

Hemchandracharya North Gujarat University, Patan



**Bachelor of Vocation**  
Programme on  
Pharmaceutical Chemistry



**Offered at**

Pramukh Swami Science and H.D. Patel Arts College

Sarva Vidyalaya Campus, Kadi

## **Preface**

The University Grants Commission (UGC) has launched a scheme on skills development based higher education as part of college/university education, leading to setting up of Bachelor of Vocation courses (B.Voc.) to serve multiple needs, including (i) career oriented education and skills to students interested in directly entering the workforce; (ii) contracted training and education programmes for local employers; (iii) high-touch remedial education for secondary school graduates not ready to enroll in traditional colleges, giving them a path to transfer to three or four year institutions; and (iv) general interest courses to the community for personal development and interest. Bachelor of Vocation will have with multiple exits such as Diploma and Advanced Diploma under the NSQF (National Skills Qualifications Framework).

The Bachelor of Vocation model, by and large, will be accessible to a large number of individuals of the community, offer low cost and high quality education locally, that encompasses both vocational skills development as well as traditional coursework, thereby providing opportunities to the learners to move directly to the employment sector or move into the higher education sector. It offers a flexible and open education system which also caters to community-based life-long learning needs.

## **About the programme**

The program is designed to educate and create skilled manpower that can serve the society through the knowledge gained during the course of time. The student enrolling in the course will be benefitted in several ways. The candidate will work in the college as well as with the industries during the time of his study. If a candidate successfully completes first year of study he would be awarded a diploma and he will be capable enough to serve as a laboratory assistant in any industry or academic institution. A candidate completing two successful years in Bachelor of Vocation program will be awarded with advanced diploma. An advanced diploma qualified student in Pharmaceutical Chemistry will be fit for working in ADL, QC and Production department of any pharmaceutical industries. The candidate completing all three years of the course successfully will be awarded with Bachelor of Vocation in Pharmaceutical Chemistry and is fit for getting absorbed in any division of Pharmaceutical Industries.

## Semester I

| Course Code  | Course Title                      | Credit    |           | Total     |
|--------------|-----------------------------------|-----------|-----------|-----------|
|              |                                   | Theory    | Practical |           |
| PC 111       | Basic Pharmaceutical Calculations | 3         | 0         | 3         |
| PC 112       | Pharmaceutics (Basic Principles)  | 3         | 0         | 3         |
| PC 113       | Basic Computer Applications       | 0         | 2         | 2         |
| PC 114       | English and Communication Skill   | 0         | 2         | 2         |
| PC 115       | Human Anatomy and Physiology      | 2         | 0         | 2         |
| PC 116       | Practicals                        | 0         | 18        | 18        |
| <b>Total</b> |                                   | <b>08</b> | <b>22</b> | <b>30</b> |

## Semester II

| Course Code  | Course Title                      | Credit    |           | Total     |
|--------------|-----------------------------------|-----------|-----------|-----------|
|              |                                   | Theory    | Practical |           |
| PC 211       | Fundamentals of Organic Chemistry | 3         | 0         | 3         |
| PC 212       | Physical Chemistry                | 2         | 0         | 2         |
| PC 213       | Fundamental Biochemistry          | 3         | 0         | 3         |
| PC 214       | Analytical Chemistry              | 2         | 0         | 2         |
| PC 215       | Introduction to Drug Laws         | 2         | 0         | 2         |
| PC 216       | Practicals                        |           | 18        | 18        |
| <b>Total</b> |                                   | <b>12</b> | <b>18</b> | <b>30</b> |

## Semester III

| Course Code  | Course Title                         | Credit    |           | Total     |
|--------------|--------------------------------------|-----------|-----------|-----------|
|              |                                      | Theory    | Practical |           |
| PC 321       | Advanced Organic Chemistry           | 3         | 0         | 3         |
| PC 322       | Advanced Analytical Chemistry-I      | 3         | 0         | 3         |
| PC 323       | Cell Biology                         | 2         | 0         | 2         |
| PC 324       | Indian Drugs Regulatory Guidelines   | 2         | 0         | 2         |
| PC 325       | Pharmaceutical Inorganic Chemistry-I | 2         | 0         | 2         |
| PC 326       | Practical                            | 0         | 18        | 18        |
| <b>Total</b> |                                      | <b>12</b> | <b>18</b> | <b>30</b> |

### Semester IV

| Course Code  | Course Title                     | Credit    |           | Total     |
|--------------|----------------------------------|-----------|-----------|-----------|
|              |                                  | Theory    | Practical |           |
| PC 421       | Medicinal Chemistry –I           | 3         | 0         | 3         |
| PC 422       | Microbiology                     | 2         | 0         | 2         |
| PC 423       | Advanced Analytical Chemistry-II | 3         | 0         | 3         |
| PC 424       | Pharmaceutics-II                 | 2         | 0         | 2         |
| PC 425       | Pharmacy Practice                | 2         | 0         | 2         |
| PC 426       | Practicals                       | 0         | 18        | 18        |
| <b>Total</b> |                                  | <b>12</b> | <b>18</b> | <b>30</b> |

### Semester V

| Course Code  | Course Title   | Credit    |             | Total     |
|--------------|--|-----------|-------------|-----------|
|              |  | Theory    | Prac./Field |           |
| PC 531       | Medicinal Chemistry-II                                   | 2         | 0           | 2         |
| PC 532       | Advanced Analytical Chemistry-III                        | 2         | 0           | 2         |
| PC 533       | Biostatistics  | 2         | 0           | 2         |
| PC 534       | Drug Screening Strategies                                | 3         | 0           | 3         |
| PC 535       | Introduction to Drug Discovery and Development Processes | 3         | 0           | 3         |
| PC 536       | Practicals   | 0         | 18          | 18        |
| <b>Total</b> |  | <b>12</b> | <b>18</b>   | <b>30</b> |

### Semester VI

| Course Code  | Course Title                     | Credit    |             | Total     |
|--------------|----------------------------------|-----------|-------------|-----------|
|              |                                  | Theory    | Prac./Field |           |
| PC 631       | Pharmacology                     | 2         | 0           | 2         |
| PC 632       | Medicinal Chemistry – III        | 3         | 0           | 3         |
| PC 633       | Advanced Analytical Chemistry-IV | 3         | 0           | 3         |
| PC 634       | Pharmacology II                  | 2         | 0           | 2         |
| PC 635       | Phytochemistry                   | 2         | 0           | 2         |
| PC 636       | Industrial Tour/Project          | 0         | 18          | 18        |
| <b>Total</b> |                                  | <b>12</b> | <b>18</b>   | <b>30</b> |

### **BVPCR1: Eligibility Criteria (EC) for Admission**

1. The eligibility conditions for admission to the program will be 10+2 or equivalent in science stream or diploma chemical or diploma pharmacy
2. If the candidate has attained the specific level 4 of NOS of pharmaceutical chemistry sector (by decision of equivalence committee of the college) can get admitted in B.Voc. for the programme
3. There is no age bar for admission to Bachelor of Vocation
4. The student can take exit from this course at any point of time and can get re-entry in this programme. Such students will get priority in admission than to a fresher student. (multi entry multi exit scheme)

### **BVPCR2: Admission Procedure**

1. For admission to the programmes offered, preference should be given to the learners living in the local community. Reservation to SC, ST, OBC and PwD categories will be available as per the extant national / State policy.
2. Admissions may be done on a rolling basis depending on the duration of the programmes to facilitate a steady stream of learners joining the college and moving out as trained work force to the job market, round the year and not just once in a year.
3. The applicants seeking re-entry into the college should get preference in admission over the new applicants.
4. Candidates are selected on the basis of Merit.

