Detailed Course Scheme

Bachelor of Science (B.Sc.)

(Biotech)

Semester-IV

(2019-2022)

DOC201807020052

RNB GLOBAL UNIVERSITY
RNB Global City, Ganganagar Road,
Bikaner, Rajasthan 334601

OVERVIEW

RNB Global University follows Semester System along with Choice Based Credit System as per latest guidelines of University Grants Commission (UGC). Accordingly, each academic year is divided into two semesters, **Odd(July-December) and Even (January-June).**Also, the university follows a system of continuous evaluation along with regular updating in course curricula and teaching pedagogy.

The curriculum for B.Sc. Program for (January- June)Even Semester, 2021 along with examination pattern is as follows.

Course Scheme

Semester – IV

S. No.	Course Code	Course Name	L	T	P	Credits
1.	13002000	Chemistry-IV	4	0	0	4
2.	13002100	Chemistry-IV Lab	0	0	4	2
3.	13015000	Environmental Biotechnology	4	0	0	4
4.	13015100	Environmental BiotechnologyLab	0	0	4	2
5.	13009100	Molecular Biology	4	0	0	4
6.	13009200	Molecular Biology Lab	0	0	4	2
7.	13003000	Ability & Skill Enhancement - IV	2	0	0	2
8.	13011200	Research Methodology in Biotechnology	2	0	0	2
9.	13014500	Renewable Energy and Energy Harvesting	2	0	0	2
10.	99002800	Workshops & Seminars	-	-	-	1
11.	99002700	Human Values & Social Service/NCC/NSS	-	-	-	1
Total			**18**	**0**	**12**	**26**

EVALUATION SCHEME -THEORY

The evaluation of the theory paper of B.Sc. program would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and ExternalAssessments as follows:

Internal Assessment

The distribution of Internal Assessment Marks is as follows:

Type	Details	Marks
Mid Term	Two Mid-term Sessional of 15 marks each (15+15)	30
Marks obtained in various Tests, Assignments, Presentations, Quiz, Tutorials, etc.	Average of marks obtained	15
Attendance	75%+ : 5 marks	5
TOTAL	**50**	

External Assessment

Type	Marks
Theory	50

EVALUATION SCHEME -PRACTICAL

The evaluation of the practical paper of B.Sc. program would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessment is as follows:

Internal Assessment

Type	Details	Marks
Marks obtained in various manuals, practical file, participation, any model prepared, output of practical	Average of marks obtained	45
Attendance	75%+ : 5 marks	5
TOTAL	**50**	

External Assessment

Type	Marks
Practical	50

EVALUATION SCHEME- WORKSHOPS & SEMINARS AND HUMAN VALUES & SOCIAL SERVICE/NCC/NSS

1. The evaluation of Workshops & Seminar and Human Values & Social Service/NCC/NSS will be completed from Semester I – Semester VI. It will be evaluated internally by the various Forums & Schools Concerned. The credit for this will be given at the end of each Semester.

2. The students have to join club/clubs/Forums with the active participation in different activities of club. The students would be continuously assessed from Semester-I to Semester-IV and credits and marks would be given after the end of each Semester.

SUMMER INTERNSHIP

Internships are taken after the end of the 4th semester for a period of 4-5 weeks. It carries 4 credits & the student needs to submit their Summer Internship Report in the 5th semester. For the ease of students understanding, Summer internship is evaluated for a total of 150 marks for Weekly Reports, Project report, Presentation & Viva Voce & later converted into grade & grade points as per the University Examination Policy.

CURRICULUM

Course Name: Chemistry- IV

Course Code: 13002000

Objectives:

To facilitate the student with graduate level Inorganic and Physical Chemistry Concepts. Students will learn about transition elements, coordination chemistry, Crystal field theory etc. Also, in Physical chemistry students will learn chemistry of Solids, Liquids, Gases and Chemical Kinetics.

Course Outline

Unit I: **Transition Elements (3d series)**
General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

Unit II: Coordination Chemistry
Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT.IUPAC system of nomenclature.

