Semester-II

Course Type	Title of the Course	Credit	Full Marks	Lecture Hour
Major Course MATH2011	Introductory Algebra & Number Theory	4 (Theory-04)	75 (Theory-60, Internal Assessment–15)	60 (Lecture -45, Tutorial – 15)
Minor Course CHEM1021	General Chemistry-I	4 (Theory-03, Practical - 01)	75 (Theory-40, Practical-20, Internal Assessment–15)	75 (Theory-45, Practical-30)
Multi/ Interdisciplinary ENGL2031	Technical Writing	3 (Theory-03)	50 (Theory-40, Internal Assessment–10)	40 (Lecture -30, Tutorial – 10)
Ability Enhancement Course [L2-1] ENGL2041	Functional English	2 (Theory-02)	50 (Theory-40, Internal Assessment–10)	30
SEC MATH2051	Programming in C	3 (Theory-03)	50 (Theory-40, Internal Assessment–10)	45
VAC CVA 2061	Understanding India/Fitness & Hygiene & Yoga/Digital India	4 (Theory-04)	100	60
		Total Credit = 20	Total Marks = 400	

MAJOR COURSES

Course Code: MATH2011
Course Name: Introductory Algebra and Number Theory (Credit: 4, Marks: 75)
Total Hours: Lecture -45, Tutorial – 15

Objectives
To present a systematic introduction to number theory and basic course on algebra.

Learning outcomes
On completion of the course, the student should have the following learning outcomes defined in terms of knowledge, skills and general competence:

Knowledge: The students would gain knowledge about
  i.   number theory which has wide applicability in advanced mathematics and also in various practical field, e.g., cryptography, computer science and many competitive exams.
  ii.   complex number and its properties which are equally indispensable tools for advanced studies and different practical field.
  iii. a basic introduction to modern algebra which has wide applicability in different branch of sciences.

Skills:
The students would be able to
  i.   access and also generate different tricky examples and counter examples involving integers during their advanced study of ring theory and field theory.
  ii.   simplify a mathematical problem in different field of science using complex number.
  iii. motivate themselves for future research after getting the glimpse of gateway of modern algebra from classical algebra and number theory and relate use of group, ring and field in different field of science.

General competence: The students would gain
  i.   descriptive idea of various properties of complex number.
  ii.   knowledge of richness in number theory.
  iii. understanding in basic concepts of group, ring and field.
  iv.   expertise in solving many tricky problems in number theory, complex numbers.

Contents:

Algebra
Complex Numbers: De Moivre's theorem for rational indices and its applications.

Theory of equations: Fundamental Theorem of Algebra (Statement), Relation between roots and coefficients, Transformation of equation, Descarte's rule of signs, Cubic and biquadratic equations, Reciprocal equation, separation of the roots of equations, Strum's theorem.

Inequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequality. [L-**10H & T-4H**]

Partial order, total order relations, partitions of a set and its connection with equivalence relation, greatest lower bound, least upper bound, maximal, minimal elements, lattice, bounded lattice, modular lattice, distributive lattice, complemented lattice, statement of Zorn's lemma.

[L-**5H & T-2H**]

Semigroups, Monoids, Groups – examples including permutation group, Matrix groups $(M_{n \times n}(\mathbb{R}), GL_n(\mathbb{R}), SL_n(\mathbb{R}))$, Z_n, elementary properties of groups, generators and relations, order of an element of a group, Subgroups and examples of subgroups, cosets, normal subgroup, center of a group, cyclic groups, Lagrange's theorem, Rings, subrings, Ideals (left, right and two sided), integral domain, field, subfield – examples and basic properties, characteristic of a ring and field.

[L-**10H & T-4H**]

Number Theory

Well ordering principle of set of natural numbers, pigeon-hole principle, division algorithm, greatest common divisor (gcd), Euclidean algorithm, least common multiple (lcm), Linear Diophantine equation, prime numbers, relatively prime numbers and related properties including Euclid's lemma, fundamental theorem of arithmetic and its applications, perfect square and square free integers, congruences, solution of congruences, Binary and decimal representation of integer, Chinese remainder theorem and its application. Fermat's little theorem, Wilson's theorem, sum of two squares, Arithmetic function-$\phi(n), d(n), \sigma(n)$. [L-**20H & T-5H**]

Reading References:

Text books:
1. Classical Algebra- S. K. Mapa,8th Edition, (Sarat Book House).
2. Topics in Abstract Algebra – M.K. Sen, S. Ghosh, P. Mukhopadhyay, S. K. Maity, 3rd Edition (University Press).
3. Higher Algebra- S. K. Mapa,8th Edition, (Sarat Book House).
4. An introduction to Theory of Numbers- Niven, Ivan,S. Zuckerman Herbert, L. Montogomery Hugh,5th Edition, (Willey).
5. Elementary Number Theory- D. M. Burton, (Mc Graw Hill Education).

