} = \frac{\partial(p,q)}{\partial(u,v)} \cdot \frac{\partial(u,v)}{\partial(x,y)}$$

If J is Jacobian of u, v, w With respect to x, y, z and J' IS Jacobian of x, y, z with respect to u, v, w then JJ'=1

If p, q are functions of u, v and u, v are functions of x ,y then prove that

If p, q, r are functions of u, v, w and u, v, w are functions of x , y, z then prove that

$$\frac{\partial(p,q,r)}{\partial(x,y,z)} = \frac{\partial(p,q,r)}{\partial(u,v,w)} \cdot \frac{\partial(u,v,w)}{\partial(x,y,z)}$$

Examples on these properties.

UNIT - III : **[07Lectures]**

Gamma and Beta function

Introduction, Definition of Gamma function, Properties of Gamma function. Illustrative examples on Gamma function. Introduction of Beta functions, Properties of Beta function, Illustrative examples on Beta function.

UNIT -IV : **[08Lectures]**

Double integral

Introduction, The evaluation of double integral, Area under the curve by double integral, Examples on double integral. Triple integral, Illustrative examples on it.

Reference books :

1. Applied Mathematics II; G.V. Kumbhojkar C. Jamnadas andco.
2. Differential Calculus; Shanti Narayan, DR. P.K. Mittal; S Chand Pub.
3. A textbook of Advanced Calculus.

Course Outcomes :

Unit - I : After completion of this unit students will be able to

1] Understand the partial differentiation of functions of two variables.

2] Understand the Euler's Theorem for partial derivatives of homogeneous functions.

Unit - II : After completion of this unit students will be able to

1] Get adequate exposure to global and local a concern that explores them many aspects of Mathematical Science.

2] Know about the concept of Jacobian to solve examples.

Unit - III : After completion of this unit students will be able to

1] Use Gamma and Beta functions to evaluate integrals.

2] Solve integrating problems easily.

Unit - IV : After completion of this unit students will be able to

1) Evaluate the double integral.

2) Find the area under the curve by using double integral

****

BNTP-114: Mathematical Science Lab
(Credits: 02)

Course Objectives :

1] To study n^{th} order differentiation.
2] To study Numerical differentiation.
3] To study Jacobian theorem.

Experiments:

1] Successive Differentiation: n^{th} order derivative
2] Examples on Leibnitz theorem.
3] Lagrange's Mean Value Theorem.
4] Numerical differentiation: Newton's Backward and Forward difference formula.
5] Maxima and Minima of the functions of two variables.
6] Taylor's series.
7] Euler's Theorem on homogeneous function.
8] Jacobian - I
9] Jacobian - II
10] Lagrange's method for undetermined multiplier.
11] Numerical method for solution of linear equations; Gauss elimination method, Gauss Jordon method
12] Numerical method for solution of linear equations; Examples Gamma functions.

Reference books :

1. Applied Mathematics II; G.V. Kumbhojkar, Cjamnadas andco.
2. Differential calculus Shanti Narayan, DR. P.K. Mittal; S Chand Pub.
3. A textbook of Advanced Calculus.
4. Numerical Analysis, Goel Mittal- Pragati Prakashan.

Course Outcomes :

After completion of this practical course students will be able to

1] Understand the Euler's Theorem for partial derivatives of homogeneous functions.
2] Understand the concept of Jacobian to solve examples.
3] Understand the Lagrange's method for undetermined multiplier.
4] Solve n^{th} order differentiation.
5] Solve numerical differentiation.

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BNTT-109: Network analysis and analog circuits I
(Lectures: 30, Credits: 02)

Course Objectives :

1] This course provides comprehensive idea about circuit analysis

2] To understand working principle, operation and characteristics of electronic devices.

3] To provide knowledge about construction and working of semiconductor devices.

UNIT -1 : [09Lectures]

Circuit Analysis :

Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Principal of Duality. Superposition Theorem. Thevenin's Theorem.Norton's Theorem. Reciprocity Theorem. Maximum Power Transfer Theorem. Two Port Networks: h, y and z parameters and their conversion.

UNIT -2 : [09Lectures]

PN Junction Diode:

PN junction diode (Ideal and practical)-constructions, Formation of Depletion Layer, Diode Equation and I-V characteristics. Idea of static and dynamic resistance, dc load line analysis, Quiescent (Q)point.

UNIT -3 : [06Lectures]

Applications of PN diode

Zener diode, Reverse saturation current, Zener and avalanche break down. Qualitative idea of Schottky diode. Regulation- Line and load regulation, Zener diode as voltage regulator, and explanation for load and line regulation.

UNIT -4 : [06Lectures]

Rectifiers and Filters

Rectifiers- Half wave rectifier, Full wave rectifiers (center tapped and bridge), circuit diagrams, working and waveforms, ripple factor and efficiency. Filter Shunt capacitor filter, its role in power supply, output waveform, and working.

Reference Books:

1. Electronic Principles Malvino, Tata Mc graw Hill publication, 6th edition
2. Basic Electronics- Grob, Tata Mc graw Hill publication, 5th edition

3. Electronic Devices and Circuits Millman and Halkies, Tata Mc grawHillPublication
4. Electric Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004)
5. Electrical Circuits, M. Nahvi & J. Edminister, Schaum's Outline Series,Tata McGraw Hill (2005)
6. Electrical Circuits, K.A. Smith and R.E. Alley, CambridgeUniversity Press,2014
7. Network, Lines and Fields, J.D.Ryder, Prentice Hall of India.
8. Electronic Devices and Circuits, David A. Bell, Oxford UniversityPress, 5th Edition 2015

Course Outcomes:

UNIT - 1: After completion of this course students will be able to understand

1] Concept of Voltage and Current Source.
2] Analysis of Network theorems.
3] Two Port Networks: h, y and z parameters and their conversion.

UNIT - 2 : After completion of this course students willbe able to understand

1] Construction and working of PN junction diode.
2] I-V characteristics and parameters of PN diode.

UNIT - 3 : After completion of this course students will be able to explain

1] Construction and working of Zener diode
2] Qualitative idea of Schottky diode.
3] Load and line regulation.

UNIT - 4 : After completion of this course students will be able to explain

1] Parameters and Working of Rectifiers
2] Parameters and Working Filters.
3] Designing of power supply.