Unit III: Crystal Field Theory
Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry.Factors affecting the magnitude of D. Spectrochemical series.Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry.Jahn-Teller distortion, Square planar coordination.

Unit IV:Kinetic Theory of Gases
Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation.Andrews isotherms of CO2. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions.Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

Unit V: Liquids
Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer.Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Unit VI: Solids:
Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices.X–Ray diffraction by crystals, Bragg's

law.Structures of NaCl, KCl and CsCl (qualitative treatment only).Defects in crystals.Glasses and liquid crystals.

Unit VII: Chemical Kinetics:
The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates.Order and molecularity of a reaction.Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants).Half–life of a reaction.General methods for determination of order of a reaction.Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Suggested Readings:

1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
5. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
6. Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
7. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
8. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
9. Rodgers, G.E. Inorganic &Solid State Chemistry, Cengage Learning India Ltd., 2008.

Course Name: Chemistry-IV Lab

Course Code:13002100

Objectives

To facilitate the students about practical aspects of undergraduate Inorganic and Physical Chemistry. Students will be versed with qualitative salt analysis, water analysis, kinetics, surface tension and viscosity of liquids as well as gravimetric analysis.

Course Outline

Section A: Inorganic Chemistry

Semi-micro qualitative analysis (using H_2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following: Cations : NH_4^+ , Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+},

Ca^{2+}, K^{+} Anions : CO_3^{2-} , S^{2-}, SO^{2-}, $S_2O_3^{2-}$, NO^{3-} , CH_3COO^{-} , Cl^{-} , Br^{-} , I^{-} , NO^{3-} , SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, $C_2O_4^{2-}$, F^{-} (Spot tests should be carried out wherever feasible)

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato)nickel(II) or aluminium as oximate in a given solution gravimetrically.
2. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
3. Estimation of total hardness of a given sample of water by complexmetric titration.

Section B: Physical Chemistry

(I) Surface tension measurement (use of organic solvents excluded). a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer. b) Study of the variation of surface tension of a detergent solution with concentration.

(II) Viscosity measurement (use of organic solvents excluded)

a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.

b) Study of the variation of viscosity of an aqueous solution with concentration of solute. (III) Chemical Kinetics Study the kinetics of the following reactions. 1. Initial rate method: Iodide-persulphate reaction

2. Integrated rate method: a. Acid hydrolysis of methyl acetate with hydrochloric acid. b. Saponification of ethyl acetate. c. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate.

Course Name: Environmental Biotechnology

Course Code: 13015000

Course Outline

Unit I

Conventional fuels and their environmental impact – Firewood, Plant, Animal, Water, Coal and Gas. Modern fuels and their environmental impact – Methanogenic bacteria, Biogas, Microbial hydrogen Production, Conversion of sugar to alcohol Gasohol.

Unit II

Bioremediation of soil & water contaminated with oil spills, heavy metals and detergents. Degradation of lignin and cellulose using microbes. Phyto-remediation. Degradation of pesticides and other toxic chemicals by micro-organisms- degradation aromatic and chlorinates hydrocarbons and petroleum products.

Unit III
Treatment of municipal waste and Industrial effluents. Bio-fertilizers. Role of symbiotic and asymbiotic nitrogen fixing bacteria in the enrichment of soil. Algal and fungal biofertilizers (VAM).

Unit IV
Bioleaching, Enrichment of ores by microorganisms (Gold, Copper and Uranium).Environmental significance of genetically modified microbes, plants and animals.

