Detailed Course Scheme

Bachelor of Science (B. Sc.)

(Biotech)

Semester- VI

(2020-2021)

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RNB GLOBAL UNIVERSITY
Educating stars for tomorrow

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. (Biotech) Program along with examination pattern is as follows:

Course Scheme

Semester – VI

S. No.	Course Code	Course Name	L	T	P	Credits
1.	-	Discipline Specific Core Course-I Elective II	4	0	0	4
2.	-	Discipline Specific Core Course-I Elective II Lab	0	0	4	2
3.	-	Discipline Specific Core Course-II Elective II	4	0	0	4
4.	-	Discipline Specific Core Course-II Elective II Lab	0	0	4	2
5.	-	Discipline Specific Core Course-III Elective II	4	0	0	4
6.	-	Discipline Specific Core Course-III Elective II Lab	0	0	4	2
7.	13003200	Ability & Skill Enhancement - VI	2	0	0	2
8.	13015600	Intellectual Property Rights	2	0	0	2
9.	99002800	Workshops & Seminars	-	-	-	1
10.	99002700	Human Values & Social Service/NCC/NSS	-	-	-	1
Total			**16**	**0**	**12**	**24**

Discipline Specific Core Course Papers

Subject	Course Code	Course Name
Chemistry	13009700	Organometallics, Bioinorganic chemistry, Polynuclear, hydrocarbons and UV, IR Spectroscopy (DSE II)
	13009800	Organometallics, Bioinorganic chemistry, Polynuclear, hydrocarbons and UV, IR Spectroscopy Lab (DSE II)
Botany	13014800	Economic Botany and Biotechnology (DSE II)
	13014900	Economic Botany and Biotechnology Lab (DSE II)
Biotechnology	13015400	Genomics and Proteomics (DSE II)
	13015500	Genomics and Proteomics Lab (DSE II)

- Lab would be same as per theory elective paper opted by the student.

Note : The dissertation is optional, which can be taken in place of any one discipline elective/subject of 6 credits in the 6th Semester.

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 External Assessments 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.

CURRICULUM

Course Name: Organometallics, Bioinorganic Chemistry, Polynuclear, Hydrocarbons and UV, IR Spectroscopy

Course Code: 13009700

Objectives

The whole curriculum deals with the core inorganic chemistry. The syllabus coverage includes 46 hardcore lectures, clarification class, presentations by students, seminar, guest

lecture by some speakers having expertise in a particular field and brainstorming quiz session. The main objectives of this teaching include:

- The 'chemistry of 3d element' segment includes the study of some particular compounds of 3d transition elements having use in analysis of ions, as a powerful oxidizing agent etc.
  Organometallics' includes the study of the concept of the preparation, structure and bonding in organometallic compounds.
  Bioinorganic chemistry' helps in the understanding of the functions of various ions like sodium, potassium, magnesium and calcium in our body.
- Polynuclear hydrocarbons and
- Active methylene section includes the understanding of the mechanism of the electrophilic substitution reactions in various polynuclear and heterocyclic compounds and the
- Chapter includes the concept of uv-visible and infra-red spectroscopy with the help of which we can determine the structure of the unknown organic compounds.

Course Outline

Section A:

Unit I

Chemistry of 3d metals Oxidation states displayed by Cr, Fe, Co, Ni and Co. A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, K2Cr2O7, KMnO4, K4[Fe(CN)6], sodium nitroprusside, [Co(NH3)6]Cl3, Na3[Co(NO2)6].

Unit II

Organometallic Compounds Definition and Classification with appropriate examples based on nature of metal carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

Unit III

Bio-Inorganic Chemistry A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na+ , K+ and Mg2+ ions: Na/K pump; Role of Mg2+ ions in energy production and chlorophyll. Role of Ca2+ in blood clotting, stabilization of protein structures and structural role (bones).

Section B:

Unit IV

Polynuclear and heteronuclear aromatic compounds: 95 Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene , Furan, Pyrrole, Thiophene, and Pyridine.

Unit V

Active methylene compounds: Preparation: Claisen ester condensation. Keto-enoltautomerism. Reactions: Synthetic uses of ethylace to acetate (preparation of non-heteromolecules having upto 6 carbon).

Unit VI

Application of Spectroscopy to Simple Organic Molecules Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λmax & εmax, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating l max of conjugated dienes and α,β – unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Suggested Readings

1. James E. Huheey, Ellen Keiter& Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
2. G.L. Miessler& Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
3. J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
4. F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley & Sons.
5. I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
6. John R. Dyer: Applications of Absorption Spectroscopy of Organic Compounds, Prentice Hall.
7. R.M. Silverstein, G.C. Bassler& T.C. Morrill: Spectroscopic Identification of Organic Compounds, John Wiley & Sons.
8. R.T. Morrison & R.N. Boyd: Organic Chemistry, Prentice Hall.
9. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
10. ArunBahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.