### **BVPCR3: Fees and Scholarship:**

1. Student fee should be decided as per the prevalent practice for fee fixation for aided courses.
2. Attempt should be made to recover part of the operating expenditure from the student fees.

### **BVPCR4: Registration / Enrollment:**

1. Every student admitted to the college for the programme must get enrolled to university within a month from the date of admission.

### **BVPCR5: Semester Examinations**

1. Candidates desirous of appearing at any Semester Examination shall have to submit applications in the prescribed form, through the designated authority on or before the prescribed date.
2. No candidate will be admitted to any Semester examination unless the Designated Authority i.e. the Head of the Department or Principal of the College certifies that:
  - (1) The candidate attended the course of study to the satisfaction of the designated authority.
  - (2) The candidate maintained a good conduct and character during the studies.
  - (3) The candidate maintained minimum 80% attendance in each semester

### **BVPCR6: Evaluation**

1. Appropriate mechanism for assessment of the learners' progress towards acquisition of knowledge and skill should be developed by the College. Partner industries should also be given a clear and well defined role in the assessment of the learners.
2. Practical or hands on skills should be given comparatively more weightage in the overall assessment plan.
3. The College should adopt and integrate the guidelines and recommendations of the respective Sector Skill Councils (SSCs) for the assessment and evaluation of the vocational component, wherever available. They should also involve the SSCs in the assessment process, wherever required. It applies to colleges, both Autonomous and non-Autonomous, and universities to maintain Occupational Standards and the fitness for the job.
4. Theory of each CORE paper will be evaluated for a maximum of 100 marks out of which, 50 marks shall be for Continuous evaluation (Exams) and 50 marks for the end semester examination. An end semester examination shall be of 2 hours duration.
5. Practical as a combined form for Each core paper will be evaluated for a maximum of 700 marks out of which, 500 marks shall be continuous internal evaluation and 200 marks for the end semester practical examination.

6. Each Elective paper is evaluated for a maximum of 50 marks which will be evaluated internally by continuous evaluation.

**BVPCR7: rules for grading**

1. One Credit would mean equivalent of 14-15 periods of 60 minutes each, for theory, workshops / labs and tutorials per semester.
2. For internship / field work, the credit weightage for equivalent hours shall be 50% of that for lectures / workshops
3. For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study shall be 50% of that for lectures / workshops
4. To pass a subject in any Semester a candidate must obtain a minimum of 40% of marks in each paper.
5. If a candidate fails in any subject, he has to reappear for that particular paper and pass. (That is, for example if candidate fails in midterm exam of a subject, he has to reappear for midterm of that subject.)
6. The performance of each candidate in all the subjects will be evaluated on 7- point scale in term of grades as follow:

| Grading Scheme |     | % age according to Grade | Grade Points | Qualitative Meaning of Grade |
|----------------|-----|--------------------------|--------------|------------------------------|
| 1              | A + | 90-100                   | 10.0         | Outstanding                  |
| 2              | A   | 80-89                    | 9.0          | Excellent                    |
| 3              | A-  | 70-79                    | 8.0          | Very Good                    |
| 4              | B + | 60 – 69                  | 7.0          | Good                         |
| 5              | B   | 50-59                    | 6.0          | Average                      |
| 6              | B-  | 40-49                    | 5.0          | Fair                         |
| 7              | F   | Less Than 40             | 0            | Fail                         |
| 8              | I   | Incomplete               |              |                              |

**BVPCR8: performance index**

1. The performance of a student in a semester is expressed in terms of the **Semester Performance Index (SPI)**.

**SEMESTER PERFORMANCE INDEX (SPI)**

The Semester Performance Index (SPI) is the weighted average of Course Grade Points obtained by the student in the semester. The Weights assigned to Course Grade Points are the Credits carried by the respective courses.

$$\begin{aligned} & a. \quad g_1 c_1 + g_2 c_2 + \dots \\ 2. \quad SPI &= \frac{g_1 c_1 + g_2 c_2 + \dots}{c_1 + c_2 + \dots} \end{aligned}$$

Where,  $g_1, g_2, \dots$  are the Grade points obtained by the student in the Semester, for Courses carrying Credits  $c_1, c_2, \dots$  respectively.

2. The cumulative performance of a student at the end of the Semester / Course is expressed in terms of the **Cumulative Performance Index (CPI)**.

**CUMULATIVE PERFORMANCE INDEX (CPI)**

This index is defined as the weighted average of Course Grade Points obtained for all the weights for Theory Papers (Both Mid Term & End Term) and Practicals attempted since his admission to the program, where the weights are defined in the same way as in **Semester Performance Index (SPI)**.

3. If a failed student repeats a course, only the Grade Points obtained in the latest attempt shall be counted in the **Cumulative Performance Index**. Whenever the candidate clears the subject in the next semester examination, the total credits for that subject will be added to CPI.
4. For any Semester, the maximum marks for the Mid Term and End Term assessments are shown in the teaching and examination scheme. For the purpose of Mid Term assessment, tests, quizzes, assignments or any other suitable methods of assessment may be used by the department.

**BVPCR9: semester passing scheme**

1. For each semester examination, a candidate will be considered as pass if he/she has secured “B-“ or above grade in all the subject (s) and overall grade point 5.00 or above.



2. For each semester examination, a candidate will be considered as fail if he/she has secured “F” grade in any or all the subject (s).
3. If the candidate does not fulfill the subject requirements including requisite attendance percentage, he/she will be given I grade and the candidate will have to complete the course requirements before the commencement of the next End Semester examination. If the candidate does not clear I grade in any subject before the commencement of the next End Semester examination, he/she will be considered fail - F grade.
4. Candidate has to clear his / her ‘F’ grade or ‘I’ grade, if any, by the next End Semester examination.

**BVPCR10: semester promotion scheme**

A candidate will be promoted to the subsequent Semester according to the following scheme:

1. A candidate would be granted admission to the Second Semester if and only if he/she has been granted Term for First Semester and has applied for the university examination.
2. A candidate would be granted admission to the Third Semester if and only if he/she has been granted Term for First & Second Semesters and has applied for the university examination.
3. A candidate would be granted admission to the Fourth Semester if and only if he/she has cleared all the subjects of First Semester. He /She will be permitted to pursue his/her study of Fourth Semester, provided his/her term for II & III Semesters is granted and has applied for the university examination.

**Promotion Criteria**

| <b>Semester</b> | <b>Condition(s) For Promotion</b>   |
|-----------------|---|
| II              | Grant of Term for Semester – I  |
| III             | Grant of Term for Semester I and Semester II  |
| IV              | Clearing of Semesters I completely and Grant of Term for Semester II & Semester III |

|   |  |
|---|--|
| V | Clearing of Semesters II completely and Grant of Term for Semester III & Semester IV |
|---|--|

|    |   |
|----|---|
| VI | Clearing of Semesters III completely and Grant of Term for Semester IV & Semester V |
|----|---|

### **BVPCR11: award of grading / division**

No class/ division will be awarded to the students in the first 5 semesters. Divisions shall be awarded only at the end of Final Examinations on successful completion of all the Semesters. For awarding the degree at the end of the course, Cumulative Performance Index (CPI) of all the Mid Term and Final exams shall be taken in to consideration as per the following pattern of **Cumulative Performance Index (CPI)**:

| <b>S.N.</b> | <b>CPI</b>    | <b>Division</b>                 |
|-------------|---------------|---------------------------------|
| 1           | 7.50 to 10.00 | FIRST Division with Distinction |
| 2           | 6.50 to 7. 49 | FIRST Division                  |
| 3           | 6.00 to 6. 49 | SECOND Division                 |