Suggested Readings

1. Environmental Science, S.C. Santra
2. Environmental Biotechnology, Pradipta Kumar Mohapatra
3. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening andJesef Winter
4. Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
5. Agricultural Biotechnology, S.S. Purohit
6. Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
7. Introduction to Environmental Biotechnology, Milton Wainwright
8. Principles of Environmental Engineering, Gilbert Masters
9. Wastewater Engineering – Metcalf & Eddy

Course Name: Environmental Biotechnology Lab

Course Code: 13015100

Course Outline

Practical's

1. Calculation of Total Dissolved Solids (TDS) of water sample.
2. Calculation of BOD of water sample.
3. Calculation of COD of water sample.
4. Bacterial Examination of Water by MPN Method

Course Name: Molecular Biology

Course Code:13009100

Objective

The course aims to provide students with a basic understanding of: the molecular architecture of eukaryotic cells and organelles, including membrane structure and dynamics;; the principles of bioenergetics and enzyme catalysis;; the chemical nature of biological macromolecules, their three-dimensional construction, The objective of this course is to identify limitations of these techniques; to given a particular biological question, identify which experimental techniques are best used to answer that question; to compare and contrast the mechanisms of bacterial and eukaryotic DNA replication, DNA repair, transcription, and translation; to explain how DNA topology and chromatin structure affects the processes of DNA replication, repair, and transcription; to give examples of DNA and histone modifications and predict how they will affect gene expression; to describe mechanisms by which DNA can be damaged and describe the molecular mechanisms by which protein complexes repair different forms of DNA damage; to provide examples of how homologous recombination, site-specific recombination, and transposition can promote both genome stability and genetic diversity; to describe how pre-mRNA splicing occurs.

Course Outline

Unit I: **DNA structure and replication**

DNA as genetic material, Structure of DNA, Types of DNA, Replication of DNA in prokaryotesand eukaryotes: Semiconservative nature of DNA replication, Bi-directional replication, DNApolymerases, The replication complex: Pre-primming proteins, primosome, replisome, Rollingcircle replication, Unique aspects of eukaryotic chromosome replication, Fidelity of replication.

Unit II:DNA damage, repair and homologous recombination

DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair:Photoreactivation, base excision repair, nucleotide excision repair, mismatch repair, translesionsynthesis, recombinational repair, non-homologous end joining. Homologous recombination:models and mechanism.

Unit III: Transcription and RNA processing

RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase,role of sigma factor, promoter, Initiation, elongation and termination of RNA chainsTranscription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters,enhancers, mechanism of transcription initiation, promoter clearance and

elongation RNAsplicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing,rRNA and tRNA splicing.

Unit IV:Regulation of gene expression and translation

Regulation of gene expression in prokaryotes: Operon concept (inducible and repressiblesystem), Genetic code and its characteristics, Prokaryotic and eukaryotic translation: ribosomestructure and assembly, Charging of tRNA, aminoacyltRNAsynthetases, Mechanism ofinitiation, elongation and termination of polypeptides, Fidelity of translation, Inhibitors of translation.,Posttranslational modifications of proteins.

Suggested Readings:

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) Molecular.
5. Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

Course Name: Molecular Biology Lab

Course Code:13009200

Objectives

This laboratory course applies concepts learned in the Molecular Biology course to a molecular biology research project. The students will be able to learn standard genetic and biochemical techniques common in a molecular biology lab, such as DNA isolation, agarose-gel electrophoresis, and transformation. The project also will provide students with a hands-on understanding of how modern DNA-sequencing technology, along with Bioinformatics tools, can be used to discover genetic differences and understand cellular function. Students in this course will learn fundamental aspects of experimental design and apply concepts and theory to a hands-on experience.

Course Outline

1. Preparation of solutions for Molecular Biology experiments.
2. Isolation of chromosomal DNA from bacterial cells.
3. Isolation of Plasmid DNA by alkaline lysis method.
4. Agarose gel electrophoresis of genomic DNA & plasmid DNA.
5. Preparation of restriction enzyme digests of DNA samples.
6. Demonstration of AMES test or reverse mutation for carcinogenicity.

Suggested Readings:

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition.John Wiley & Sons.Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006).Cell and Molecular Biology VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009): The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

Course Name: Renewable Energy and Energy Harvesting

Course Code:13014500

Objectives

By using various pedgogies like lecture seminar, webinar, class assignments and home assignments, students wll learn about the need of studying about the renewable energies and enegy harvesting to meet the increasing demand of power supply. Students will be aware of generating energy via various technologies apart from the conventional methods. These new methods are clean and hazard free. Solar energy, Geothermal energy, Tidal energy, Wind energy and many more methods are being developed for fulfilling the power need.

