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NH-52, Namsai, Arunachal Pradesh -792103

## **BACHELOR OF SCIENCE BACHELOR OF EDUCATION (PCM) – SECOND SEMESTER**

<b>Second Semester</b>			
<b>S. No.</b>	<b>Name of Subject</b>	<b>Credits</b>	<b>Total Marks</b>
1	Environmental Science	4	100
2	Electricity, Magnetism and EMT	4	100
3	Electricity, Magnetism and EMT-Lab	3	100
4	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I	4	100
5	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab	3	100
6	Differential Equations	6	100
7	Language Across the Curriculum	4	100
<b>Total</b>		<b>28</b>	

**Subject Name:** ENVIRONMENTAL SCIENCE

**Unit 1:** The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

**Unit 2: Natural Resources:** Renewable and non-renewable resources:

Natural resources and associated problems

- Forest resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.

- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

### **Unit 3: Ecosystems:**

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession - Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem:
  - a. Forest ecosystem
  - b. Grassland ecosystem
  - c. Desert ecosystem
  - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

### **Unit 4: Biodiversity and its Conservation**

- a. Introduction-Definition: genetic, species and ecosystem diversity.
- b. Biogeographical classification of India.
- c. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- d. Biodiversity at global, National and local levels.
- e. India as a mega-diversity nation.
- f. Hot-spots of biodiversity.
- g. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- h. Endangered and endemic species of India.
- i. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### **Unit 5: Environmental Pollution:**

- Causes, effects and control measures of: -
  - a. Air pollution
  - b. Water pollution
  - c. Soil pollution
  - d. Marine pollution
  - e. Noise pollution
  - f. Thermal pollution

g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

#### **Unit 6: Social Issues and the Environment**

- From Unsustainable to Sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, watershed management.
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Case studies.

- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act. - Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Public awareness.

#### **Unit 7: Human Population and the Environment**

- Population growth, variation among nations.
- Population explosion-Family welfare Programme.
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of information Technology in Environment and human health.
- Case Studies.

#### **Unit 8: Field Work (Practical)**

- Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

**Subject Name:** ELECTRICITY, MAGNETISM AND EMT

**Vector Analysis:** Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

**Magnetism:**

Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials.

**Electromagnetic Induction:** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.

**Maxwell's equations and Electromagnetic wave propagation:** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

**Reference Books:**

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole
- D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings

**Subject Name:** ELECTRICITY, MAGNETISM AND EMT-LAB

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
  - (i) Measurement of charge and current sensitivity
  - (ii) Measurement of CDR
  - (iii) Determine a high resistance by Leakage Method
  - (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
5. To study the Characteristics of a Series RC Circuit.
6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
7. To study a parallel LCR circuit and determine its
  - (a) Anti-resonant frequency and
  - (b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorem
10. To verify the Superposition, and Maximum Power Transfer Theorem

**Reference Books**

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11<sup>th</sup> Edition, 2011, Kitab Mahal, New Delhi.
- Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4<sup>th</sup> Edition, reprinted 1985, Heinemann Educational Publishers

**Subject Name:** CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL GROUP ORGANIC CHEMISTRY-I

***Physical Chemistry***

**Chemical Energetics**

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.

#### **Chemical Equilibrium:**

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

#### **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.

#### **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 ( $SN_1$ ,  $SN_2$  and  $SN_i$ ) 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:  $KNH_2/NH_3$  (or  $NaNH_2/NH_3$ ).

Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

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

**Alcohols**: *Preparation*: Preparation of  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  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.  $KMnO_4$ ,

acidic dichromate, conc. HNO<sub>3</sub>). 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. Clemmensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.

#### Reference Books:

- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7<sup>th</sup> Ed. Cengage Learning India Edition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
- Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
- Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
- Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985)

**Subject Name:** CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL GROUP ORGANIC CHEMISTRY-I LAB

#### *Physical Chemistry*

##### **Thermochemistry**

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 ( $\text{KNO}_3$ ,  $\text{NH}_4\text{Cl}$ ).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of  $H$ .

#### **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.

#### **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

Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

#### **Reference Books**

- 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.
- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011)

#### **Subject Name: DIFFERENTIAL EQUATIONS**

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for  $x$ ,  $y$ ,  $p$ . Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order.

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial

differential equation of first order, Lagrange's method, Charpit's method.

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

### **Books Recommended**

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967

## **Subject Name: LANGUAGE ACROSS THE CURRICULUM**

### **Unit 1: Language Background of Students**

Understanding multilingualism in the classroom; home language and school language; power dynamics of the 'standard' language as the school language vs. home language or 'dialects'; (Deficit theory (Eller, 1989); Discontinuity theory).

(The focus is to create sensitivity to the language diversity that exists in the classrooms. Understanding the language background of students, as first or second language users of the language used in teaching the subject.)

#### **Practicum**

- Discussion on role and importance of home language and school language
- Discussion on role and importance of dialect and standard language.

#### **Project**

- Interview some technical people and find out which language do they prefer to use? And why?
- What are the gaps in learning in a particular language and using local language for work.
- As a student you must have felt that sometimes the language of instruction did not help in understanding of the text. Keeping that in view how will you facilitate your students to understand the content.

### **Unit 2: Nature of Classroom Discourse**

Classroom Discourse — oral language; discussion as a tool for learning; the nature of questioning in the classroom — types of questions and teacher's role.

(The focus is to help students-teachers understand the nature of classroom discourse and develop strategies for using oral language in the classroom in a manner that promotes learning in the subject area.)

#### **Practicum**

- Comprehending and analysing the texts.
- Re-telling the text - in one's own language from different points of view.
- Narrating / describing a related account from one's life experience.
- Discussion of related topics and issues - sharing interpretations and points of view.
- Writing — based on the text, e.g. summary of the text, extrapolation of story, converting a situation into a dialogue, etc.

- Preparing questions that develop critical thinking and problem solving leading to discussion.

### **Project**

- Choose a few words from different text of content areas and give examples how similar word / language used in different context for convey the meaning.

### **Unit 3: Informational Reading and Writing**

Reading in the content areas — social sciences, science, mathematics; nature of expository texts vs. narrative texts; transactional vs. reflexive texts; schema theory; text structures; examining content area textbooks; reading strategies — note-making, summarizing; making reading-writing connections; process writing; analyzing students' writings to understand their conceptions; writing with a sense of purpose — writing to learn and understand.

(The focus is to develop critical reading comprehension in the content areas informational reading and developing writing in specific content areas with familiarity of different registers.)

### **Practicum**

- Using reading strategies, such as scanning, skimming and reading for extracting information - as appropriate for initial reading of articles (guided individual task)
- Analysis of structure of the article, identifying sub-headings, key words, sequencing of ideas, use of concrete details, illustrations and / or statistical representations, etc. (guided working in pairs)
- Critical reading for attending 'framing' of the article, point(s) of view presented, possible biases or slants (small group discussion)
- Researching and writing articles/reports on topics related to content areas and current issues.

### **Project**

- Take different types of texts from content areas. Analyse the language and develop a thematic lesson design.