### **BVPCR12: award of degree**

1. Award of Certificate, Advanced certificate, Diploma or Advanced Diploma, as the case may be, would depend on acquisition of requisite credits as prescribed by the certification body and not on the duration of the calendar time spent in pursuing the course.
2. The certificate shall mention the credits earned, course duration (in hours), and the curriculum covered. If the course is aligned with NVEQF / NSQF, the corresponding NVEQF / NSQF level should also be mentioned on the certificate.
3. Award of degree will be as follows

| <b>NVEQF Level</b> | <b>Skill Component Credits</b> | <b>General Education Credits</b> | <b>Normal calendar duration (post meeting the entry criterion)</b> | <b>Awards</b>        |
|--------------------|--------------------------------|----------------------------------|--|----------------------|
| 7                  |                                |                                  | Six semesters  | Bachelor of Vocation |
| 6                  | 72                             | 48                               | Four semesters   | Advanced Diploma     |
| 5                  | 36                             | 24                               | Two semesters  | Diploma              |
|                    | 18                             | 12                               | One semester   | Advanced Certificate |
|                    | 9                              | 6                                | Three Months   | Certificate          |

**MODEL PAPER**

**Hemchandracharya North Gujarat University, Patan  
Bachelor of Vocation**

**'Pharmaceutical Chemistry' Semester - I  
END TERM Examination, November, 2014**

**Subject:**

**Time: 2 hrs**

**Date**

**Maximum marks: 50**

**Q.1 Answer any 9 questions. Each question carries 1 mark  
Marks)**

**(9\*1=9)**

**(OBJECTIVE QUESTIONS)**

1. a) b) c) d)
2. Fill in the blank.
3. Short Questions / Definitions.
4. Match the following.
5. Assertion / Reason of
6. a) b) c) d)
7. Fill in the blank.
8. Short Questions / Definitions.
9. Match the following.
10. Assertion / Reason of True / False.

**Q. 2 Answer any 5 questions. Each question carries 4 marks  
Marks)**

**(5\*4=20)**

**( SHORT QUESTIONS)**

- 1.
- 2.
- 3.
- 4.
- 5.

**Q.3 Answer any 3 question. The question carries 07 marks  
Marks)**

**(3\*7=21)**

**(DESCRIPTIVE QUESTIONS)**

- 1.
- 2.
- 3.
- 4.

### **PC-111 Basic Pharmaceutical Calculations**

**RATIONALE** : Lots of calculations are required in pharmaceutical chemistry profession which involves basic mathematics and knowledge of simple physics and chemistry principles. The course is intended to teach the student how such calculations are done. The subject will be fundamental for many of the subjects the student will encounter in future.

**COURSE OBJECTIVES** :

To make student learn the basic calculations a pharmaceutical chemistry professional is expected to do in his/her professional life.

**LEARNING OUT COMES** :

The student should be able to :

- 1) Carry out routine calculations involved in pharmaceutical chemistry profession.
- 2) Draw and understand different graphs

**PREREQUISITES** : Basic knowledge of arithmetic, physics and chemistry.

### **SYLLABUS**

#### **Unit-1**

**a) Rational nos.**

Proportional set of nos., Ratios, Fractions, Decimals, Percentage.

**b) Other nos.**

Exponents and Logarithms, Variables, Constants and Parameters, Graphical presentation of data-Different types of graphs (Line graph, Bar graph, Pie chart, Histogram etc.) Slope and Intercept.

#### **Unit-2**

**a) Systems and units**

Mass and weights, Metric units, Conversions between systems, Temperature conversions and others.

**b) Ratios, proportions, and percentage**

Percent calculations, Proportions, Concentration systems, Part per million, Calculation of amount of ingredients required to make up percentage solutions, Conversion from one to another strength.

### **Unit-3**

#### **a) Dilutions**

Simple dilutions, Serial dilutions, concentrated solutions' strengths, multiple dilutions, mixing concentrations.

#### **b) Density**

Determination of density, specific gravity

Determination of displacement value, Displacement volumes-solid-solid, liq-liq.

### **Unit-4**

#### **a) Molecular weight**

Moles, millimoles, milliequivalents, milliosmoles. Molar concentrations.

#### **b) Accuracy and measurements**

Rounding nos. Significant figures, Correcting nos, Accuracy in arithmetic calculations, Accuracy in weighing, measuring for assays, Limits and uniformity of content.

### **Unit-5**

#### **a) Parenteral solutions and isotonicity**

Rate of flow of IV solutions, Isotonicity

#### **b) Alcohol calculations**

### **Reference books:**

1. A. J. Winfield, J. A. Rees, I. Smith, Pharmaceutical Practice, 4<sup>th</sup> edition, Elsevier publication.
2. Christopher A. L. and D.B. Pharmaceutical compounding and Dispensing, Pharmaceutical press.
3. D.P., G. Dosage Calculations, Delmar Publishers.
4. Don A. B. and T. W. G. Pharmacy Calculations, CBS Publisher.
5. Cooper and Gunn's. Dispensing for Pharmaceutical students, ed. S. J. Carter, 12<sup>th</sup> edition. CBS Publisher.
6. Judith A. R, Ian S, et al. Introduction to Pharmaceutical Calculations, Pharmaceutical Press.

## **PC-112 Pharmaceutics (Basic Principles)**

**RATIONALE** : The subject is meant for exposing the student to different dosage forms, Routes of drug administration and their merits and demerits. Also the student will be provided knowledge of fundamental physical properties of compounds useful in manufacturing of drug formulations. The in depth understanding of some of the important basic processes used in Industry will also be taught.

**COURSE OBJECTIVES** :

1. To make student understand the different dosage forms and routes of administration.
2. To understand the important physical properties of compounds and its impact in preparation and stability of drug formulation
3. To understand the common processes used in manufacturing of drug formulations.

**LEARNING OUT COMES** :

The student should be able to:

1. Narrate various dosage forms, routes of administration and their merits and demerits
2. Describe importance of environmental factors on drug manufacturing.
3. Explain some unit processes used in industry.
4. Describe the importance of certain physical properties of drugs and excipients and their utilization in drug manufacturing.

**PREREQUISITES** : The student knowledgeable of basic physics and chemistry can take this course well.

### **SYLLABUS**

#### **Unit-1 Introduction**

Introduction to Different dosage forms, Routes of administration and their comparisons, Environment control in Pharmaceutical industry and its importance, Importance of air, water, Humidity, Temperature in drug manufacturing giving some examples.

#### **Unit-2**

##### **a) Introduction to various processes in Pharmaceutical manufacturing units**

Principles of heat transfer: Modes of Heat transfer-Conduction, Convection, Radiation, Induction. Sources of heat—Steam and Electricity

Factors affecting:-Rate of evaporation, Differentiations between Evaporation, Distillation, Rectification, Precipitation, Crystallization.

Brief introduction:- Solvent distillation and its application. Different types of heat reactions—Heats of reactions and formations, Heat of melting, vaporization and sublimation, Differential and integral heat of hydration and salvation.

##### **b) Introduction to dispensed products**

Classification of dispensed products: Brief description and applications of each product. Difference between extemporaneous preparations and Non extemporaneous preparations.

Classification as per physical state—Solids, Liquids, Semisolids, Inhalations.

Classification as per route of administration, Classification as Sterile and non-sterile preparations, Classification as Galenicals and non galenicals

Packaging of dispensed products:- Containers and closures. Labeling of dispensed products

### **Unit-3**

#### **a) States of matter**

Different states of matter-Solid, liquid, Gas., Crystalline and Amorphous, Hygroscopic-Efflorescent-Deliquescent, Modified states of matter-Glassy state, Glass transition temperature, Liquid crystals, Liquid-solid compacts, Solid dispersions.

