

**Detailed Course Scheme**  
**Bachelor of Science**  
**(Chemistry, Botany & Biotechnology)**

**Semester- II**

**2018-2021**

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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. Program for (January-June) Even Semester, 2019 along with examination pattern is as follows:

### **Course Scheme**

#### **Semester - II**

S. No.	Course Code	Course Name	L	T	P	Credits
1.	1300700	Chemistry II	4	0	0	4
2.	13001100	Chemistry-II Lab	0	0	4	2
3.	13008700	Plant Physiology and Metabolism	4	0	0	4
4.	13008800	Plant Physiology and Metabolism Lab	0	0	4	2
5.	13005900	Biochemistry & Metabolism	4	0	0	4
6.	13006000	Biochemistry & Metabolism Lab	0	0	4	2
7.	99001900	Environmental Studies	4	0	0	4
8.	13002800	Ability & Skill Enhancement Module - II	2	0	0	2
9.	99002800	Workshops & Seminars	-	-	-	1
10.	99002700	Human Values & Social Service/NCC/NSS	-	-	-	1
<b>Total</b>			<b>18</b>	<b>0</b>	<b>12</b>	<b>26</b>

### **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**

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 - NSS/NCC AND CLUB ACTIVITIES**

1. NSS/NCC /Similar activities prescribed by University will be completed from Semester I – Semester IV. It will be evaluated internally by the respective institute. The credit for this will be given after IV<sup>th</sup> Semester.
2. The students have to join club/clubs with the active participation in different activities of club. The students would be continuously assessed from Semester I – Semester IV and credits and marks would be given after IV<sup>th</sup> Semester.

### **CURRICULUM**

**Course Name: Chemistry II**

**Course Code: 13000700**

#### **Course Outline**

##### **Unit I: Chemical Energetic**

Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

##### **Unit II: Chemical Equilibrium**

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between  $\Delta G$  and  $\Delta G^\circ$ , Le Chatelier's principle. Relationships between  $K_p$ ,  $K_c$  and  $K_x$  for reactions involving ideal gases.

##### **Unit III: Ionic Equilibria**

Strong, moderate and weak 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. Salt hydrolysis-calculation of hydrolysis constant,

degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

#### **Unit IV: Organic Chemistry**

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

##### **Aromatic hydrocarbons**

Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

**Alkyl and Aryl Halides:** Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions.

Preparation: from alkenes and alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.

Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by -OH group) and effect of nitro substituent. Benzyne Mechanism:  $\text{KNH}_2/\text{NH}_3$  (or  $\text{NaNH}_2/\text{NH}_3$ ). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

##### **Alcohols, Phenols and Ethers (Upto 5 Carbons):**

Preparation: Preparation of 1°, 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk.  $\text{KMnO}_4$ , acidic dichromate, conc.  $\text{HNO}_3$ ). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben-Hoesch Condensation, Schotten - Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

**Aldehydes and ketones (aliphatic and aromatic):** (Formaldehyde, acetaldehyde, acetone and benzaldehyde)

Preparation: from acid chlorides and from nitriles.

Reactions – Reaction with HCN, ROH, NaHSO<sub>3</sub>, NH<sub>2</sub>-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.

**Suggested Readings:**

1. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons, 2014.
2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
3. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
4. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
5. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
6. Barrow, G.M. Physical Chemistry Tata McGraw-Hill, 2007.
7. Castellan, G.W. Physical Chemistry 4th Ed. Narosa, 2004.
8. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi, 2009.
9. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York, 1985.

**Course Name: Chemistry –II Lab**

**Course Code: 13001100**

**Course Outline**

**Section A: Physical Chemistry Thermo chemistry**

1. Determination of heat capacity of calorimeter for different volumes
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO<sub>3</sub>, NH<sub>4</sub>Cl)
5. Determination of enthalpy of hydration of copper sulphate
6. Study of the solubility of benzoic acid in water and determination of  $\Delta H$ . Ionic equilibria pH measurements a) 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. b) Preparation of buffer solutions: (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

### **Section B: Organic Chemistry**

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation
2. Criteria of Purity: Determination of melting and boiling points
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done. (a) Bromination of Phenol/Aniline (b) Benzoylation of amines/phenols (c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

### **Suggested Readings:**

1. 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
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960
3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011)

## **Course Name: Plant Physiology and Metabolism**

**Course Code: 13008700**

### **Course Outline**

#### **Unit I: Plant-water relations**

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

#### **Unit II: Mineral nutrition**

Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

#### **Unit III: Translocation in phloem**

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

**Unit IV: Photosynthesis**

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.

**Unit V: Respiration**

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

**Unit VI: Enzymes**

Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

**Unit VII: Nitrogen metabolism**

Biological nitrogen fixation; Nitrate and ammonia assimilation.