****

BNTT-110: Network analysis and analog circuits - II
(Lectures : 30, Credits 02)

Course Objectives :

1] Students are get familiarize the students with BJT

2] Analysis and design of basic transistor amplifier circuits

3] Analysis and design of tuned amplifiers, wave shaping circuits.

UNIT -1 : [06Lectures]

Bipolar Junction Transistor :

Theory and working of BJT, Characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains β and α. Relations between β and α. dc load line and Q point.

UNIT -2 : [09Lectures]

Amplifiers:

Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S. Transistor as a two port network, h-parameter equivalent circuit. Small signal analysis of single stage CE amplifier. Input and Output impedance, Current and Voltage gains. Class A, B and C Amplifiers.

UNIT -3 : [09Lectures]

Cascaded Amplifiers :

Two stage RC Coupled Amplifier and its Frequency Response. Feedback in Amplifiers: Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative only). Sinusoidal Oscillators: Barkhausen criterion for sustained oscillations. Phase shift and Colpitt's oscillator. Determination of Frequency and Condition of oscillation.

UNIT -4 : [06Lectures]

Unipolar Devices :

JFET: Construction, working and I-V characteristics (output and transfer), Pinch-off voltage. UJT: basic construction, working, equivalent circuit and I-V characteristics.

Reference Books:

1. Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, Tata McGraw Hill
2. Electrical Circuit Analysis, Mahadevan and Chitra, PHILearning
3. Text book of Applied Electronics, R. S. Shedha, S Chand and companyLtd. 2001
4. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, Oxford University Press, 6th Edn. 2014
5. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
6. Solved Problems in Electronics ,J. J. Cathey, Schaum's outline Series, Tata McGraw Hill (1991)

Course Outcomes :

UNIT - 1 : After completion of this unit students will be able to understand

1] Construction and working of BJT
2] Characteristics of transistor in CE mode
3] Parameters of transistors.

UNIT - 2 : After completion of this unit students will be able to understand

1] Transistor biasing and Stabilization circuits
2] Transistor as a two port network, h-parameter equivalent circuit.
3] Small signal analysis of single stage CE amplifier.
4] Transistor working as Class A, B and CA mplifiers.

UNIT - 3 : After completion of this unit students will be able to explain

1] Two stage RC Coupled Amplifier and its Frequency Response.
2] Feedback in Amplifiers
3] Sinusoidal Oscillators and their working.

UNIT - 4 : After completion of this unit students will be able to explain

1] Construction, working and I - V characteristics of JFET.
2] Construction, working and I - V characteristics UJT.

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BNTP-115: Electronics Science Lab
(Credits: 02)

Course Objectives :

1] To gain knowledge in designing basic electronic circuits
2] To study their operation practically.
3] To learn various measurement techniques in electronics

Experiments :

1] To familiarize with basic electronic components (R, C, L, diodes, transistors) digital Multimeter, Function Generator and Oscilloscope.
2] Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3] Verification of (a) Thevenin's theorem and (b) Norton'stheorem.
4] Verification of (a) Superposition Theorem and (b) ReciprocityTheorem.
5] Study of the I-V Characteristics of p-n junction Diode,
6] Study of the I-V Characteristics of Zener diode
7] Study of Full wave rectifier(FWR).
8] Study of the I-V Characteristics of UJT and design relaxation oscillator.
9] Study of the output and transfer I-V characteristics of common source JFET.
10] Design of a Single Stage CE amplifier of given gain.
11] Study of the RC Phase Shift Oscillator.
12] Study the Colpitt's oscillator.

Reference Books :

1. Electrical Circuits, M. Nahviand J. Edminister, Schaum's Outline Series,Tata McGraw-Hill (2005)
2. Networks, Lines and Fields, J. D. Ryder, Prentice Hall ofIndia.
3. Integrated Electronics, J. Millman and C. C. Halkias, Tata McGrawHill (2001)
4. Electronic Devices and Circuits, Allen Mottershead, Good year Publishing Corporation.

Course Outcomes:

After completion of this practical course students will be able

1] To know the design procedure of various electronic circuit configurations
2] To have an idea about the frequency response of amplifiers
3] To have a clear understanding of operation of oscillators and power supplies
4] To study about the different types of feedback circuits
5] To know the design procedure of various electronic circuit configurations

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B. Sc. Part – I Semester II
BNTT -201: Vectors and Electrostatics
(Lectures: 30, Credits: 02)

Course Objectives :

1] This syllabus is designed to understand fundamental forces of universe.
2] To develop the power of appreciations, the achievements in Physics and role innature.
3] To study Gradients, divergence, curl and their physical significance.
4] To study integrals of vector fields and corresponding various theorems

Unit - I : [06Lectures]

Vector Analysis :

Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

Unit - II : [07Lectures]

Electrostatics - I

Electrostatic Field, electric flux, Gauss's theorem of electrostatics, Electric potential as line integral of electric field, potential due to a point charge, electric dipole, Problems

Unit - III : [09Lectures]

Electrostatic - II

Equipotential surfaces, uniformly charged spherical shell and solid sphere, Calculation of electric field from potential, Capacitance of an isolated spherical conductor, parallel plate, spherical and cylindrical condenser, Energy per unit volume in electrostatic field, problems

Unit - IV : [08Lectures]

Dielectric

Polarization of dielectrics, and polarization vector, Displacement vector, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric Electric susceptibility of dielectrics, Electrostatic at nanoscale.

Reference Books

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajanand Choudhury, Tata McGraw, 2012
2. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education, 1986
3. Introduction to Electrodynamics, D.J. Griffiths,Benjamin Cummings.PHI learning privet limited, 3rd Edition., 1998

4. Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands,Pearson Education, 2008
5. Elements of Electromagnetic, M.N.O. Sadiku, Oxford University Press.2010
6. Electricity and Magnetism, J. H. Fewkes & J. Yarwood. Vol. I, Oxford Univ.Press, 1991
7. Mathematical Physics, By B. S. Rajput. Pragati edition
8. Foundations of Electromagnetic Theory – Rritz and Milford.
9. University Physics 9th edition – Young and Freedman.
10. Mathematical Physics: B. D. Gupta
11. Electromagnetism by B. B. Laud New age international publication.