The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible.

Course Outline

Unit I: Fossil fuels and Alternate Sources of energy

Fossil fuels and Nuclear Energy, theirlimitation, need of renewable energy, non-conventional energy sources. An overview ofdevelopments in Offshore Wind Energy, Tidal Energy, Wave energy systems, OceanThermal Energy Conversion, solar energy, biomass,

biochemical conversion, biogasgeneration, geothermal energy tidal energy, Hydroelectricity.

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, nonconvective solar pond, applications of solar pond and solar energy, solar water heater,flat plate collector, solar distillation, solar cooker, solar green houses, solar cell,absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PVmodels and equivalent circuits, and sun tracking systems.

UnitII: Wind Energy harvesting: Fundamentals of Wind energy

Wind Turbines and differentelectrical machines in wind turbines, Power electronic interfaces, and gridinterconnection topologies.

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristicsand Statistics, Wave Energy Devices.

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy,Osmotic Power, Ocean Bio-mass.

UnitIII: Geothermal Energy

Geothermal Resources, Geothermal Technologies.

Hydro Energy: Hydropower resources, hydropower technologies, environmental impactof hydro power sources.

Piezoelectric Energy harvesting: Introduction, Physics and characteristics ofpiezoelectric effect, materials and mathematical description of piezoelectricity,Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energyharvesting applications, Human power.

Unit IV: Electromagnetic Energy Harvesting

Linear generators, physics mathematical models, recent applications

Carbon captured technologies, cell, batteries, power consumption. Environmental issues and Renewable sources of energy, sustainability.

Demonstrations and Experiments

1. Demonstration of Training modules on Solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Suggested Readings:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004,Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

Course Name: Ability & Skill Enhancement - IV

Course Code:13003000

Objectives

To make the students competent in appearing for interviews.

Course Outline - Final Assessment – Mock Interviews & PI Kit Submission

Unit I: Tele – Etiquettes

Receiving Calls, Placing a call, Ending Calls, Transferring calls, Taking Message/ Voice Mails, Placing call on hold, Handling Complaints.

Unit II : Confidence Building & Brain Storming

How to build confidence by positive thinking, identifying negative thoughts, how to control negative thoughts entering our mind, identifying personal talents, and its ways to improve, how to develop good habits and having principles and follow them at all times.

Need to learn new things, ideas and skills, what is brain storming, why do we need it, what are the different ways of brain storming through logics and reasoning, Brain Storming Session.

Unit III : PI Kit

What is resume, Format of Resume, Formatting, Resume Preparation, Covering Letter, PI Kit.

Unit IV : Interview Skills

Mastering the art of giving interviews in - selection or placement interviews, web /video conferencing, Mock Interview, HR Expert Mock Interview, Telephonic Interviews.

Unit V: Internship Preparation: Company Specific Research and Presentation

Identifying domain specific industries, researching the industry, Industry analysis, Presentation on specific industry/company.

Course Name: Research Methods in Biotechnology

Course Code: 13011200

Course Outline

Unit I Introduction

Concept of Research and Its Application, Types of Research, Process of Research: Steps Involved in Research Process. Research Design: Various Methods of Research Design. Hypothesis as a framework for scientific projects, Null Hypothesis, Collection of Data, Experimental Design, Control Samples.

Unit II Analysis of Data

Organize data, describe data Tabulation of Data, Various Kinds of Charts and Diagrams, Tables, Bar Graphs, Pie charts or circle graphs and Line graphs.

Statistical Tests, t-test, G-test ,Chi-square test, Confidence levels, Standard Deviation ,mean, variance, Basic Software's for Statistical Analysis

Note: The review of Syllabus happens on periodic basis for the benefit of the students. In case there are changes in curriculum due to review, students would be intimated in writing.

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