**Unit VIII: Plant growth regulators**

Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

**Unit IX: Plant response to light and temperature**

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

**Suggested Readings:**

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5<sup>th</sup> Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

**Course Name: Plant Physiology and Metabolism Lab****Course Code: 13008800****Course Outline**

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.



3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration
6. To study the effect of light intensity and bicarbonate concentration on O<sub>2</sub> evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.

#### **Demonstration experiments (any four)**

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration.
4. R.Q.
5. Respiration in roots.

#### **Suggested Readings**

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology, John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual, Narosa Publishing House, New Delhi.

### **Course Name: Biochemistry & Metabolism**

**Course Code: 13005900**

#### **Course Outline:**

##### **Unit I: Introduction to Biochemistry**

A historical prospective. Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Level of structural organization of proteins, Protein Purification. Denaturation and renaturation of proteins.

Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Bacterial cell wall polysaccharides, Glycoprotein's and their biological functions.

**Unit II: Lipids:** Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol.

Nucleic acids: Structure and functions: Physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines, Biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and renaturation of DNA.

### **Unit III:Enzymes**

Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites, enzyme specificity: types & theories, Biocatalysts from extreme thermophilic and hyperthermophilic archaea and bacteria. Role of: NAD<sup>+</sup>, NADP<sup>+</sup>, FMN/FAD, coenzymes A, Thiamine pyrophosphate, Pyridoxal phosphate, lipoic-acid, Biotin vitamin B12, Tetrahydrofolate and metallic ions

### **Unit IV:Carbohydrates Metabolism**

Reactions, energetics and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation.  $\beta$ -oxidation of fatty acids

### **Suggested Readings:**

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
2. Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
4. Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons.
5. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.

**Course Name: Biochemistry & Metabolism Lab**

**Course Code: 13006000**

### **Course Outline**

1. To study activity of any enzyme under optimum conditions.
2. To study the effect of pH, temperature on the activity of salivary amylase enzyme.
3. Determination of - pH optima, temperature optima, Km value, Vmax value, Effect of inhibitor (Inorganic phosphate) on the enzyme activity.
4. Estimation of blood glucose by glucose oxidase method.
5. Principles of Colorimetry: (i) Verification of Beer's law, estimation of protein. (ii) To study relation between absorbance and % transmission.
6. Preparation of buffers.
7. Separation of Amino acids by paper chromatography.
8. Qualitative tests for Carbohydrates, lipids and proteins.

### **Course Name: Environmental Studies**

### **Course Code: 99001900**

### **Course Outline**

#### **Unit I**

Introduction to environmental studies: Multidisciplinary nature of environmental studies; Scope and importance; Need for public awareness.

Ecosystems: What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

#### **Unit II**

Natural Resources: Renewable and Non-renewable Resources, Land resources and land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources : Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

#### **Unit III**

Biodiversity and Conservation: Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ

conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

#### **Unit IV**

Environmental Pollution: Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste. Pollution case studies.

Environmental Policies & Practices: Sustainability and sustainable development. Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

#### **Unit V**

Human Communities and the Environment: Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Field work; Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

#### **Suggested Readings:**

1. Bharucha, E. 2003, Textbook for Environmental Studies, University Grants Commission, New Delhi and Bharati Vidyapeeth Institute of Environmental Education and Research, Pune. 361.
2. Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
3. Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
4. Gadgil, M. & Ramachandra, G. 1993. This fissured land: an ecological history of India. Univ of California Press.
5. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
6. Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. Science 339.6115 (2013): 36-37.
7. Heywood V.H. & Watson, R.T. 1995. Global Biodiversity Assessment

## **Course Name: Ability and Skill Enhancement II**

**Course Code : 13002800**

### **Course Outline - Final Assessment – Debate/Group Discussion**

#### **Unit I: Phonetics**

Phonetic symbols and the International Phonetic Alphabets (IPA), The Description and Classification of Vowels (Monophthongs & Diphthong) Consonants, Phonetic Transcription & Phonology, Syllable, Stress & Intonations, Reading aloud, recording audio clips.

#### **Unit II: Vocabulary Building**

Idioms and Phrases, Words Often Confused, One word Substitution, Word Formation: Prefix & Suffix

#### **Unit III : Ethics & Etiquettes**

What are ethics, what are values, difference between ethics and morals, Business ethics, workplace ethics, what are virtues for e.g. civic virtues, etc. Human ethics and values- 5 core human values are: right conduct, living in peace, speaking the truth, loving and care, and helping others.

Etiquette awareness, Importance of First Impression, Personal Appearance & Professional presence, Personal Branding, Dressing Etiquette, Dining Etiquette.

#### **Unit IV: Reading & Writing Skills**

Reading Comprehension, News Reading, Picture Description, Paragraph Writing, News Writing.

#### **Unit V: Listening & Speaking Skills**

Public Speaking, Debate, Inspirational Movie Screening, Skit Performance.

**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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