Course Outcomes:

Unit - I : After completion of the unit students will be able to:

1] Understand complex vector functions.
2] Define gradient, divergence and curl.
3] Understand significance of gradient, divergence and curl

Unit - II : After completion of the unit students will be able to :

1] Get introduction to the electrostatics.
2] Understand basic concept of electrostatic field, electric flux and electric dipole.
3] Understand concept of potential due to point charge.

Unit - III : After completion of the unit students will be able to :

1] Get advance knowledge of electrostatic force.
2] Understand concept of parallel plate, cylindrical and spherical condenser.
3] Understand energy per unit volume in electrostatic field.

Unit - VI : After completion of the unit students will be able to :

1] Understand concepts of dielectric, application of dielectric material.
2] Define dielectric medium, polarization and displacement vector.
3] Understand relation between three electric vectors.

****

BNTT- 202: Electricity and Magnetism

(Lectures: 30, Credits: 02)

Course Objectives :

1] It is expected to inspire and boost interest of the students towards Physics as the main subject.

2] To study LCR series circuit and A.C.bridge.

3] To study magnetostatics and magnetic properties ofmaterials.

4] To learn electromagnetic induction law's.

Unit - I : **[06Lectures]**

A.C. Circuits :

Complex numbers and their application in solving AC series LCR circuit, complex impedance, Reactance, Admittance, and Susceptance, Resonance in LCR series circuit, Sharpness of resonance (qualitative treatment only), Q-factor (definitiononly), A.C. Bridge - Owen's Bridge, Memristor circuits at nanoscale.

Unit - II : **[08Lectures]**

Magnetism :

Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law, properties magnetic of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, Brief introduction of dia-, para- and ferro-magnetic materials, Introduction tospintronics.

Unit - III : **[06Lectures]**

Electromagnetic Induction :

Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils, Energy stored in magnetic field. Problems

Unit - IV : [10Lectures]

Maxwell's equations and Electromagnetic wave propagation :

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization, Introduction to nano-electrodynamics.

Reference Books :

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajanand Choudhury, Tata McGraw,2012
2. Electricity and Magnetism, Edward M. Purcell, McGraw-HillEducation,1986
3. Introduction to Electrodynamics, D.J. Griffiths,Benjamin Cummings.PHI learning PVT, 3rd Edn., 1998,
4. Feynman Lectures Vol.2, R. P. Feynman, R.B.Leighton, M. Sands, Pearson Education,2008
5. Elements of Electromagnetics, M.N.O. Sadiku, Oxford UniversityPress.2010
6. Electricity and Magnetism, J.H. Fewkes&J. Yarwood. Vol. I, 1991, Oxford Univ.Press
7. Fundamentals of physics Halliday,Resnik,Wiley Indiapublication, 8th edition
8. Electromagnetics : B. B. Laud ,New Age internationalpublishers
9. Physics: S. G. Starling and A. J. Woodall.The English Language Book Society Publication.
10. Foundations of Electromagnetic Theory – Rritz andMilford.
11. University Physics 9th edition – Young andFreedman.
12. The big ideas of Nanoscale Science & Engineering- S. Stevens andM. Sutherland, CRC Press.

Course Outcomes :

Unit - I : After completion of the unit students will be able to:

1] Make difference between ac and dc circuits.

2] Understand applications of complex numbers in solving AC series circuit.

3] Define complex impedance, reactance, admittance and susceptance.

4] Understand concept of Wein's bridge.

Unit - II : After completion of the unit students will be able to :

1] Learn about formation of magnetic forces, and their mathematical representation.

2] Learn applications of Biot-Sawart Law in straight conductor, circular coil & solenoid

3] Understand concept of divergence & curl of magnetic field.

Unit - III : After completion of the unit students will be able to:

1] Learn about electromagnetism.

2] Understand concept of self and mutual inductance.

3] Determine energy stored in magnetic field.

Unit - IV : After completion of the unit students will be able to :

1] In this unit student learns about Maxwell's equations for electromagnetism

2] Understand concept of conservation of charge.

3] Learn divergence and curl of electric & magnetic fields in Maxwell's Equations.

4] Study the EM wave propagation through vacuum & isotropic dielectric medium.

****

BNTP-211: Physical Science Lab

(Credits- 02)

Course Objectives :

1] This practical course will provide student better understanding ofelectricity and concepts related to magnetism

2] To earn measuring skills in practical.

3] To determine M.I. and acceleration due to gravity.

4] To understand the measurement of electrical quantities by using Multimeter.

5] To determine capacitances and Impedance.

Experiments :

1] Measurement of Constant of BallisticGalvanometer:

2] To compare capacitances using De'Sauty'sbridge.

3] Impendence of series LCRcircuit.

4] To study a series LCR circuit and determine its

a] Resonant Frequency,

b] Quality Factor.

5] To study a parallel LCR circuit and determine its

a] Anti-resonant frequency and

b] Quality factorQ.

6] To verifythe Thevenin/ Nortontheorem.

7] Frequency of A.C. mains bysonometer (A) magnetic wire (B) nonmagnetic wire

8] To use a Multimeter formeasuring

a] Resistances,

b] AC and DC Voltages,

c] DC Current,

d] checking electrical fuses.

9] Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).

10] Zener diode as voltage regulator.

11] Bridge rectifier with Pifilter.

12] Output characteristics of transistor –CEmode

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint & H. T. Worsnop, Asia Publishing House, 1971
2. AText Book of Practical Physics, Indu Prakash and Ramakrishna,Kitab Mahal, New Delhi, 11thEdition, 2011
3. Engineering Practical Physics, S. Panigrahi & B. Mallick, Cengage Learning India Pvt. Ltd.,2015
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publisher, 4th Edition, reprinted 1985

Course Outcomes:

After completion of this practical course students will be able to

1) Better understanding of electricity and concepts related to magnetism
2) Handle different instruments with ease.
3) Learn measuring skills inpractical
4) Understand theoretical concepts by performing experiments.

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BNTT- 203: Physical Chemistry
(Lectures: 30, Credits: 02)

Course Objectives :

1] To study basic concepts of Thermodynamics Definition of system, surrounding, closed and open system, extensive and intensive properties.
2] To study Gibbs free energy and Gibbs Helmholtz equation.
3] To study identify the endothermic and exothermic reaction.
4] To study degree of ionization and factor affecting on degree of ionization.
5] Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories in Physical Chemistry.
6] Development of analytical problemsolving skills in the major areas of chemical study.