Two component system containing solid—Solid liquid phases, Eutectic mixtures

#### **b) Polymorphism**

What is Polymorphism, Pseudo polymorphism, Solvates and Hydrates, Metastable forms? Examples of polymorphic drugs and effect on physicochemical properties

#### **c) Principles of fluid flow**

Reynolds's no., and its importance. Types of flow-Laminar flow, Intermediate flow, Turbulent flow.

Importance of types of flow in Pharmaceutical processing.

### **Unit-4**

Solubility and solubilisation: Definitions and expressions Physical properties of different solvents and solutes and their effects on solubility, Major pharmaceutical solvents –brief discussions. Liquid-liquid systems-Solubility and Miscibility, Partitioning between immiscible solvents and partition co-efficient, Effect of pH on solubility—Dissociation constant. Solubilisation techniques –Brief discussion.

Complexation:-Classification of complexes and its applications.

Concept of Filtration and filtration techniques.

### **Reference books:**

1. C.V.S, S. Pharmaceutical engineering , Principles and Practice, Vallabh Prakashan.
2. K., S. Pharmaceutical Engineering New age International publishers.
3. P., M. Elementary chemical engineering, Tta macgrowhill.
4. Physical Pharmacy By Alfred Martin.
5. Physical pharmaceutics, E.Shotton, Indian edition, oxford press.
6. Physico chemical principles of pharmacy, 5thedition,Alexander T. Florence and David Attwood., Pharmaceutical press.



## PC-113 Basic Computer Application

**RATIONALE** : Computers have become essential component in any profession. Basic knowledge of computers for preparing documents, do calculations of data gathered during experiments and also draw graphs is must for any professional.

**COURSE OBJECTIVES** : To learn proper usage of computers for preparing documents, conduct simple calculations and provide pictorial representation of data.

**LEARNING OUT COMES** :

The student should be able to:

- 1) Prepare documents in MS-Word
- 2) Preparing data tables in MS-Excel
- 3) Do calculation in MS-Excel of the data collected from various experiments using simple operations and formulas.
- 4) Draw Graphs in MS-Excel.

**PREREQUISITES** : Basic computer operations

### SYLLABUS

#### Unit-1

Computer Fundamentals: MS-Office, Networking and Internet.

#### Unit-2

MS-Word

Preparation of documents that include text, tables, figures, calculation steps and formatting of such documents.

#### Unit-3

MS-Excel

To perform calculations for Chemical kinetics (zero and first order), Area under curve, Solubility, buffers, titration, acid-base titration, oxidation-reduction (Preparation of graphs)

#### Unit-4

Powerpoint presentations

#### Reference books:

1. "Computers Today" by Senders D. H., McGrawHill.
2. "Computer fundamentals" by P. K. Sinha. Third edition, BPB Publication.
3. "Information technology", Jaiswal, S., Galgotia Pub.
4. Manuals for MS DOS, MS Office, MS Windows, UNIX.
5. "Office 2000/2003 Complete", BPB Publication.
6. "Internet basic reference A to Z", by Falk B., BPB, Delhi
7. "Operating Systems" by Stallings, PHI.
8. "Computers in Pharmacy" by Thakur P.S., Manchanda R. Nand P; Birla Pub. Pvt Ltd.
9. "Programming in ANSI-C by E. Balaguruswamy –Tata Mc. Graw Hill.
10. "Computer Networks" by Tenenbaum A.S., Prentice Hall of India.
11. "Programming with C" by Byron Gottfield.



## **PC-114 English & Communication Skill**

**RATIONALE** : English Communications becoming the important skill for pharmaceutical professionals. Also at professional level the students good in communication have better career opportunities.

**COURSE OBJECTIVES** :  
To learn basic communication skills( oral and written)

**LEARNING OUT COMES** :  
The student should be able to communicate well both verbally and in written form at various levels such as at interviews, group discussion, letter writing, writing proposals etc.

**PREREQUISITES** : Basic English

### **SYLLABUS**

#### **Unit-1**

English grammar- Parts of speech, articles, preposition, tenses, active and passive speech, direct and indirect speech.

#### **Unit-2**

Presentation techniques- Tips, Dos and don'ts of presentation, notice and placard presentations.

#### **Unit-3**

Written skills: Proposal, writing formats, report writing business letters, applications, covering letters, curriculum vitae designing, summary writing.

#### **Unit-4**

Listening- Phonetics and pronunciations (with the help of phonetics dictionary and with tapes from language laboratory).

#### **Unit-5**

Etiquettes and grooming.

Group discussion and extempore communication.

Interviews- Tips and model interviews (video shooting and display).

#### **Reference Book:**

1. Wren and Martin, English Grammar. Tapes from language laboratory, Hyderabad.

## PC-115 Human Anatomy and Physiology

**RATIONALE** : The subject provides basic understanding structure and functions of the human body parts. The understanding of the subject will become the base for many subjects of the higher classes.

**COURSE OBJECTIVES** :

1. To understand structure and function of each body components from cellular level to system level.
2. To understand how functions of each cell is integrated to make the entire body function with complete co-ordination.
3. To understand the various diseases related to disturbances in the body function.
4. To learn fundamentals of health, various dimensions of health, understanding of basic terminologies related to epidemiology and disease management and parameters for measuring health.
5. To learn some simple first aid techniques and management of emergency situations.

**LEARNING OUT COMES** :

The student should be able to:

1. Draw and label the internal structure of cell, arrangement of tissues, important organs and body systems.
2. Narrate the functions of important organs and their sub-parts.
3. Provide the basis for physiological variations.
4. Quantify the various components of blood and able to diagnose any abnormalities based on variations in the blood components.
5. Identify the important bones, body organs in the models.
6. Able to measure the radial pulse, Blood pressure and body temperature.
7. Take ECG tracings and describe the significance of each wave.
8. Explain the cause, transmission, prevention and management of common communicable diseases.
9. Define various terminologies used in health.
10. Narrate various macro and micro-nutrients and provide the importance in maintenance of health.
11. Demonstrate the various first-aid techniques used in emergencies.
12. Narrate the various contraceptive methods, the merits and demerits.

**PREREQUISITES** : Basic knowledge of arithmetic, physics and chemistry of H.S.C level.

## SYLLABUS

### Unit-1

#### a) Introduction & Scope of Human Anatomy & Physiology

Scope of anatomy and physiology and terminology used in these subjects.

Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

#### b) Elementary tissues of the human body

Elementary tissues of the human body: Epithelial, connective muscular and nervous tissues, their sub-type and characteristics.

Structural & functional organization of cell, its components and functions: Body fluids & its composition, transport mechanisms across the cell membrane, Cell cycle.

## **Unit-2**

### **a) Support & Movement**

Osseous system: Structure, composition and functions of skeleton, classification of joints, types of movements at joints, Disorders of joints.

Skeletal muscles: Their gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscle and their disorders.

### **b) Nervous System**

Central Nervous System: Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, cranial nerves and their functions.

Autonomic Nervous System: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S

## **Unit-3**

### **Maintenance of Human body-I**

Haemopoietic system: Composition and function of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.

Lymph and Lymphatic system: Composition, formation and circulation of lymph, disorders of lymph and lymphatic system. Basic physiology and functions of spleen.

Cardiovascular system: Basic anatomy of the heart, physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sound and electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, hypo tension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmia.

Respiratory system: Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and capacity.

## **Unit-4**

### **Maintenance of Human body-II**

Digestive System: Gross anatomy of the gastrointestinal tract functions of its different-parts including those of liver, pancreas and gall bladder. Various gastro-intestinal secretions and their role in the absorption and digestion of food, disorders of digestive system.