Course Name: Organometallics, Bioinorganic Chemistry, Polynuclear, Hydrocarbons and UV, IR Spectroscopy Lab

Course Code: 13009800

Objectives

Syllabus deals with the practical aspects of the inorganic chemistry and organic chemistry . Inorganic chemistry the synthesis of metal complexes and their conductivity measurements

and chromatographic separation of some metal ions. Organic chemistry includes the analysis of various functional group in unknown organic compounds.

Course Outline

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given) Paper chromatographic separation of Fe3+, A13+ and Cr3+ or Paper chromatographic separation of Ni2+, Co2+, Mn2+ and Zn2+
2. Preparation of any two of the following complexes and measurement of their conductivity: (i) tetra ammine carbonato cobalt (III) nitrate (ii) tetraam mine copper (II) sulphate (iii) potassium trioxalatoferrate (III) trihydrate Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl2 and LiCl3.

Section B: Organic Chemistry

Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Suggested Readings

1. A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
2. A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

Course Name: Economic Botany and Biotechnology

Course Code: 13014800

Objectives

To provide an overview of the various business process, analyze operations, production planning.

Course outline:

Unit I: Origin of Cultivated Plants

Concept of centres of origin, their importance with reference to Vavilov's work.

Unit II: **Cereals**

Wheat -Origin, morphology, uses.

Unit III: Legumes

General account with special reference to Gram and soybean.

Unit IV: Spices
General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses).

Unit V: Beverages
Tea (morphology, processing, uses).

Unit VI: Oils and Fats
General description with special reference to groundnut.

Unit VII: Fibre Yielding Plants
General description with special reference to Cotton (Botanical name, family, part used, morphology and uses).

Unit VIII: Introduction to Biotechnology:

Unit IX: Plant tissue culture
Micropropagation; haploid production through and rogenesis and gynogenesis; brief account of embryo & endosperm culture with their applications.

Unit X: Recombinant DNA Techniques
Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridomaand monoclonal antibodies, ELISA and Immuno- detection. Molecular diagnosis of human disease, Human gene Therapy.

Suggested Readings

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice.Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

Course Name: Economic Botany and Biotechnology Lab

Course Code: 13014900

Objectives

To provide an overview of the various business process, analyze operations, production planning.

Course Outline

1. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and micro chemical tests
2. Familiarization with basic equipment in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micro propagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

Course Name: Genomics & Proteomics

Course Code: 13015400

Objectives

The aim of this course is to teach genomics, proteomics, metabolomics and phonemics using model organisms representing plants and animals. The course will cover recent developments in genetics, epigenetics, small RNAs, proteomics, gene expression, mutagenesis and mapping genes. An objective of the course will be to develop skills in experimental design within the context of learning about biology including: signal transduction, regulation of transcription and translation, cancer, aging, drought stress and metabolic pathways. This course aims to provide you with the knowledge and practical skills associated with functional genomics and proteomics. Particular emphasis is given to techniques used in eukaryotes (plants and animals) so you understand the responses of these organisms at the 'whole-genome' level to biotic and abiotic stresses. It also covers the topic of pharmacogenomics and the implications of applying 'personalized medicine' in human health. The environmental, economic and ethical aspects of this emerging technology will be examined.

The course helps the students to understand the molecular biology in terms of detailed genes and protein level approach.

The course aims to appraise the students to basic and high throughput techniques in Genomics and Proteomics and their applications.

Course Outline

Unit I

Introduction to Genomics, DNA sequencing methods – manual & automated: Maxam & Gilbert and Sangers method. Pyrosequencing, Genome Sequencing: Shotgun & Hierarchical (clone contig) methods, Computer tools for sequencing projects: Genome sequence assembly software.

Unit II

Managing and Distributing Genome Data: Web based servers and softwares for genome analysis: ENSEMBL, VISTA, UCSC Genome Browser, NCBI genome. Selected Model Organisms' Genomes and Databases.

Unit III

Introduction to protein structure, Chemical properties of proteins. Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, van der waal interactions, hydrogen bonds, Hydrophobic interactions. Determination of sizes (Sedimentation analysis, gel filteration, SDS-PAGE); Native PAGE, Determination of covalent structures – Edman degradation.

Unit IV

Introduction to Proteomics, Analysis of proteomes.2D-PAGE. Sample preparation, solubilization, reduction, resolution. Reproducibility of 2D-PAGE. Mass spectrometry based methods for protein identification. De novo sequencing using mass spectrometric data.

Suggested Readings

1. Genes IX by Benjamin Lewin, Johns and Bartlett Publisher, 2006.
2. Modern Biotechnology, 2nd Edition, S.B. Primrose, Blackwell Publishing, 1987.
3. Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I to III, 1989.
4. Principles of Gene Manipulation 6th Edition, S.B.Primrose, R.M.Twyman and R.W. Old. Blackwell Science, 2001.
5. Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
6. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.