Unit - I : Thermodynamics : [08Lectures]

Introduction, Review of Thermodynamics and laws of Thermodynamics (only statement) Second law of Thermodynamics and its different statements, Carnot's cycle, its efficiency, Carnot's Theorem (Heat engine), Concept of free energy, Helmholtz free energy, Gibb's free energy, Gibb's Helmholtz equation, criteria of spontaneity, Numerical problems

Unit - II : Thermochemistry : [07Lectures]

Introduction, exothermic endothermic reaction, important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differentialenthalpies ofsolution and dilution. Calculation ofbond energy, bond dissociation energy and resonance energy from thermochemical data.

Unit - III : Ionic Equilibria: [07Lectures]

Types of electrolytes, degree of ionization, factors affecting degree of Ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect, Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Unit - IV :Chemical Kinetics : [08Lectures]

Introduction, rate of reaction, Definition and units of rate constant, Factors affecting rate of reaction (Nature of reactant, concentration, pressure, temps catalyst), Order and molecularity of reaction, First order reaction (Derivation not expected). Characteristics of first order reaction Pseudo-unimolecular reactions. Examples: Hydrolysis of methylacetate, Inversion of cane sugar, second order reaction: Derivation of rate constant for equal & unequal concentration of the reactants; characteristics of second order reaction. Reaction between $K_2S_2O_8$ and KI Saponification of ethyl acetate, Numericalproblems.

Reference Books :

1. Solid State Chemistry and its applications, A.R. West John Wiley & Sons, 2003.
2. Physical Chemistry, P.W. Atkins, Oxford University press, 7th edition, 2002.
3. Physical Chemistry – G. M. Barrow, Tata-McGraw Hill, 7th edition, 2003.
4. Thermodynamics A Core Course- R. C. Srivastava, S. K. Saha and A. K. Jain,
5. Prentice-Hall of India, 2nd edition, 2004.
6. Physical Chemistry – R.S. Berry, S.A. Rice, J. Ross, 2nd Ed., Oxford University Press, New York, 2000.
7. Physical Chemistry, T. Engle and P. Reid, (Pearson Education) 2006
8. Chemical Kinetics-K. J. Laidler, Pearson Education,2004
9. Physical Chemistry by Ira N. Levine Published by McGraw-Hill Science August 29th 2001
10. Physical Chemistryby David W. Ball Published by Brooks Cole d August 20th 2002

Course Outcomes :

Unit - 1 : After completion of the unit, Students will be able to

1] Basic concepts of Thermodynamics Definition of system, surrounding, closed and open system, extensive and intensive properties, Calculate of changes in kinetic, potential, enthalpy and internal energy.

2] Carnot's cycle process & Gibbs free energy and Gibbs Helmholtz equation

Unit - 2 : After completion of the unit, Students will be able to

1] Identify the endothermic and exothermic reaction

2] Standard state and standard enthalpies formation & calculation of bond energy, bond dissociation energy, and resonance energy from thermodynamics data.

Unit - 3 : After completion of the unit, Students will be able to:

1] The degree of ionization and factor affecting on degree of ionization.

2] Measurement of pH scale, common ion effects, buffer solution.

3] Concept of solubility and solubility product of sparingly soluble salt.

Unit - 4 : After completion of the unit, Students will be able to

1] Rate of reaction order of reaction, molecularity of reaction.

2] Concept of first and second order of reaction.

3] Factors affecting on the chemical reaction.

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BNTT-204: Functional Organic Chemistry
(Lectures: 30, Credits: 02)

Course Objectives :

1] Understanding of the underlying theoretical principles of fundamental organic chemistry and industrial chemistry.
2] To study concept of aromaticity, Electrophilic substitution reaction, preparation and reaction of case benzene.
3] To learn reaction and synthesis of alkyl halides.
4] To study the basic term of solute, solvent, polar solvent, nonpolar solvent, saturated solution, normality, and molarity.

Unit - I :Aromatic hydrocarbons [08Lectures]

Aromaticity: Introduction, Characteristics, meaning of important terms , structure of benzene, Modern theory of aromaticity, application of huckels rule, Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Preparation (Case benzene): from phenol, bydecarboxylation, from acetylene, from benzene Sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel- Craft'sreaction.

Unit - II : Alkyl Halides [08Lectures]

Introduction, nomenclature, classification, structure. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether Synthesis: Elimination vs substitution. Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 andSNi).

Unit - III : Aryl Halides [08Lectures]

Introduction, nomenclature, classification, structure; Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann Reactions, from aniline. Chemicalproperties: formation oforganometallic compound, electrophilicsubstitution, reaction with ammonia, nucleophilic substitution. Reactions(Chlorobenzene):

1] Aromatic nucleophilic substitution: Formationofalcohol, formation ofnitrile and cyanide
2] formation ofGrignardreagent
3] fridel craft reaction
4] reduction
5] oxidation. Mechanism of nucleophilic substitution ofaryl halide:
1] addition-elimination
2] elimination-addition. (Benzyne Mechanism: KNH_2/NH_3 or $NaNH_2/NH_3$)

Unit - IV :Basic Concepts inIndustrialChemistry [06 Lectures]

Introduction, Definition and Explanation of following terms- Solute, Solvent, Solution, Polar solvent, Non-Polar solvent, Saturated solution, Unsaturated solution, Super saturated solution, Normality, Equivalent weight, Molecular weight, Molarity, Acidityof base, Basicity of acid, Percentage solution, ppt, ppm, ppb solutions, Mole Fraction, Weight fraction, Problems based on Normality, Molarity, mole fraction, mixedsolution

Reference Books :

1. Organic Chemistry by Morrison & Boyd, Pearson Education India. 7thEdn.2010
2. Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren,2nd Edition,Oxford Publisher, 2014.
3. Organic ReactionMechanism byV. K.Ahluwalia, Naroso Publishing House. 4thEdn 2011.
4. Advanced organic chemistry- Arun Bahl, B. S. Bahl, S. Chand, 2010.
5. Calculation in chemistry-Donald J. Dahm, Eric A. Nelson, W. W. Norton & Company. Second edition (June 1, 2017)
6. Advanced Organic Chemistry, Bhal and Bhal 2nd Edition, S. Chand Publisher, 2012.
7. Organic Chemistry, Graham Solomons T. W., Fryhle, Craig B., Snyder Scott A, Wiley Student Ed, 11th Edition (2013)

Learning Outcomes:

Unit - 1 : After completion of the unit, Students will be able to:

1] The concept of aromaticity.
2] The electrophilic substitution reaction i. e. nitration, halogenation, sulphonation.

