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NH-52, Namsai, Arunachal Pradesh -792103

BACHELOR OF SCIENCE BACHELOR OF EDUCATION (PCM) – FIRST SEMESTER

First Semester			
S. No.	Name of Subject	Credits	Total Marks
1	English	4	100
2	Mechanics	4	100
3	Mechanics Lab	3	100
4	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4	100
5	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons -Lab	3	100
6	Differential Calculus	6	100
7	Childhood and Growing Up	4	100
Total		28	

Subject Name: ENGLISH

Unit 1: English Grammar

- 1. An Introduction to Part of Speech :** Verb, Tenses, Voice, Direct and Indirect Forms of Speech.
2. Prepositions
3. List of Appropriate Preposition Used
4. Sentence
5. Synthesis of Sentences
6. Transformation of Sentences
7. Syntax
8. Punctuation
9. **Vocabulary :** Antonyms and Synonyms, Similar Words Distinguished, One Word Substitutions, More about words, Idioms & Phrases, Idioms.
10. **Common Error :** Some fundamental Rules for Correction, Sentences with error.
11. Comprehension

Unit 2 : Composition

1. Paragraph Writing

2. Letter writing
3. Essay Writing
4. The Essays

Subject Name: MECHANICS

Vectors: Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter.

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.

Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass.

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets.

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum.

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations.

Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q , η and λ by Searles method

Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.

Reference Books:

1. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison-Wesley
2. Mechanics Berkeley Physics course, v.1: Charles Kittel, et. Al. 2007, Tata McGraw-Hill.
3. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Subject Name : MECHANICS-LAB

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.

2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To determine g and velocity for a freely falling body using Digital Timing Technique
10. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint and 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. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Subject Name: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wavefunctions (atomic orbitals) and their variations for $1s$, $2s$, $2p$, $3s$, $3p$ and $3d$ orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to $1s$ and $2s$ atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms . Shapes of s , p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

Chemical Bonding and Molecular Structure

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO⁺. Comparison of VB and MO approaches.

Fundamentals of Organic Chemistry

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule

Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; *cis* - *trans* nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems)

Aliphatic Hydrocarbons

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

Alkanes: (Upto 5 Carbons). *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) *Preparation:* Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); *cis* alkenes (Partial catalytic hydrogenation) and *trans* alkenes (Birch reduction). *Reactions:* *cis*-addition (alk. KMnO₄) and *trans*-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) *Preparation:* Acetylene from CaC₂ and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO₄, ozonolysis and oxidation with hot alk. KMnO₄

Reference Books:

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. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
5. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
6. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
7. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
8. Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
9. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
10. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
11. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.

Subject Name: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS-LAB

Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO₄.
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO₄.
4. Estimation of Fe (II) ions by titrating it with K₂Cr₂O₇ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using Na₂S₂O₃

Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
 - (a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
 - (b) Identify and separate the sugars present in the given mixture by paper chromatography.

Reference Books:

- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- 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.
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

Subject Name: DIFFERENTIAL CALCULUS

Limit and Continuity (ϵ and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Books Recommended

- H. Anton, I. Birens and S. Davis, *Calculus*, John Wiley and Sons, Inc., 2002.
- G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, 2007.

Subject Name: CHILDHOOD AND GROWING UP**Unit 1: Learner as a Developing Individual**

- Growth and Development
- Developmental Influences: Development as a resultant of interactions between individual potential (innate, acquired) and external environment (physical, socio-cultural, ecological, economic and technological). Nature and nurture, continuity and discontinuity issues, growth and maturation.

(The focus is on understanding the key cognitive and affective processes influencing the development of the learner and their applications in classroom teaching. The innate and environmental influences shaping development would help foster an understanding of learner as a situated individual).

Unit 2: Development and Learning

- Meaning and principles of development, relationship between development and learning.
- Dimensions of individual development: physical, cognitive, language, affective, social and moral, their interrelationships and implications for teachers (relevant ideas of Piaget, Erikson and Kohlberg).
- Stages of development—developmental tasks with focus on processes growth and development across various stages from infancy to post adolescence.
- Meaning of 'cognition' and its role in learning.
- Socio-cultural factors influencing cognition and learning.
- Facilitating holistic development (for self and society).