Course Name: Genomics & Proteomics Lab

Course Code: 13015500

Objectives

The aim of this course is to teach genomics, proteomics, metabolomics and phonemics using model organisms representing plants and animals. The course will cover recent developments in genetics, epigenetics, small RNAs, proteomics, gene expression, mutagenesis and mapping genes. An objective of the course will be to develop skills in experimental design within the context of learning about biology including: signal transduction, regulation of transcription and translation, cancer, aging, drought stress and metabolic pathways. This course aims to provide you with the knowledge and practical skills associated with functional genomics and proteomics. Particular emphasis is given to techniques used in eukaryotes (plants and animals) so you understand the responses of these organisms at the 'whole-genome' level to biotic and abiotic stresses. It also covers the topic of pharmacogenomics and the implications of applying 'personalised medicine' in human health. The environmental, economic and ethical aspects of this emerging technology will be examined.

Course Outline

1. Use of SNP databases at NCBI and other sites
2. Use of OMIM database
3. Detection of Open Reading Frames using ORF Finder
4. Proteomics 2D PAGE database
5. Softwares for Protein localization.
6. Hydropathy plots
7. Native PAGE
8. SDS-PAGE

Course Name: Intellectual Property Rights

Course Code:13015600

Objectives

This course aims to empower students with knowledge and capacities to understand and analyze the meaning and nature of the Intellectual Property Rights besides being conversant with the actual operation and enforcement of different laws dealing with the Patents, Copyrights, Trade- marks, Industrial designs and the Geographical indications etc. In addition to this, . Lectures will cover the theory mainly supported by a few case- studies to as to improve their deep understanding and memorization so that their involvement and working- capacities become efficiently skillful and dynamic enough. Highlighting the role of judiciary sufficiently, target will be focused on certain vital issues like the Word Trade Organization (WTO), the General Agreement on Tariffs & Trade (GATT), the Trade Related Intellectual Property Rights (TRIPS) agreement, the General Agreement on Trade related Services (GATS) besides commenting duly on the Madrid Protocol, the Berne Convention, the Budapest Treaty and the Paris Convention dealing with WIPO and TRIPS along with

discussion on the ongoing Police, Customs etc. within the Indian Context besides the existing Indian laws on Licensing and Technology transfer.

Course Outline

Introduction to Intellectual Property:
Historical Perspective, Different Types of IP, Importance of protecting IP.

Copyrights
Introduction, How to obtain, Differences from Patents.

Trade Marks
Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc. Differences from Designs.

Patents
Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

Geographical Indications
Definition, rules for registration, prevention of illegal exploitation, importance to India.

Industrial Designs
Definition, How to obtain, features, International design registration.

Layout design of integrated circuits
Circuit Boards, Integrated Chips, Importance for electronic industry.

Trade Secrets
Introduction and Historical Perspectives, Scope of Protection, Risks involved andlegal aspects of Trade Secret Protection.

Different International agreements

(a) Word Trade Organization (WTO):

i. General Agreement on Tariffs & Trade (GATT), TradeRelated Intellectual Property Rights (TRIPS) agreement
ii. General Agreement on Trade related Services (GATS)
iii. Madrid Protocol
iv. Berne Convention
v. Budapest Treaty

(b) Paris Convention

WIPO and **TRIPS, IPR** and Plant Breeders Rights, IPR and Biodiversity
IP Infringement issue and enforcement – Role of Judiciary, Role of law enforcement agencies – Police, Customs etc Economic Value of Intellectual Property– Intangible assets and their valuation, Intellectual Property in the Indian Context –Various laws in India Licensing and technology transfer.

Suggested Readings:

1. N.K. Acharya: *Textbook on intellectual property rights*, Asia Law House(2001).
2. Manjula Guru & M.B. Rao, *Understanding Trips: Managing Knowledge in Developing Countries*, Sage Publications (2003).
3. P. Ganguli, Intellectual Property Rights: *Unleashing the Knowledge Economy,* Tata McGraw-Hill (2001).
4. Arthur Raphael Miller, Micheal H. Davis; *Intellectual Property: Patents, Trademarks and Copyright in a Nutshell,* West Group Publishers (2000).
5. Jayashree Watal, *Intellectual property rights in the WTO and developing countries,* Oxford University Press, Oxford.

Course Name: Ability and Skill Enhancement - VI

Course Code: 13003200

Objectives:

- To enhance the aptitude and Verbal Communication of the students.

Course Outline – Final Assessment – Report/Presentation

Unit I: Verbal Reasoning & English Aptitude
Logical Sequence of Words, Verbal Analogy, Classification, Blood Relation Test, Syllogism, Reading Comprehension.

Unit II: Winning Attitude
Attitude is the most important thing for success, how to develop a winning attitude, what is it, when we need it, what is mindset, how to have a winning and positive mindset, how to win in difficult situations, Positive thinking, passion, dedication, confidence, well preparation, focus, hard work, planning, never give up, etc - some traits that help in developing winning attitude.

Unit III: Understanding the News
Reading Current News, Comparing & Analysing the news, Write an editorial, News Vocabulary, Presentation on any major news (political/social/sports/economics).

Unit IV: Be a Journalist
Chat Show, Panel Discussion, Parliamentary debate, News Inspired Theatrical Performance.

Unit V: Report

Preparing a report on major National/International News – Insights/ review of major newspapers and news channels.

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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