Unit - 2 : After completion of the unit, Students will be able to :

1] The reaction and synthesis of alkyl halides
2] The mechanism of the elimination and substitution reaction.

Unit - 3 : After completion of the unit, Students will be able to :

1] The reaction and synthesis of aryl halides
2] The mechanism of the nucleophilic substitution reaction.

Unit - 4 : After completion of the unit, Students will be able to :

1] The basic term of solute, solvent, polar solvent, nonpolar solvent, saturated solution, normality, and molarity.
2] Calculation ofequivalent weight, molecular weight, mole fraction, percentage ofsolution, ppt, ppm, ppb solutions, mole fraction etc.

BNTP-212: Chemical Science Lab
(Credits: 02)

Course Objectives :

1] The aim of this course is to provide a core for future studies in chemistry and allied subjects, in aspects of chemistry as specified below and an introduction to basic practical skills, including safe working practices (risk, hazard and control measures) laboratory report writing, error and accuracy.

2] Evaluate the risks associated with an experiment and understand how to militate against those risks.

3] To study instrumental and non – instrumental experiments.

Experiments :

Section - A : Physical Chemistry

1] Determination of enthalpy of neutralization of hydrochloric acid withsodiumhydroxide.

2] Determination of enthalpy of ionization of acetic acid.

3] Study of solubility of benzoic acid in water and determine”H

4] pH measurements: Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (Use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH meter.

5] Preparation of buffer solutions:

a) Sodium acetate-acetic acid.

b) Ammonium chloride-ammonium hydroxide.

Measurement of the pH of buffer solutions and comparison of the values with theoretical Values.

6] To investigate the reaction between $K_2S_2O_8$ and KI with equal initial concentration of reactants.

7] Equivalent weight: To determine equivalent weight of metal (mg) byhydrogen displacement method usingEudiometer

8] Estimation of aniline.

9] Estimation of amide.

10] Preparations: Mechanism of various reactions involved to be discussed, Recrystallization, determination of melting point and calculation of quantitative yields to bedone.

a) Bromination of Phenol/Aniline

b)Nitration of nitrobenzene

c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

11] Preparations of derivatives of organiccompounds
a) Nitration
b) Oximes of aldehydes &ketones
c) 2,4dinitropherylhydrazone of aldehydes &ketones
d)Oxalate
e) Sublimation

Reference Books:

1. Elementary Practical Organic Chemistry, Part 1: Small scale Preparations, Vogel, A. I. Pearson (2011)
2. Practical Organic Chemistry, Mann, F.G. & Saunders, B.C. Pearson Education (2009)
3. Practical Organic Chemistry, Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. 5th Ed., Pearson (2012)
4. Inquiry-based Experiments in Chemistry Valerie LudwigLechtanski Oxford University Press, 2000
5. Laboratory Manual for Principles of General Chemistry, J A Beran John Wiley & Sons, 6th Edition 2000
6. Dean's Handbook of Organic Chemistryby JohnA. Dean; George W.Gokel Publication Date:
7. 2004
8. Senior Practical Physical Chemistry, Khosla, B. D.; Garg, V. C. & Gulati, R. Chand & Co.New Delhi (2011).
9. Comprehensive Practical Organic Chemistry, Ahluwalia, V. K. & Renu Agarwal Orient Black Swan (2004)

Course Outcomes :

After completion of this practical course students will be able to

1] Prepare organic derivatives.
2] Determine and calculate physical parameters of there actions.
3] Prepare Buffers and compare their pH.
4] Study progress of reaction using kinetics and plotting of graph.
5] Determine physical constants of purified compounds.
6] Explain and summarize quantitative analysis of organic compounds.

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BNTT - 205 : Mammalian physiology - I
(Lectures : 30, Credits : 02)

Course Objectives :

1] To study digestive, respiratory, circulatory, cardiac system.

2] To know working mechanism of these systems.

3] To know action of nanoparticle on these systems.

UNIT - I : **[08Lectures]**

Digestive system :

Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice.

Unit - II : **[09Lectures]**

Respiratory system :

Exchange of gases, Transport of O_2 and CO_2, Oxygen dissociation curve, Chloride shift. Fate of nanoparticles in body.

Respirocytes; a Mechanical Artificial Red Cell: Exploratory Design in Medical Nanotechnology.

Unit - III : **[06Lectures]**

Circulatory system :

Composition of blood, Plasma proteins & their role, blood cells, Haemopoisis, Mechanism of coagulation of blood.

Unit - IV : **[07Lectures]**

Cardiac system :

Mechanism of working of heart: Cardiac output, cardiac cycle, Origin & conduction of heart beat. Nanoparticles: Blood Components Interactions.

Reference Books :

1. Textbook of Medical Physiology, Guyton, A. C. & Hall, J.E. Hercourt Asia PTE Ltd. /W.B. Saunders Companypublication. (2006)., XI edition-
2. Comparative animal physiology by Philip C.Withers.
3. The World of the Cell Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P.,Pearson Benjamin Cummings Publishing, San Francisco, 7th edition.2009

Course Outcomes:

Unit - I : After completion of unit, Student will be able to

1] Know mechanism of Digestive system.

2] Know composition of various components required for digestion.

Unit - II : After completion of unit, Student will be able to

1] Know mechanism of Respiratory system.

2] Know effect of Nanoparticles on respiration.

Unit - III : After completion of unit, Student will be able to

1] Know mechanism of Circulatory system.

2] Know mechanism of blood formation and its composition.

Unit - IV : After completion of unit, Student will be able to

1] Know mechanism of Cardiac system.

2] Know effect of Nanoparticles on heart.

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BNTT- 206: Mammalian physiology II
(Lectures 30, Credits 02)

Course Objectives :

1] To study nervous, endocrine, immunity and excretion system.

2] To study interaction between antigen -antibody.

3] To study mechanism of these systems and interaction with nanoparticle.