Reference Books:
1. Topics in Algebra – I. N. Herstein,2nd Edition, (Wiley).
2. Contemporary Abstract Algebra - Gallian, A. Joseph, Standard Edition, (Cengage India Private Limited).
3. Higher Algebra - S. Barnards, J. M. Child, (Arihant).
4. Algebra - M. Artin, 2nd Edition, (Pearson Education, India).
5. A first course in Abstract Algebra - J. B. Fraleigh7th Edition, (Pearson Education, India).

Chemistry MINOR

Paper code: CHEM102-I

Paper title: General Chemistry-I   Credits 3+1

Theory   Credits 3

1. **Atomic structure**

Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, Aufbau principle and its limitations   *6 Hours*

2. **Periodic properties**

Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements, positions of hydrogen and noble gases, atomic and ionic radii, ionization potential, electron affinity and electronegativity,periodic and group-wise variation of above properties in respect of s- and p- block elements

6 Hours

3. **Acids and bases**

Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents,Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept, hard and soft acids and bases (HSAB concept), applications of HSAB process, acidity and basicity of common organic compounds   *7 Hours*

4. **Aliphatic hydrocarbons**

Functional group approach for the following compounds to be studied in context of their preparations, properties, structures and reactions

Alkanes (up to 5 carbons): preparation- catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis using Grignard reagent; Reaction mechanism for free radical substitution, halogenation

Alkenes (up to 5 carbons): preparation- elimination reactions, dehydration of alcohols and dehydrohalogenation of alkyl halides, *cis* alkenes (partial catalytic hydrogenation) and trans alkenes (Birch reduction), reactions- *cis*-addition (alkaline $KMnO_4$) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition], hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction

Alkynes (up to 5 carbons):preparation- acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides, formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alkaline $KMnO_4$ *10 Hours*

5. Ideal and real gases

Concept of pressure and temperature, Deviation of gases from ideal behaviour, compressibility factor, Boyle temperature, Andrew's and Amagat's plots, van der Waals equation and its features, derivation and application in explaining real gas behaviour, existence of critical state, critical constants in terms of van der Waals constants, law of corresponding states

Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only)   *5 Hours*

6. Thermodynamics-I

Intensive and extensive properties state and path functions, isolated, closed and open systems, zeroth law of thermodynamics,concept of heat, work, internal energy and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases

Standard states, heat of reaction, enthalpy of formation of molecules and ions, enthalpy of combustion and its applications, laws of thermochemistry, bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchoff's equation and effect of pressure on enthalpy, adiabatic flame temperature, explosion temperature

7 Hours

7. Chemical Kinetics-I

Introduction of rate law, order and molecularity, extent of reaction, rate constants, rates of first-, second- and n-th order reactions and their integrated forms (with derivation), pseudo first order reactions, determination of order of a reaction- half-life and differential method, opposing reactions, consecutive reactions and parallel reactions (elementary idea)

Theories of reaction rate: Temperature dependence on reaction rate, Arrhenius equation, energy of activation   *4 Hours*

Reference Books:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970.
4. Atkins, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).

5. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India.

6. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005.

7. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006.

8. Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998).

9. Burgess, J., Ions in solution: basic principles of chemical interactions. Ellis Horwood (1999).

10. Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012.

11. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.

12. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

13. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education).

14. Morrison, R. T. Study guide to organic Chemistry, Pearson.

15. Pathak & Saha, Organic Chemistry (Volume-1), Books and Allied (P) Ltd.

16. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press.

17. Castellan, G. W., Physical Chemistry, Narosa Publishing House.

18. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press.

19. Engel, T. & Reid, P. Physical Chemistry, Pearson.

20. Mortimer, R. G. Physical Chemistry, Elsevier.

21. Ball, D. W. Physical Chemistry, Thomson Press.

22. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry.

23. Rakshit, P.C., Physical Chemistry, Sarat Book House.

24. Zemansky, M. W. &Dittman, R.H. Heat and Thermodynamics, Tata-McGraw-Hill.

25. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas Publishing House.