Urinary System: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance. Diseases of the urinary system.

Reproductive system: Male and Female reproductive system and their hormones. Physiology of menstruation, coitus and fertilization.

Endocrine System: Basic anatomy and physiology of pituitary, thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions.

## **Unit-5**

### **Public Health, Diseases & awareness**

Classification of food requirements, balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water.

Demography and family planning: Demography cycle, family planning, various contraceptive methods.  
First Aid: Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

**Reference books:**

1. Anne M.R. Agur & Ming J. Lee: Grant's Atlas of Anatomy, Lippincott, Williams and Wilkins  
B.D. Chaurasia's Human Anatomy (3 Volumes) CBS Publishers & Distributors.
2. B. Young, J.W. Heath: Wheater's functional Histology – a Text and Colour Atlas, Churchill Livingstone.
3. Bullock B.L. & Henze R.L., Focus on Pathophysiology, Lippincott Chatterjee, C.C. Human Physiology (Medical Allied Agency, Calcutta).
4. Chummy S. Sinnatamby: Last's Anatomy – Regional and Applied, Churchill Livingstone.
5. Gandhi, T.P. et. al.: Human Anatomy, Physiology & Health Education (B.S. Shah Prakashan, Ahmedabad).
6. Garg K. et al. A Text Book of Histology (CBS Publishers, New Delhi).
7. Ghai, C.L.: A Textbook of practical physiology (Jaypee Brothers Medical Publisher (P)

## PC-116 Practicals

**RATIONALE** : To provide the basic knowledge of very important concepts of all subjects and to provide overview of the applications of the concepts in applied field to the students is also an objective.

**PREREQUISITES** : Basic knowledge of arithmetic, physics and chemistry of H.S.C level.

### Human Anatomy Physiology

- 1 Introduction to microscope.
- 2 To study the various tissue permanent slide (part I).
- 3 To study the various tissue permanent slide (part II).
- 4 Introduction to haemoglobinometer and haemocytometer.

### Pharmaceutics (Basic Principles) Practical

- 1 To prepare the list of market products as per physical form.
- 2 To prepare the list of market products as per route of administration..
- 3 To study two component system –Preparation of eutectic mixture.(2)
- 4 To study the solubility relationship of 3-component system containing benzene, water and acetic acid
- 5 To study the mutual solubility of given liquids (phenol,water) and find out upper consolute temperature.
- 6 To determine Reynold's no. in given system.
- 7 To prepare Different pharmaceutical buffers.
- 8 To study the effect of pH on solubility of given drugs.

### Chemistry

1. Introduction to laboratory and safety hazards.
2. Introduction to organic compound identification test.
3. Introduction to reagent test.
4. Introduction to functional group (I )to(V) and to identifies the give nunknown. (4-9).
5. Preparation of standard solutions.
6. Introduction to laboratory glasswares and analytical balance.
7. Preparation and standardization of sodium hydroxide.
8. Preparation and standardization of Hydrochloric acid.
9. To determine Normality, Molarity, %w/v, and gm/litre of any solution.
10. Standardization of analytical weights and calibration of volumetric apparatus.

**Reference Books:**

1. Manuals provided with the licensed version of the software.
2. Computer Applications and Basic Biostatistics : H.B.Bhadka, Dr. N.N.Jani, Dr. G.R.Kulkarni, Akshat Publications.



Hemchandracharya North Gujarat University, Patan

UGC Approved  
Bachelor of Vocation (B. Voc.)  
in  
Pharmaceutical Chemistry  
Curriculum for Semester II

Offered at  
Pramukh Swami Science and H.D. Patel Arts College  
Sarva Vidyalaya Campus, Kadi

## Semester II

| Course Code | Course Title                      | Credit    |             | Total     |
|-------------|-----------------------------------|-----------|-------------|-----------|
|             |                                   | Theory    | Prac./Field |           |
| PC 211      | Fundamentals of Organic Chemistry | 3         | 0           | 3         |
| PC 212      | Physical Chemistry                | 2         | 0           | 2         |
| PC 213      | Fundamental Biochemistry          | 2         | 0           | 2         |
| PC 214      | Analytical Chemistry              | 3         | 0           | 3         |
| PC 215      | Fundamentals of Pharmacognosy     | 2         | 0           | 2         |
| PC 216      | Practical                         | --        | 18          | 18        |
| Total       |                                   | <b>12</b> | <b>18</b>   | <b>30</b> |

### PC-211 Fundamental of Organic Chemistry

**SUBJECT CODE:** PC 211

**RATIONALE:** Majority of the drugs used are organic in nature and therefore understanding the basics of organic chemistry, naming these complex chemical structures, understanding the chemical and physical properties of the common groups of compounds and also doing synthesis of these compounds becomes very important in understanding drug properties.

**COURSE OBJECTIVES :**

1. To learn fundamentals of chemical bonds, stereochemistry.
2. To learn basic chemical functional groups of compounds with respect to their physical and chemical properties.
3. To learn the simple organic chemical reactions.
4. To identify organic compounds by testing their physical and chemical properties.

**LEARNING OUTCOMES :**

The student should be able to:

1. Define and explain different types of chemical bonds.
2. Name the organic compounds according to IUPAC nomenclature system.
3. Narrate physical and chemical properties of different compounds representing different functional group.
4. Write chemical reactions depicting synthesis and chemical properties of these organic compounds.
5. Synthesis some organic compounds.
6. Identify unknown organic compounds by conducting different physical and chemical tests.

### TEACHING AND EVALUATION SCHEME:

| SUB CODE | TITLE OF SUBJECT                 | Credit | Theory (hr/week) | EVALUATION SCHEME |          | Total Marks |
|----------|----------------------------------|--------|------------------|-------------------|----------|-------------|
|          |                                  |        |                  | Theory            |          |             |
|          |                                  |        |                  | Internal          | External |             |
| PC 211   | Fundamental of Organic Chemistry | 3      | 3<br>-           | 50                | 50       | 100         |

#### Unit-1

##### Basics

Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces, Acids and bases, general nomenclature.

#### Unit-2

##### Stereochemistry

Stereochemistry: Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations, stereochemistry of specific reactions and intermediates, Stereoselective and stereospecific reactions.

#### Unit-3

##### Structure, Nomenclature, Preparation and Reactions

Structure, Nomenclature, Preparation and Reactions of: Alkanes, Alkenes, Alkynes; Cycloalkanes, Dienes, Benzene, Polynuclear aromatic compounds, Arenes, Alkyl halides, Alcohols, Ethers, Epoxides, Amines, Phenols, Aldehydes and ketones, Carboxylic acids, Functional derivatives of carboxylic acids, Reactive intermediates – carbocations, carbanions, carbenes, nitrene and nitrenium ions.

#### Recommended Books for the syllabi are:

1. Morrison & Boyd, Organic Chemistry, Prentice-Hall, 6<sup>th</sup>, 2001.
2. March J, Advanced Organic Chemistry, MacGraw-Hill, 3<sup>rd</sup>, 1985.

#### Reference Books:

1. Solomon & Fryhle, Organic Chemistry, Wily, 8<sup>th</sup>, 2004.
2. Shriner & Morill, The systemic Identification of Organic Compounds, Wily, 8<sup>th</sup>, 2004.
3. Furniss, Vogel's Textbook of Practical Organic Chemistry, Pearson education, 5<sup>th</sup>, 2004.
4. Eliel E, Stereochemistry of Carbon Compounds, McGraw-Hill, 7<sup>th</sup>, 1962.
5. Eliel E, Elements of Stereochemistry, wily, 3<sup>rd</sup>, 1969.
6. Cahn & Dermer, Introduction to Chemical Nomenclature, Butterworths, 3<sup>rd</sup>, 1979.
7. Warren S, Organic synthesis-The disconnection approach, Wily, 4<sup>th</sup>, 1982.
8. Wheland G Advanced Organic Chemistry, Wily, 3<sup>rd</sup>, 1960.
9. Kagan H, Organic Stereochemistry, Wily, 4<sup>th</sup>, 1965.
10. House H, Modern Synthetic Reactions, Wily, 2<sup>nd</sup>, 1972.