Unit - I : **[08Lectures]**

Nervous system :

Nervous coordination Mechanism of generation & propagation of nerve impulse, structure of synapse: - chemical and electrical synapse, synaptic conduction, salutatory conduction, threshold stimulus, All or None rule,Neurotransmitters.

Unit - II : **[09Lectures]**

Endocrine system :

Mechanism of action of hormones (insulin and steroids) Different endocrine glands– Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions. Nanotechnology in neuroscience, nanotube microelectrodes neurotransmitter measurements in the brain.

Unit - III : **[06Lectures]**

Excretion and osmoregulation :

Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation, Excretion and Toxicity of nanoparticles. Concept of tissue, Role of nanotechnology in tissue engineering. Role and effect of osmoregulation.

Unit - IV : **[07Lectures]**

Immunity system :

Overview of immune system, innate and adaptive immunity, cells and organs of the immune system, Types of immune response.

Antigen :

Introduction to the concept of immunogenicity, antigenecity, factors influencing immunogenicity, epitopes, haptens, pattern recognition receptors.

Antibody :

Basic structure of antibody, antibody classes and biological activities, antigenic determinants and immunoglobulin's, B cell receptors, monoclonal antibodies.

Reference Books :

1. Textbook of Medical Physiology , Guyton.A.C. & Hall J.E., Hercourt Asia PTE Ltd. /W.B. Saunders Companypublication. XI edition-
2. Immunology by Kuby, W.H. Freeman andCompany 5th edition-.
3. PrinciplesofAnatomy&Physiology, Tortora,G.J.&Grabowski,S.John wiley & sons,Inc.XI Edition 2006.

Course Outcomes :

Unit - I : After completion of unit Student will be able to

1] Know mechanism of Nervous system.

2] Know structure and functions of neurotransmitters.

Unit - II : After completion of unit, Student will be able to

1] Know mechanism of Endocrine system.

2] Know mechanism of hormone formation and its function.

Unit - III : After completion of unit, Student will be able to

1] Know mechanism of Immunity system.

2] Know structure and function of cells and organs in immune system.

Unit - IV : After completion of unit, Student will be able to

1] Know structure of antigen and antibody.

2] Know interaction between antigen and antibody.

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BNTP- 213: Biotechnology Lab
(Credits: 02)

Course Objectives :

1] To study different immunological techniques which are help to study antigens antibody interaction.
2] To study different blood group components and analysis of different body organs.

Experiments :

1] Finding the coagulation time of blood.
2] Determination of blood groups.
3] Counting of mammalian RBCs.
4] Determination of TLC and DLC.
5] Determination of action of an enzyme (amylase).
6] Determination of Hemoglobin.
7] Study of DotElisa.
8] Study of Radial Immuno diffusion.
9] Latex agglutination.
10] Rocket immuno elecrtophoresis.
11] Demonstration of dialysis.
12] Isolation of Mitochondria from goat liver.

Reference Books :

1. Practical immunology by Frank C. Hay.
2. Practical physiology by G.K.Pal and Pravati Pal.
3. Clinical biochemistry by Plummer.

Course Outcomes :

After completion of this practical course students will be able to

1] Determine different blood group.
2] Understand mechanism of interaction between antigen and antibody.
3] Understand different components of blood.
4] Understand different immunological techniques.

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BNTT- 207: Differential Equation I
(Lectures: 30 Credits: 02)

Course Objectives :

1] To solve higher order differential equations.

2] To solve 1st order and 1st degree differential equations.

Unit - I : **[07Lectures]**

Differential Equation of 1st order and 1st Degree

Introduction, First order exact differential Equation, Illustrative examples on exact differential equation, Integrating factor, Rules to find an integrating factor.

Unit - II : **[08Lectures]**

Differential Equation of 1st order but not 1st degree

Introduction, Equations solvable for p: Method and problems, Equations solvable for x: Method and problems. Differential equations solvable for y: Method and problems.

Unit - III : **[06Lectures]**

Methods of solving higher order differential equations

Basic theory of linear differential equations and reducing its order, Wronskian and Wronskian's property.

Unit - IV : **[09Lectures]**

Linear Homogeneous equations with constant coefficient

Introduction, Complementary function and particular integral, Generalsolution of $f(D)y = X$ and solution of the equation $f(D)\,y = x$, Illustrative examples, The symbolic function of $\frac{1}{f(d)}$, To evaluate $\frac{1}{D-a}X$, short methods for finding particular integral for specialcases. To find the particularintegral of f (D) y = x

Reference books :

1. M. D. Raisinghania, ordinary andpartialDifferentialEquation, Eighteenth Revised Edition 2016,
2. S. Chand and company Pvt Ltd NewDelhi.
3. G. V. Kumbhojkar, C. Jamnadas andCo.
4. Differential equations byGupta-Malik- Mittal -Pundir; Pragatiprkashan.
5. ATextbook of advanced calculus and differential equations.

Course Outcomes:

Unit - I : After completion of the unit, Students will be able to:

1] Know about the exact differentialequations.
2] Define the integratingfactor.
3] Solve the differential equations by using rules to find integratingfactor.

Unit - II : After completion of the unit, Students will be able to:

1] Know about how to solve differential equation whichhas 1^{st} order but not 1^{st} degree.
2] Solving equations byusing variable methods.

Unit - III : After completion of the unit, Students will be able to :

1] Solve differential equations which are used in derivation of physics and statistics.

Unit - IV : After completion of the unit, Students will be able to :

1] Define the concept of complementary functions, particular integral, general solution.
2] Solve the problems of linear homogeneous equations with constant coefficient.

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BNTT-208: Differential Equation II
(Lectures: 30, Credits: 02)

Course Objectives :

1] To solve simultaneous differential equations.

2] To solve total and partial differential equation of first and second order.

Unit - I : **[09Lectures]**

Simultaneous and Total differential equation

The method ofvariation of parameter ,Simultaneous differential equation, Introduction, Simultaneous differential equation of 1^{st} order and 1^{st} degree, Illustrative examples Total differential equation, Introduction ,Condition of integrability, Method ofsolving the integrable equation, Geometric interpretation, Illustrative examples.

UNIT -II : **[08Lectures]**

Partial differential equation

Order and degree of partial differential equation.

Concept of Linear and nonlinear partial differential equation. Formation of 1^{st} order Partial differential equation.

