Detailed Course Scheme

Bachelor of Science (B. Sc.)

(Physics, Mathematics, Chemistry)

Semester- V

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

Course Scheme

Semester – V

S. No.	Course Code	Course Name	L	T	P	Credits
1.	13012200	Summer Internship or Summer Project	0	0	8	4
2.	-	Discipline Specific Core Course-I Elective I	4	0	0	4
3.	-	Discipline Specific Core Course-I Elective I Lab	0	0	4	2
4.	-	Discipline Specific Core Course-II Elective I	4	0	0	4
5.	-	Discipline Specific Core Course-II Elective I Lab	0	0	4	2
6.	-	Discipline Specific Core Course-III Elective I	6	0	0	6
7.	13003100	Ability & Skill Enhancement Module - V	2	0	0	2
8.	99002800	Workshops & Seminars	-	-	-	1
9.	99002700	Human Values & Social Service/NCC/NSS	-	-	-	1
Total			**16**	**0**	**16**	**26**

Discipline Specific Electives

Subject	Course Code	Course Name
Physics	13006800	Elements of Modern Physics
	13006900	Elements of Modern Physics Lab
Chemistry	13007000	Chemistry of Main Group Elements, Theories of Acids and Bases
	13007100	Chemistry of Main Group Elements, Theories of Acids and Bases Lab
Mathematics	13009900	Complex Analysis

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

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: Elements of Modern Physics

Course Code: 13006800

Objectives:

- To provide students conceptual frameworks of modern physics like Quantum Mechanics, atomic Physics and Nuclear Physics.
- From the beginning of Quantum mechanics to Schrodinger equation and its applications.
- To introduce students to the fundamentals of atomic physics and nuclear physics.
- To introduce them to the basic Laser principles and Properties.

Course Outline

Unit I

Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson Germer experiment.

Unit II

Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra.

Unit III

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.

Unit IV

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical 20 interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension.

Unit V

One dimensional infinitely rigid box- energy eigenvalues and eigen functions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier

Unit VI

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.

Unit VII

Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & half-life; α decay; β decay - energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission

Unit VIII

Fission and fusion - mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions.

Suggested Readings

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson, 2009, PHI Learning.
3. Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill.
4. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
5. Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning.
6. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill.

Course Name: Elements of Modern Physics Lab

Course Code: 13006900

Course Outline

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different colours.
4. To determine the ionization potential of mercury.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
9. To determine the value of e/m by magnetic focusing.
10. To setup the Millikan oil drop apparatus and determine the charge of an electron.

Suggested Readings

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Course Name: Chemistry of Main Group Elements, Theories of Acids and Bases

Course Code: 13007000

Objectives

The whole curriculum deals with the core inorganic chemistry. The syllabus coverage includes 51 hardcore lectures, tutorials for solving problems and clarification of concepts, presentations by students and brainstorming quiz session.
The main objectives of this teaching include:

1. The 'ACID AND BASES' segment includes the historical development for the definitions of acid and base and its application in whole chemistry. it deals with the explanation of the relative strength of different kind of acid and bases. 'METALLUGY' includes the understanding of the thermodynamic concept of extraction process and various extraction process involved in the elements. 's and p BLOCK ELEMENTS' helps in the understanding of various periodic properties of the s and p block elements of the periodic table. Study of the structure, prepartion and properties of oxides, oxoacids, halides etc.
2. (Last segment ' INORGANIC POLYMERS ' includes the preparation, properties and structure of some inoganic ploymers which are of industrial importance.

Course Outline

Unit I

Acids and Bases Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and leveling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

Unit II

General Principles of Metallurgy Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond's process and Kroll Process.

Unit III

s- and p-Block Elements Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electro negativity (Pauling scale). General characteristics of s-block metals like density, melting and boiling points, flame colour and reducing nature. Oxidation states of s- and p-block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S. Complex forming tendency of s block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals. Solutions of alkali metals in liquid ammonia and their properties. Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of s-block metals.