(The focus is on understanding the key concepts of development and cognition, different stages and dimensions of development and their applications in teaching–learning contexts).

Unit 3: Understanding Childhood in Socio Cultural Perspectives

- Concept of Childhood (Criticality of the misperception that childhood is a homogenous entity).
- Childhood across cultures and societies (examining children perspectives, experiences and actions in which they construct and re constructs their lives).
- Impact of diversity, differences, marginalisation on childhood.
- Childhood in difficult circumstances (jail, war affected families; conflict situation, very poor families; urban slum), growing up as girls, growing up in dalit /tribal households etc.

Unit 4: Understanding Adolescence: Issues and Concerns

- Realistic and contextual frames of growing up in Adolescence
 - Cultural differences and Adolescence
 - Impact of economic changes and urbanisation
 - Impact of Media
 - Adolescence in difficult circumstances
- Issues and Concerns
 - Problems of adjustment
 - Understanding of emotional disturbance and risk behaviour
 - Identity Crisis
 - Parent child conflict
 - Drug addiction and Abuse
 - Bullying
 - Juvenile delinquency
 - Health awareness –personal hygiene, nutrition, disease prevention and control.

Unit 5: Understanding Stages of Child Development Implications for Teachers

- Need of understanding Human development in the classroom.
- Problems resulting from lack of understanding of Human development.
- Promoting development of all children in the classroom (Positive classroom environment; social and emotional wellbeing of all children; addressing diversity and equality. The student teacher will read about childhood from diverse contexts through biographies, stories, narrations of growing up in different cultures, children’s diaries and the media. They will be used as a resource themselves and their own experiences will be utilized in classroom discussions.

The student teachers will observe children in their natural settings, especially at play or in a community setting and to interact with children through activities.

Practicum

1. Observe children during their playtime in your practicing school (or nearby school) for a week; observe their play activities, relationships, communication with their peers. On the basis of that prepare a report about understanding childhood.
2. Prepare a case study of a girl child from a minority community or a dalit household or a tribal community.
3. Observe and interact with ten adolescent children living in different contexts (rural areas, urban slum, dalit household, urban area, and working/street people) and compare their characteristics and problems.
4. View any two movies out of the following

1. Smile Pinky (2008)
2. Born into Brothels (2014)
3. Salaam Bombay (1988)
4. Slumdog Millionaire (2009)
5. Gippie (2013)

Discuss their content, picturization, characters in the context of issues and concerns of childhood/adolescence

5. Collect five stories that children are told by elders from nearby community.

Suggested Readings

- Cole, M and Cole, S (1989). *The Development of Children*, Scientific American Books, New York
- Huslok, E.B. (2003). *Child Growth and Development*, Tata Mc Graw Hill
- Kakkar, S (1978). *The Inner World: A Psychoanalytic Study of Childhood and Society in India*. Oxford University Press, New Delhi
- Mishra, A (2007), Everyday Life in a Slum in Delhi. In D.K. Behera (Ed.O. *Childhood in South Asia*. New Delhi: Pearson Education India
- Nambissan, G.B. (2009). *Exclusion and Discrimination in Schools: Experiences of Dalit Children*. Indian Institute of Dalit Students and UNICEF
- Parry, J. (2005). Changing Childhoods in Industrial Chattisgarh. In R. Chopra and P. Jeffery (Eds), *Educational regimes in Contemporary India*. Sage
- Piaget, J. (1997). Development and Learning. In M. Gauvain and M. Cole (Eds), *Readings on the development of children*. New York: WH Freeman and Company
- Saraswathi, T.S. (1999). Adult-Child Continuity in India: Is Adolescence a myth or an emerging reality? In T.S. Saraswathi (Ed), *Culture, Socialisation and Human Development: Theory, research and applications in India*. New Delhi. Sage
- Sharma, N (2011). *Understanding Adolescence*, MBT India
- Singh, A (Ed), (2015). *Human Development: A Life Span Approach*. Orient Black Swan, Delhi