Unit - III : **[07Lectures]**

Linear partial differential equation of 1^{st} order

Introduction, Lagrange's equation, Lagrange's method of solving equation, Examples Charpit's Method and its examples.

Unit - IV : **[06Lectures]**

Classification of 2^{nd} order differential equation

Classification of 2^{nd} order differential equation into elliptic, parabolic, hyperbolic form through illustration only.

Reference books :

1. Ordinary and partial Differntial Equation, M.D. Raisinghania, R-S.Chand and company Pvt Ltd New Delhi. Eighteenth Revised Edition 2016,
2. Differential equations by Gupta-Malik- Mittal -Pundir; Pragati prkashan.
3. ATextbook of advanced calculus and differential equations.

Course Outcomes:

Unit - 1 : After completion of this unit students will be able to :

1] Explain concept of differential equation

2] Solve differentiate simultaneous and total differential equation.

Unit - 2 : After completion of this unit students will be able to :

1] Find the order partial differential equation

2] Find the degree of partial differential equation and forms the 1st order partial differential equation.

Unit - 3 : After completion of this unit students will be able to

1] Know ideas about Charpit's method

2] Know ideas about Lagrange's method.

3] Using these methods they can easily solve the differential equation of higher order.

Unit - 4 : After completion of this unit students will be able to

1] Students should able to classify the 2nd order differential equation into elliptic, parabolic and hyperbolic form.

2] Student able to apply Mathematical knowledge, skills and formulae to draw the relevant conclusion from the given information.

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BNTP-214: Mathematical Science Lab
(Credits: 02)

Course Objectives :

1] To study methods of solving higher order differential equation.
2] To study differential equations of first order and first degree.
3] To study linear differential equations.

Experiments :

1] Method of solving higher order differential equation.
2] Differential Equations of First Order and First Degree. (Linear DifferentialEquations)
3] Differential Equations of First Order and First Degree. (Bernoullis Differential Equations).
4] Clairauts Form and Equations Reducible to Clairauts Form.
5] Numerical Methods for differential equations; Picard's Method.
6] Numerical Methods for differential equations; Euler's Method.
7] Numerical Methods for differential equations; Euler's Modified Method.
8] Linear Differential Equations with Constant Coefficients.
9] Differential Equation of first order but not of first degree.
10] Second Order Linear Differential Equations.
11] Laplace Transform.
12] Simultaneous Differential Equations and Total differential Equations.

Reference Books :

1. G.V. Kumbhojkar and H.V. Kumbhojkar, Differential and Integral Calculus.
2. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Pub.
3. Numerical Analysis, Goel Mittal- Pragati Prakashan.

Course Outcomes :

After completion of this practical course students will be able to :

1] Learn the Method of solving higher order differential equation.
2] Solve the Bernoullis differential equations.
3] Understand the Clairauts Form solve the examples.
4] Solve the differential equations using Picards method ,Euler's Method and Euler's Modified Method
5] Solve the examples of Linear Differential Equations with Constant Coefficients
6] Solve the Differential Equation of first order
7] Understand the Laplace transforms.
8] Understand the concept of Simultaneous DifferentialEquations and Total differential Equations.

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BNTT-209: Linear Integrated Circuits
(Lectures: 30, Credits: 02)

Course Objectives :

1] This course provides comprehensive idea about working principle, operation and characteristics of Linear Integrated Circuits.

2] Students are get familiarize with Op-Amp and its applications.

3] Students are get familiarize with data converters devices.

UNIT -1 : [06Lectures]

Operational Amplifiers (Black box approach):

Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Open and closed loop configuration, Frequency Response. CMRR, Slew Rate and concept of Virtual Ground.

UNIT -2 : [09Lectures]

Applications of Op-Amps:

1] Inverting and non-inverting amplifiers,
2] Summing and Difference Amplifier,
3] Differentiator,
4] Integrator,
5] Wein bridge oscillator,
6] Comparator and Zero-crossing detector, and
7] Active low pass and high pass Butterworth filter (1st orderonly).

UNIT -3 : [09Lectures]

D-A and A-D Conversion :

4 bit binary weighted and R-2R D-A converters, circuit and working. Accuracy and Resolution. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs forall).

UNIT -4 : [06Lectures]

CLOCK AND TIMER (IC 555) :

Introduction, Block diagramof IC 555, Astable and Monostable multivibrator circuits.

Reference Books:

1. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, PrenticeHall, 4th edition, 2000
2. Pulse, switching and Digital circuit, David A. Bell, Oxford UniversityPress, 5th edition.
3. Operational Amplifiers and Linear ICs, David A. Bell, Oxford UniversityPress, 3rd Edition,2011.
4. Digital Principles and Applications, A. P. Malvino, D. P. Leach and Saha, Tata McGraw, 7th Ed., 2011
5. Integrated circuits, K. R. Botkar, Khanna Publication

Course Outcomes :

UNIT - 1 : After completion of this unit students will be able to understand

1] Ideal and Practical characteristics Operational Amplifier (IC741),
2] Concept of Open and closed loop configuration
3] Concept of Frequency Response. CMRR. Slew Rate
4] Concept of Virtual Ground.

UNIT - 2 : After completion of this unit students will be able to explain

1] Applications of Op-Amps as Inverting and non-inverting amplifiers
2] Op-Amps as Summing and Difference Amplifier, Differentiator and Integrator
3] Working of Op-Amp as Wein bridge oscillator, Comparator and Zero-crossing detector
4] Active low pass and high pass Butter worth filter

UNIT - 3 : After completion of this unit students will be able to understand

1] Working of ADC
2] Working of DAC

UNIT - 4 : After completion of this unit students will be able to explain

1] Construction and working of Clock and Timer (IC 555)
2] Astable and Monostable multivibrator circuits using IC555

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BNTT- 210: Digital Electronics
(Lectures: 30, Credits: 02)

Course Objectives :

1] This course provides comprehensive idea about working principle, operation and characteristics Digital Electronics Systems.

2] Students are get idea about Combinational and Sequential logic circuits Analysis and Design

UNIT -1 : [06Lectures]

Number System and Codes :

Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned numbers, BCD code. Binary, octal and hexadecimal arithmetic; addition, subtraction by 2's complement method, multiplication.