## PC-212 Physical Chemistry

**SUBJECT CODE** : PC 212

**RATIONALE:** Physical properties of drugs and chemicals have immense effect on drug manufacturing, efficacy and stability. Strong knowledge of these subjects becomes mandatory for any professional.

**COURSE OBJECTIVES** :

1. To learn the important physical properties of drugs and chemicals, that can significantly affect the drug manufacturing.
2. To quantify these physical properties and methods to alter the same so as to avail desired levels.

**LEARNING OUTCOMES** :

The student should be able to:

1. Define and explain the various physical properties.
2. Measure the physical properties and demonstrate the methods to alter the same by different ways.
3. Narrate and explain the laws, theories pertaining to these properties.
4. Carry out simple calculations involved with these properties.

### TEACHING AND EVALUATION SCHEME:

| SUB CODE | TITLE OF SUBJECT   | Credit | Theory (hr/week) | EVALUATION SCHEME |          | Total Marks |
|----------|--------------------|--------|------------------|-------------------|----------|-------------|
|          |                    |        |                  | Theory            |          |             |
|          |                    |        |                  | Internal          | External |             |
| PC 212   | Physical Chemistry | 2      | 2                | 50                | 50       | 100         |

#### Unit-1

##### Gaseous and solid state chemistry

Behavior of Gases: Kinetic theory of gases, deviation from behaviors and explanation.

Solid State: Crystalline structures, lattices, physical properties.

Adsorption: Freundlich and Gibbs adsorption isotherms, Langmuir theory of adsorption.

#### Unit-2

##### The Liquid State

The Liquid State: Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents).

Solutions: Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory.

#### Unit-3

##### Thermodynamics

Thermodynamics: first, second and third laws, Zeroth law, absolute temperature scale, thermo

chemical equations, phase equilibria and phase rule.

#### **Unit-4**

##### **Photochemistry**

Photochemistry: Consequences of light absorption, Jablonski diagram, Lambert-Beer Law, Quantum efficiency.

#### **Unit-5**

##### **Chemical Kinetics**

Chemical Kinetics: Zero, first and second order reactions, complex reactions, theories of reaction Kinetics, characteristics of homogeneous and heterogeneous catalysts, acid base and enzyme catalysis.

#### **Recommended Books for the syllabi :**

1. G. Raj, Advanced Physical Chemistry, 20<sup>th</sup> Edition, Goel Publishing House, Meerut, 1996-97.
2. Dr. J.N. Gurtu, Dr. Hemant Snehi, Advanced Physical Chemistry, 7<sup>th</sup> Revised and Enlarged Edition, Pragati Prakashan, Meerut, 2000.
3. P.L. Soni, O.P. Dharmarha, U.N. Dash, Textbook of Physical Chemistry, 22<sup>nd</sup> Edition, Sultan Chand and Sons, New Delhi, 2001.

#### **Reference Books:**

1. B.S. Bahl, G.D. Tuli, Arun Bahl, Essentials of Physical Chemistry, Reprinted 24<sup>th</sup> Edition, S. Chand and Company Ltd., New Delhi, 2004.
2. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry, 8<sup>th</sup> Edition, Oxford University Press, Bombay, 1994.
3. S. Glasstone, Textbook of Physical Chemistry, 2<sup>nd</sup> Edition, Rajiv Beri for Macmillan India Limited, New Delhi, 1995.
4. J. B. Yadav, Advanced Practical Physical Chemistry, 15<sup>th</sup> Edition, Goel Publishing House, Meerut, 1997.
5. W. J. Moore, Physical Chemistry, 5<sup>th</sup> Edition, Orient Longman Pvt. Ltd., New Delhi, 2004.
6. I. Das, A. Sharma, N. R. Agrawal, An Introduction to Physical Chemistry, Revised 2<sup>nd</sup> Edition, New Age International Publishers, New Delhi, 2005.
7. B. Viswanathan, P.S. Raghawan, Practical Physical Chemistry, 1<sup>st</sup> Edition, Viva Books Pvt. Ltd., 2005.
8. D.P. Shoemaker, C.W. Garland, J.W. Nibler, Experiments in Physical Chemistry, 5<sup>th</sup> Edition, McGraw Hill International Edition, New York, 1989.
9. S. Glasstone, D. Levis, Elements of Physical Chemistry, 2<sup>nd</sup> Edition, Macmillan and Company Limited, 1970.
10. R.M. Verma, A Textbook of Physical Chemistry, Volume – I & II, 1<sup>st</sup> Edition, CBS Publishers and Distributors, Delhi, 1992.
11. P.W. Atkins, Physical Chemistry, 5<sup>th</sup> Edition, Oxford University Press, UK, 1994.

12. P.S. Rachavan, M.S. Shethi, Concepts and Problems in Physical Chemistry, 1<sup>st</sup> Edition, Discovery Publishing House, New Delhi, 1997.
13. A.W. Adamson, Physical Chemistry of Surfaces, 5<sup>th</sup> Edition, A Wiley Interscience Publication, New York, 1990.
14. C.K. Vemulapathi, Physical Chemistry, 1<sup>st</sup> Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 1997.
15. C.R. Metz, Schaum's Solved Problems Series, 2000 solved problems in Physical Chemistry, 2<sup>nd</sup> Edition, McGraw Hill Publishing Company, USA, 1989.
16. R. Chang, Physical Chemistry with Applications to Biological Systems, 2<sup>nd</sup> Edition, Macmillan Publishing Co., New York, 1981.
17. Prof. S.K. Dutta, Principles of Physical Chemistry and Biophysical Chemistry, 1<sup>st</sup> Edition, Books and Allied (P) Ltd., Kolkata, 2007.

## PC-213 Fundamental Biochemistry

**SUBJECT CODE** : PC 213

**RATIONALE** : Understanding the chemistry of life is fundamentally required for studying the effect of drugs on human body. The course will enable student to learn the basic chemical reactions occurring in the human body. Also the various factors which can regulate this chemical processes will be taught.

**COURSE OBJECTIVES** :

1. To learn the structure and function of various biochemical.
2. To learn the basic metabolic processes occurring within the human body and factors regulating the same.

**LEARNING OUTCOMES** :

The student should be able to:

1. Describe the structure and functions of various biochemical.
2. Describe the various biochemical pathways occurring within the human body.
3. Describe the basic principles of enzymology.
4. Classify the different enzymes.

### TEACHING AND EVALUATION SCHEME:

| SUB CODE | TITLE OF SUBJECT         | Credit | Theory (hr/week) | EVALUATION SCHEME |          | Total Marks |
|----------|--------------------------|--------|------------------|-------------------|----------|-------------|
|          |                          |        |                  | Theory            |          |             |
|          |                          |        |                  | Internal          | External |             |
| PC 213   | Fundamental Biochemistry | 2      | 2                | 50                | 50       | 100         |

#### Unit-1

##### Biological macromolecules: carbohydrates

Introduction to carbohydrates, Nomenclature, definition and classification of carbohydrates, Monosaccharides, Classification, structural aspect and biological significance, Disaccharides, Oligosaccharides, Polysaccharides.

