

**Detailed Course Scheme**  
**Bachelor of Science (B.Sc.)**  
**(Biotech)**

**Semester- VI**  
**(2018-2021)**

DOC201807020048



**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 - 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-II Elective III	4	0	0	4
6.		Discipline Specific Core Course-II Elective III 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
<b>Total</b>			<b>16</b>	<b>0</b>	<b>12</b>	<b>24</b>

### **Discipline Specific Core Course Papers**

Subject	Course Code	Course Name
<b>Chemistry</b>	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)
<b>Zoology</b>	13014800	Economic Botany and Biotechnology (DSE II)
	13014900	Economic Botany and Biotechnology Lab (DSE II)
<b>Biotechnology</b>	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
<b>TOTAL</b>		<b>50</b>

#### **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
<b>TOTAL</b>	<b>50</b>	

### **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 oxidising 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 function 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 hetrocyclic 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,  $K_2Cr_2O_7$ ,  $KMnO_4$ ,  $K_4[Fe(CN)_6]$ , sodium nitroprusside,  $[Co(NH_3)_6]Cl_3$ ,  $Na_3[Co(NO_2)_6]$ .

#### **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  $Mg^{2+}$  ions: Na/K pump; Role of  $Mg^{2+}$  ions in energy production and chlorophyll. Role of  $Ca^{2+}$  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-enol tautomerism. Reactions: Synthetic uses of ethylacetoacetate (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,  $\lambda_{\max}$  &  $\epsilon_{\max}$ , chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating  $\lambda_{\max}$  of conjugated dienes and  $\alpha, \beta$  - 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. Arun Bahl 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 R<sub>f</sub> value in each case. (Combination of two ions to be given) Paper chromatographic separation of Fe<sup>3+</sup>, Al<sup>3+</sup> and Cr<sup>3+</sup> or Paper chromatographic separation of Ni<sup>2+</sup>, Co<sup>2+</sup>, Mn<sup>2+</sup> and Zn<sup>2+</sup>
2. Preparation of any two of the following complexes and measurement of their conductivity: (i) tetra ammine carbonato cobalt (III) nitrate (ii) tetraamminecopper (II) sulphate (iii) potassium trioxalatoferate (III) trihydrate Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl<sub>2</sub> and LiCl<sub>3</sub>.

#### **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 androgenesis 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. Hybridoma and 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.

### **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 software's 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 filtration, 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 World 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.

The course is designed to introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries. The course introduces all aspects of the IPR Acts. It also includes case studies to demonstrate the application of the legal concepts in Science, Engineering, Technology and Creative Design.

### **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 and legal aspects of Trade Secret Protection.

## **Different International agreements**

### **(a) World Trade Organization (WTO):**

- i. General Agreement on Tariffs & Trade (GATT), Trade Related 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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