UNIT -2 : [04Lectures]

Logic Gates and Boolean Algebra :

Truth Tables of OR, AND, NOT, NOR, NAND, XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Boolean algebra.

UNIT -3 : [06Lectures]

Combinational Logic Analysis and Design :

Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).

UNIT -4 : [14Lectures]

Arithmetic Circuits:

Binary Addition. Half and Full Adder. Half and Full Subtractor, 4- bit binary Adder / Subtractor.

Data processing circuits :

Multiplexers, De-multiplexers, Decoders, Encoders.

Sequential Circuits :

SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop.

Master-slave JK Flip-Flop.

Shift registers:

Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Counters (4 bits):

Ring Counter. Asynchronous counters, Decade Counter, Synchronous Counter.

Reference Books :

1. Fundamentals of Digital Circuits, Anand Kumar, PHILearning Pvt.Ltd. 2nd Edn, 2009
2. Digital Circuits and systems, Venugopal, Tata McGrawHill,2011
3. Digital Systems: Principles & Applications, R. J. Tocci, N. S. Widmer, PHILearning, 2001
4. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia(1994)
5. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill(1994)

Course Outcomes:

UNIT - 1 : After completion of this unit students will be able to learn

1] Number System and conversions of number systems.
2] Representation of signed and unsigned numbers,
3] BCD code representation and Binary arithmetic operations.

UNIT - 2 :After completion of this unit students will be able to understand

1] Working of Basic Logicgates
2] Basic postulates and fundamental theorems of Boolean algebra.

UNIT -3 : After completion of this unit students will be able to understand

1] Standard representation of logic functions (SOP and POS),
2] Minimization Techniques (Karnaugh map minimization up to 4 variablesfor SOP).

UNIT - 4 : After completion of this unit students will be able to design

1] Arithmetic Circuits: Adder, Subtractor
2] Data processing circuits : Multiplexers, De-multiplexers, Decoders, Encoders.
3] Sequential Circuits : Flip - Flops, Shiftregisters, Counters

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BNTP-215: Electronic Science Lab (Credits: 02)

B.Sc. Nanoscience and Technology

Course Objectives :

1] To gain knowledge in designing basic Digital circuits 2] To study circuits operation practically.

Experiments:

1] To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain 2] To investigate the use of an op-amp as an Integrator.

3] To investigate the use of an op-amp as a Differentiator. 4] Study of basic logic gate

5] Study universality of NAND and NOR gate

6] a) To design a combinational logic system for a specified TruthTable.

b) To convert Boolean expression into logic circuit & design it using logic gate ICs.

c) To minimize a given logic circuit. 7] Half Adder and Full Adder.

8] Half Subtractor and Full Subtractor.

9] To design an Astable Multivibrator of given specification using IC555 Timer. 10] To design a Monostable Multivibrator of given specification using IC555 Timer.

11] To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates. 12] To build JK Master-slave flip-flop using Flip-Flop ICs

13] To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.

Reference Books :

1. Digital Principles and Applications, A. P. Malvino, D. P. Leach and Saha, TataMcGraw, 7th Ed., 2011
2. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, Prentice Hall, 4th edn., 2000
3. Digital Principles ,R. L. Tokheim, Schaum's Outline Series, Tata McGraw- Hill(1994)
4. Digital Electronics, S.K. Mandal, McGrawHill, 1st edition,2010

Course Outcomes :

After completion of this lab course students will be able to

1) To know the design procedure of various applications of Op-Amp
2) To know about designing of data converters with desire specifications
3) Designing of various arithmetic circuits
4) Designing of various combinational and sequential circuits and study their operations practically.

Evaluation Scheme
B. Sc. Nanoscience and Technology
Semester I

Course Code	Name of the Course	ESE	Internal Exam		Course Code	Practical		Submission		Total
			CCE -I	CCE-II (Online Test)		Exam	Journal	Case study/ Educational Tour/ Seminar	Day to day Performance	
BNTE-101T	Physics-I	30	5	5	BNTE LAB 1 -111 P (Physics)	30	05	05	05	125
BNTE-102T	Physics-II	30	5	5						
BNTE-103T	Chemistry-I	30	5	5	BNTE LAB 2-112 P (Chemistry)	30	05	05	05	125
BNTE-104T	Chemistry-II	30	5	5						
BNTE-105T	Biotechnology -I	30	5	5	BNTE LAB 3 -113 P (Biotechnology)	30	05	05	05	125
BNTE-106T	Biotechnology -II	30	5	5						
BNTE-107T	Mathematics - I	30	5	5	BNTE LAB 4-114 P (Mathematics)	30	05	05	05	125
BNTE-108T	Mathematics - II	30	5	5						
BNTE-109T	Electronics -I	30	5	5	BNTE LAB 5-115 P (Electronics)	30	05	05	05	125
BNTE-110T	Electronics -II	30	5	5						
BNTE-AECC -1T	English-I	40	5	5						50
Total of SEM I										**675**

B.Sc. Nanoscience and Technology

Semester II

Course Code	Name of the Course	ESE	Internal Exam		Course Code	Practical		Submission		Total
			CCE -I	CCE-II (Online Test)		Exam	Journal	Case study/ Educational Tour/ Seminar	Day to day Performance	
BNTE-201T	Physics-III	30	5	5	BNTE LAB 1 -211 P (Physics)	30	05	05	05	125
BNTE-202T	Physics-IV	30	5	5						
BNTE-203T	Chemistry-III	30	5	5	BNTE LAB 2-212 P (Chemistry)	30	05	05	05	125
BNTE-204T	Chemistry-IV	30	5	5						
BNTE-205T	Biotechnology -III	30	5	5	BNTE LAB 3 -213 P (Biotechnology)	30	05	05	05	125
BNTE-206T	Biotechnology -IV	30	5	5						
BNTE-207T	Mathematics - III	30	5	5	BNTE LAB 4-214 P (Mathematics)	30	05	05	05	125
BNTE-208T	Mathematics - IV	30	5	5						
BNTE-209T	Electronics - III	30	5	5	BNTE LAB 5-215 P (Electronics)	30	05	05	05	125
BNTE-210T	Electronics - IV	30	5	5						
BNTE-AECC -2T	English-II	40	5	5						50
Total of SEM II										**675**
Total of SEM I & SEM II										**1350**