Unit IV

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental chemistry wherever applicable: Diborane and concept of multicentre bonding, hydrides of Groups 13 (BH_3), 14, 15, 16 and 17. Oxides of N and P, Oxoacids of P, S and Cl. Halides and oxohalides of P and S (PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2) Interhalogen compounds. A brief idea of pseudohalides.

Unit V

Noble gases: Rationalization of inertness of noble gases, clathrates, preparation and properties of XeF_2, XeF_4 and XeF_6; bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory.

Unit VI

Inorganic Polymers Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones. Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in $(NPCl_2)_3$

Suggested Readings

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth Heinemann. 1997.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

6. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson, 2010. •Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).

Course Name: Chemistry of Main Group Elements, Theories of Acids and Bases Lab

Course Code: 13007100

Course Outline

1. Iodometric estimation of potassium dichromate and copper sulphate.
2. Iodimetric estimation of antimony in tartaremetic.
3. Estimation of amount of available chlorine in bleaching powder and household bleaches.
4. Estimation of iodine in iodized salts.
5. Iodimetric estimation of ascorbic acid in fruit juices.
6. Estimation of dissolved oxygen in water samples.
7. Gravimetric estimation of sulphate as barium sulphate.
8. Gravimetric estimation of aluminium as oximato complex.
9. Preparation of the following: potash alum, chrome alum, tetraammine copper(II) sulphate monohydrate, potassium trioxalato ferrate(III) (any two, including one double salt and one complex).

Suggested Readings

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2000

Course Name: Complex Analysis

Course Code: 13009900

Objectives

- Understand how complex numbers provide a satisfying extension of the real numbers; Appreciate how throwing problems into a more general context may enlighten one about a specific context (e.g. solving real integrals by doing complex integration; Taylor series of a complex variable illuminating the relationship between real function that seem unrelated -- e.g. exponentials and trig functions); Learn techniques of complex analysis that make practical problems easy (e.g. graphical rotation and scaling as an example of complex multiplication); Continue to develop proof techniques.

Course Outline

Unit I
Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

Unit II
Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula

Unit III
Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples Laurent series and its examples, absolute and uniform convergence of power series.

Suggested Readings

1. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.

Course Name: Ability & Skill Enhancement - V

Course Code: 13003100

Objectives

The objectives of the module are to make students self-confident individuals by developing leadership and organizing skills; to guide students in making appropriate and responsible decisions; to give each student a realistic perspective of work related skills and to help students prepare effective interview questions to conduct effective interviews.

Course Outline – Final Assessment - Interview with an Entrepreneur /Leader

Unit I: Leadership
What is leadership? Traits of Leadership, Identifying leaders and traits of Leadership, Movie/ Story/ Interviews of leaders: Identify leadership qualities, Debate/ Discussion/ Presentations on leaders.

Unit II: Entrepreneurship
What is Entrepreneurship, Traits of Successful Entrepreneurs, Movie/ Story/Interviews of Entrepreneurs: Identify Entrepreneurial qualities, Debate/ Discussion/Presentation on Entrepreneurs.

Unit III: Organisational Skills & Employability Skills
What are organizational skills, how to develop them, the skills needed to become a successful entrepreneur/administrator, good communication, ambition, courage, hardwork, planning, accountability. Organizational skills can be developed by discipline making a system, rules, delegation of power at workplace, etc.
How to enhance employability; skills, why do we need them, different workplaces, having different needs, different skills, how to recognize different work skills.

Unit IV: Decision making
The process of decision making, its steps, what are its basics, what are the basics of organizational decision making process, entrepreneurial decision making, how to make a right decision at right time, dilemma.

Unit V: Interview Skills
Conducting Interviews with Leaders/ Entrepreneurs, Preparing Questions, Interviewing the fellow person, do's & don'ts while taking interview.

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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