



## UNIVERSITY OF JAMMU

### NOTIFICATION (17/Jan/Adp/01)

In supersession to this office Notification No. F.Acd./II/16/8435-86 dated 04.08.2016, it is hereby notified for the information of all the concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the Syllabi and Courses of Study in the subject of **Chemistry** under **Choice Based Credit System** at undergraduate level for the examinations to be held in the years as under:-

<u>Subject</u>	<u>Semester</u>	<u>For the Examinations to be held in the years</u>
Chemistry	Semester-II	May 2017

*[Signature]*  
30/1/17  
DEAN ACADEMIC AFFAIRS

No. F.Acd/II/17/15970-16020

Dated: 30/01/2017

Copy for information and necessary action to:

1. Special Secretary to the worthy Vice-Chancellor
2. Sr. P.A. to the Dean Academic Affairs
3. Sr. P.A. to the Registrar / Controller of Examinations
4. Dean, Faculty of Sciences
5. Convener, Board of Studies in Chemistry
6. All members of the Board of Studies
7. Principals of concerned colleges - *Through E-mail*
8. C.A. to Controller of Examinations
9. I/c Director, Computer Centre, University of Jammu
10. Asst. Registrar (Conf./Exams. U.G/ Inf./Pub.)
11. Website Office
12. S.O (Confidential)

**CHOICE BASED CREDIT SYSTEM**

**B. Sc. WITH CHEMISTRY**

## CHEMISTRY SYLLABUS

(For examinations to be held in the year 2017)

### SEMESTER-II

Course No.: UCHTC201

Theory: 60 Lectures

Title: CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY

Credits: 04

Maximum Marks: 100

Time: 03 hours

External Examination: 80 marks

Internal Assessment: 20 marks

#### *Section A: Physical Chemistry-1 (30 Lectures)*

##### **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.

(10 Lectures)

##### **Chemical Equilibrium:**

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between  $\Delta G$  and  $\Delta G^0$ , Le Chatelier's principle. Relationships between  $K_p$ ,  $K_c$  and  $K_x$  for reactions involving ideal gases.

(8 Lectures)

##### **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.

(12 Lectures)

## Section B: Organic Chemistry-2 (30 Lectures)

### 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.

### Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Intconversion 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).

(6 Lectures)

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).

(7 Lectures)

### Alkyl and Aryl Halides

**Alkyl Halides** (Upto 5 Carbons) Types of Nucleophilic Substitution ( $S_N1$ ,  $S_N2$  and  $S_Ni$ ) 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.

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*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.

(7 Lectures)

### 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.  $\text{KMnO}_4$ , 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,  $\text{NaHSO}_3$ ,  $\text{NH}_2$ -G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.

(10 Lectures)

### Note for Paper Setting

Internal Assessment Test of 1 hour duration of 20 marks will be conducted when upto 50% (after 45 days) syllabus has been covered. Internal assessment test will contain one long answer type question of 10 marks and five short answer type questions of 02 marks each.

External End Semester University Examination of 03 hours duration of 80 marks will be conducted after 100% (after 90 days) has been covered.

Pattern of Examination: There will be two sections A & B. The candidate has to attempt five questions in all.

Section A will be compulsory containing ten very short answer type questions of 02 marks each covering the entire syllabus.

Meens

Section B will contain seven long answer type questions of 15 marks each covering the entire syllabus. The candidate will attempt any four questions from Section B.

**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).
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*Meera*

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## CHEMISTRY SYLLABUS

(For examinations to be held in the year 2017)

### SEMESTER-II

Course No.: UCHPC202

60 Lectures

Title: Laboratory Course-II

Credits: 02

Maximum Marks: 50

Time: 04 hours

External Examination: 25 marks

Internal Assessment: 25 marks

#### *Section A: 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  $\Delta H$ .

##### **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

20 marks

S.

## Viva-Voce

05 marks

**Note for distribution of 25 marks in internal assessment in practical examination:**  
**Internal Assessment:** Total marks reserved for internal assessment shall be distributed as under:

- |  |   |          |
|--|---|----------|
| (i) Daily assessment in the laboratory and internal practical test | : | 15 marks |
| (ii) Regularity of attendance                                      | : | 05 marks |
| (iii) Viva-voce  | : | 05 marks |

**External Examination:** There shall be two exercises in the external examination of ten marks each and viva-voce of 05 marks.

## 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).
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