#### Unit-2

##### Introduction to lipids

Structure and function diversity of lipids, Definition and classification, Fatty acids, Triacyl glycerols, glycerophospholipids, Sphingolipids, steroids and other biologically important lipids (Terpenes, steroids, cholesterol etc)

#### Unit-3

##### Proteins

Proteins, structure and function, General structure of Amino acids, Classification of Amino acids, Peptide bond link amino acids in proteins, Composition of amino acid in protein and determining sequence of amino acid residue, Structure of protein, Types of protein structure, Primary structure, Secondary structure, Tertiary structure, Quaternary structure, Various other biologically important protein.

## Unit-4

### Enzymes and co-enzymes

Structure and function of enzyme, Classification of enzyme, Enzyme kinetics and its mechanism of action Enzyme inhibition, Types of enzyme inhibition, Reversible enzyme inhibition, Irreversible enzyme inhibition, Regulation of enzyme activity, Enzymes and iso enzymes in clinical diagnosis, Coenzyme classification, Role of vitamin as coenzyme, Biological significance, Metal as coenzyme and its biological significance.

### Recommended Books for the syllabi:

1. Dr. U. Satyanarayana, Biochemistry, 2nd edition, Books and allied (P) Ltd., 2004.
2. A. White, Philip Handler, E.L. Smith, R.L. Hill, I.R. Lehman, Principles of Biochemistry, 6<sup>th</sup> edition, Tata McGraw Hill Publishing Company Ltd., 2004.
3. D. L. Nelson, M. M. Cox, Lehninger Principles of Biochemistry, 4<sup>th</sup> edition, W. H. Freeman & Company, 2005.

### Reference Books:

1. P.C. Champe, R.A. Harvey, Biochemistry, 2nd edition, Lippincott – Raven publishers, 1994.
2. R. K. Murray, D.K. Granner, P.A. Mayes, V.W. Rodwell, Harper's Illustrated Biochemistry, 26<sup>th</sup> edition, McGraw Hill Publishers, 2003.
3. W. H. Elliott, D. C. Elliott, Biochemistry & Molecular Biology, 1<sup>st</sup> edition, Oxford University Press, 1997.
4. G. L. Zubay, W. W. Parson, D.E. Vance, Principles of Biochemistry, 1<sup>st</sup> edition, WCB publishers, 1995.
5. E.E. Conn and P.K. Stumpf, G. Bruening, R. H. Doi, Outlines of Biochemistry, 5<sup>th</sup> edition, John Wiley & Sons, New York, 1999.
6. D. B. Marks, Board Review Series, Biochemistry, 2<sup>nd</sup> edition, Harwal Publishing, 1994.
7. R. H. Garrett, C. M. Grisham, Principles of Biochemistry with a Human Focus, 1<sup>st</sup> edition, Harcourt College Publishers, 2002.
8. M. Cohn, K.S. Roth, Biochemistry and Disease, 1<sup>st</sup> edition, William and Wilkins Co., Baltimore, 1996.
9. H. R. Horton, L. A. Moran, R. S. Ochs, J. D. Rawn, K. G. Scrimgeour, Principles of Biochemistry, 2<sup>nd</sup> edition, Prentice-Hall International Inc., 1996.
10. S. Ramakrishnan, K.G. Prasanan, R. Rajan, Textbook of Medical Biochemistry, 3rd Edition, Orient Longman, Madras, 2001.



## PC-214 Analytical Chemistry

**SUBJECT CODE:** PC 214

**RATIONALE** : Measuring Drug purity is a primary requirement to ensure the quality of drugs. Quantifying the purity of compound can be done by different techniques. Some of the most commonly used techniques will be taught in this subject. This will make the student capable to work in a quality control department of the pharmaceutical industry.

### **COURSE OBJECTIVES** :

1. To make student learn the basic principles of various assay techniques commonly used in quality control department of any pharmaceutical industry.
2. To provide the hands-on experience by actually conducting these assays in the lab.

### **LEARNING OUTCOMES** :

The student should be able to:

1. Correctly sample the drug for testing
2. Carry out calculations involved in basic statistics.
3. Narrate the principles of methods and instruments used in assay of various drugs and chemicals.
4. Conduct assays of some drugs using these methods and instruments.

### **TEACHING AND EVALUATION SCHEME:**

| SUB CODE | TITLE OF SUBJECT     | Creditt | Theory (hr/week) | EVALUATION SCHEME |          | Total Marks |
|----------|----------------------|---------|------------------|-------------------|----------|-------------|
|          |                      |         |                  | Theory            |          |             |
|          |                      |         |                  | Internal          | External |             |
| PC 214   | Analytical Chemistry | 3       | 3                | 50                | 50       | 100         |

### **Unit-1**

#### **Errors and statistics**

Types of error, Precision and accuracy, Mean and Standard deviation, Confidence interval, Comparison of results and means of two samples, Paired T-test, Q-test, Correlation and linear regression, comparison of more than two means, Significant figures, Rules for retaining significant digits.

### **Unit-2**

#### **Sampling**

Basis of sampling, sampling procedure and selection of sample, factors affecting sampling: sampling and physical state, crushing, grinding and hazards in sampling.

### Unit-3

#### Introduction to titrimetric analysis:

Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.

### Unit-4

#### Errors and Statistical Data Treatment of Analytical Results

Introduction to Analytical Chemistry, Classification of Classical and Electroanalytical Techniques, Literature of Analytical Chemistry (Names of Author and Publishers for any Ten Books, Journals and Reviews), Criterion for Selection of analytical Techniques, Analytical Data Treatment, Error, Types of errors, Accuracy and Precision, Statistical Terms :Mode, Average, Median, Deviation, Average Deviation, Relative Average Deviation, Standard Deviation & Coefficient of variance, Q-Test for the rejection of result and related numerical.

#### Recommended Books for the syllabi are:

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mandham, R.C. Denney, J.D. Bernes, M.J.K. Thomas, 5th Edition, ELBS, UK, 1996.
2. G.D. Christian, Analytical Chemistry, 5th Edition, John Wiley & Sons, New York, 1994.
3. D.A. Skoog, D.M. West, F.J. Holler, Analytical Chemistry: An Introduction, 6th Edition, Saunders College Publishing, New York, 1994.
4. J.A. Dean, Analytical Chemistry Handbook, 1<sup>st</sup> Edition, Mc Graw Hill Inc., New York, 1995.

#### Reference Books:

1. Dr. A.V. Kasture, Dr. K.R. Mahadik, Dr. S.G. Wadodkar, Dr. H.N. More, A Textbook of Pharmaceutical Analysis, Volume – I, 8<sup>th</sup> Edition, Nirali Prakashan, Pune, 2002.
2. R.A. Day and A.L. Underwood, Quantitative Analysis, 6<sup>th</sup> Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 1993.
3. K.A. Connors, A Textbook of Pharmaceutical Analysis, 3<sup>rd</sup> Edition, John Wiley & Sons, New York, 1982.
4. J.H. Kennedy, Analytical Chemistry Principles, 2<sup>nd</sup> Edition, Saunders College Publishing, New York, 1990.
5. D.A. Skoog, D.M. West, F.J. Holler, Fundamentals of Analytical Chemistry, 7<sup>th</sup> Edition, Saunders College Publishing, New York, 1996.
6. The Indian Pharmacopoeia 2007, Volume-I,II & III, Controller of Publication, 2007.
7. R.M. Verma, Analytical Chemistry, 2<sup>nd</sup> Edition, CBS Publishers, New Delhi, 1991.
8. S.M. Khopkar, Basic Concepts of Analytical Chemistry, 2<sup>nd</sup> Edition, New Age International Publishers, New Delhi, 1998.
9. A.H. Backett, J.B. Stenlake, Practical Pharmaceutical Chemistry, 4<sup>th</sup> Edition, CBS Publishers, Delhi, 1997.
10. V. Alexeyev, Quantitative Chemical Analysis, 1<sup>st</sup> Edition, Mir Publishers, Moscow, 1994.
11. I.M. Pande, Systemic Analytical Chemistry, 1<sup>st</sup> Edition, Central Book Depot, Allahabad, 1965.
12. R. Kellner, J.M. Mermet, M. Otto, H.M. Widmer, Analytical Chemistry, 1<sup>st</sup> Edition, Wiley-VCH, 1998.
13. T. Higuchi, Pharmaceutical Analysis, 1<sup>st</sup> Edition, CBS Publishers, New Delhi, 1997
14. P.D. Sethi, Quantitative Analysis of Drugs in Pharmaceutical Formulations, 3<sup>rd</sup> Edition, CBS Publishers, New Delhi, 1997.

15. F.W. Fifield, D. Kealey, Principle and Practice of Analytical Chemistry, 5<sup>th</sup> Edition, Blackwell Science Ltd., 2000.
16. Y. Anjaneyulu, K. Chandrasekhar, Valli Manickam, A Textbook of Analytical Chemistry, 1<sup>st</sup> Edition, Pharma Book Syndicate, Hyderabad, 2006.

## PC-215 Fundamentals of Pharmacognosy

**SUBJECT CODE** : PC 215

**RATIONALE** : It provides knowledge of drugs of natural origin. Since ages humans have been using drugs from natural origin. Many of the allopathic drugs also have herbal origin. Learning these drugs is of great value for pharmacy professionals as these drugs have important place in treatment of diseases.

### **COURSE OBJECTIVES** :

1. To learn general morphological and microscopically characters of crude drugs.
2. To understand general methods of checking purity of herbal drugs.

### **LEARNING OUTCOMES** :

The student should be able to:

1. Explain structure and function of plant tissues.
2. Describe and demonstrate the morphological characters of different parts of plants.
3. Describe taxonomical characters of plants belonging to some important plant families.
4. Classify plant derived drugs.
5. Demonstrate different tests used for quality control of herbal drugs.

### **TEACHING AND EVALUATION SCHEME:**

| SUB CODE | TITLE OF SUBJECT              | Credit | Theory (hr/week) | EVALUATION SCHEME |          | Total Marks |
|----------|-------------------------------|--------|------------------|-------------------|----------|-------------|
|          |                               |        |                  | Theory            |          |             |
|          |                               |        |                  | Internal          | External |             |
| PC 215   | Fundamentals of Pharmacognosy | 2      | 2                | 50                | 50       | 100         |

#### **Unit-1**

##### **Introduction to Pharmacognosy**

Definition, scope, history and development of Pharmacognosy, introduction to secondary metabolites – Definition & classification.

#### **Unit-2**

##### **Plant tissue & Morphology**

Plant tissue of simple and complex and tissue system, morphology of root, stem, bark, wood, leaf, flower, fruit and seed, modification of root, stem and leaf, histology of root, stem and leaf.

#### **Unit-3**

##### **Plant taxonomy**

Study of the following families with special reference to medicinally important plants – Malvaceae, Apocynaceae, Solanaceae, Leguminosae, Rubiaceae. sources of crude drugs & Classification of crude drugs

#### **Unit-4**

##### **Classification and cultivation of crude**

Sources of crude drugs & Classification of crude drugs, cultivation, collection, processing and storage of crude drugs: importance and factors, influencing cultivation of medicinal plant, quality control of crude drugs: Adulteration and evaluation.

#### **Unit-5**

##### **Carbohydrates and derived products**

Definition, classification & chemical tests of carbohydrates; Agar, Guar gum, Acacia, Honey, Isabgol, pectin, Starch and Tragacanth.

#### **Recommended Books for the syllabi are:**

1. Atal C.K. And Kapur B.M., Cultivation and Utilization of Medicinal Plants, Rrl Jammu.
2. Quadry J S, Shah and Qadry Pharmacognosy, B.S.Shah Publication.
3. MG Chauhan, Microscopy of Leaf Drug, Jamnanagar Ayurved University.
4. Iyengar, Text Book of Pharmacognosy, Manipal Power Press.

#### **Reference Books:**

1. Rangari & Rangari, Text Book of Pharmacognosy.
2. Datta A.C., A Class Book of Botany, Oxford Uni.
3. Bendre A. M, Ashokkumar. A Textbook of Practical Botany Ii Rastogi Publications, Meerut, India.
4. Wallis T.E., Text Book of Pharmacognosy, 5th Edition, Cbs Publishers and Distributors.
5. Kokate C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
6. Kokate C.K, Purohit A.P. And Gokhale S.B. Pharmacogonosy (Degree) Nirali Prakashan, Pune.
7. Khandelwal K R, Practical Pharmacognosy, Nirali Prakashan.
8. Trease E and Evans W.C., Pharmacognosy, Balliere Tindall. Eastbourne, U.K.
9. Tyler V.C., Brady L.R. And Robers W.E. , Pharmacognosy, Lea And Febiger, Ph.
10. MG Chauhan, Microscopy of Bark Drug, Jamnanagar Ayurved University.
11. Jackson Betty P., Atlas Of Microscopy Of Medicinal Plants, Culinary Herbs And Spices, CBS publication.

### PC-216: Practical

| SUB CODE | TITLE OF SUBJECT | Credit | EVALUATION SCHEME |  | Total Marks |
|----------|------------------|--------|-------------------|--|-------------|
|          |                  |        | Practical         |  |             |
|          |                  |        | External          |  |             |
| PC 216   | Practical        | 18     | 600               |  | 600         |

#### Practical:

1. Introduction to laboratory and safety hazards.
  2. Introduction to organic compound identification test.
  3. Introduction to reagent test.
  4. Introduction to functional group (I) to (V) and to identifies the given unknown. (4-9).
  10. To synthesize acetanilide from aniline.
  11. To synthesize p – bromo acetanilide from acetanilide.
  12. To synthesize p – bromo aniline from p – bromo acetanilide.
  13. To synthesize Benzoic acid from benzamide or phenyl benzoate
  14. To synthesize Benzamide from benzoyl chloride.
  15. To determine the viscosity and specific gravity of the given liquids.
  16. To determine the surface tension of the given liquids.
  17. To study the effect of temperature on viscosity and surface tension of the given liquids.
  18. To check the validation of Freundlich and Langmuir adsorption isotherm using charcoal and acetic acid.
  19. Preparation and standardization of sodium hydroxide.
  20. Preparation and standardization of Hydrochloric acid.
  21. To determine Normality, Molarity, %w/v, and gm/litre of any solution.
  22. Standardization of analytical weights and calibration of volumetric apparatus.
  23. Non-aqueous titrations: Preparation and standardization of perchloric acid and sodium/potassium/lithium methoxides solutions; Estimations of some Pharmacopoeial products.
  24. Care, use and types of microscopes and Preparation of different types of slides and Study of different cell and tissue system.
  25. Microscopical examination of cell contents: starch grains, calcium oxalate & carbonate crystals and phloem fibres. & stomatas.
  26. Morphology of plant parts indicated in theory.
  27. Microscopic examination of stem monocot and dicot plants.
  28. Microscopic examination of root monocot and dicot plants.
  29. Microscopic examination of leaf monocot and dicot plants.
  30. Morphological characteristic of plant family Solanaceae.
  31. Quantitative microscopy Leaf constants.
  32. Quantitative microscopy Dimention measurement.
  33. To study morphology and chemical tests of cabohydrate containing drug.
  34. Preparation of herbarium sheets.
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