26. Clauze& Rosenberg, Chemical Thermodynamics: Basic concepts & Methods, John Wiley & Sons, 2008.

27. Sharma, K. K. & Sharma, L. K., A Textbook of Physical Chemistry, Vikas Publishing House.

28. Bajpai, D. N., Advanced Physical Chemistry, S. Chand Publication.

29. Rajaram, J. Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson.

30. Chatterjee Hrishikesh, Physical Chemistry (Volume-1), Platinum Publisher

31. Kapoor, K.L., Textbook of Physical Chemistry (Volume 1 and Volume-2), McGraw Hill Education

32. Ghoshal, A. Numerical problems & short questions on Physical Chemistry, Books and Allied (P) Ltd.

33. Maron, S. &Prutton, Principles of Physical Chemistry, Collier Macmillan Ltd.

34. Levine, I. N. Physical Chemistry, Tata McGraw-Hill.

Practical   Credit 1

*(i) Determination of boiling point*s

    Boiling points of common organic liquid compounds e.g., ethanol, cyclohexane, ethyl methyl ketone, cyclohexanone, acetylacetone, anisole, crotonaldehyde, mesityl oxide,etc.

12 Hours

(ii) Identification of a pure organic compound

       Solid compounds: oxalic acid, succinic acid, resorcinol, urea, glucose, benzoic acid and salicylic acid.

       Liquid Compounds: acetone, aniline and nitrobenzene   *18 Hours*

Reference Books:

1. Bhattacharyya, R. C, A Manual of Practical Chemistry.

2. Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.

3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).

4. A.K. Manna, Practical Organic Chemistry, Books & Allied (P) Ltd.

Ghosh, Das Sharma, Majumdar, Manna, Chemistry in Laboratory, Santra Publication (P) Ltd.

INTERDISCIPLINARY COURSE

ENGL2031: Technical Writing
[3 Cr, Full Marks: 50 (Theory: 40 + IA: 10), LH: 45 hrs]

COURSE OBJECTIVE:

Technical writing is a necessary requirement in many professions, and this course is designed to make students aware ofthe various forms of such writing. The objective is to equip students to face the challenges of technical writing in professional life.

Introducing Technical Writing(LH: 15)
What is technical writing?
Difference between technical writing and other forms of writing
Roles and responsibilities of technical writers
Qualities and qualifications of technical writers

Forms and Styles of Technical Writing(LH: 30)
Styles in technical writing
Forms of discourse, audience analysis, persuasion
Grammar in technical writing, revising a written document
Clarity, precision, coherence and logic in technical writing
Collecting notes, writing summaries and drafts, writing minutes and resolutions of meeting
Designing and reviewing documents
Document formats, differences between hard and soft copy versions
Web content writing
Collaborative writing
Professional Ethics, plagiarism, and copyright

COURSE OUTCOME:

It is expected that students emerging from this course will be capable of handling the demands and challenges of technical writing in the course of their professional careers in government and private sectors as well as in transactions of business.

ABILITY ENHANCEMENT COURSE

ENGL2041: Functional English
[2 Cr, Full Marks: 50 (Theory: 40 + IA: 10), LH: 30 hrs]

COURSE OBJECTIVE:

The importance of functional English at the present moment cannot be over-emphasized. Recognizing this importance, the course seeks to acquaint students with the various uses of English in today's world, with particular focus on developing one's conversational and writing skills together with the ability to comprehend English speech and writing.

What is functional English? (LH: 1)
Aims and objectives of functional English (LH: 1)
Functional English and formal English/ literary English (LH: 1)
Types and modes of Communication (LH: 1)
Language of communication (LH: 1)
Conversational skills (LH: 1)
Verbal and Non-verbal communication(LH: 1)
Personal, social and business communication (LH: 1)
Understanding English language films, songs, documentaries, news bulletins, sports commentaries (LH: 4)
Comprehension skills (LH: 2)
Paraphrasing difficult passages (LH: 2)
Analysis and Interpretation (LH: 1)
Writing for classified advertisements (LH: 2)
Using idioms and phrases (LH: 2)
One-word substitution (LH: 1)
Figures of speech: simile, metaphor, irony, personification, hyperbole (LH: 3)
Reading online content (LH: 1)
George Bernard Shaw: "Spoken English and Broken English" (LH: 4)

COURSE OUTCOME:

Besides developing the student's ability to comprehend the English that one hears and reads, the course will also enhance the student's skills at using English in speech and in various forms of writing. Thus, the course shall fulfil to a large extent an intensely felt need in today's professional world.

SKILL ENHANCEMENT COURSES

Course Code: MATH2051
Course Name: Programming in C
(Credit: 3, Marks: 50)
Total Hours: Lecture -30, Tutorial – 15

Objectives

To learn the basics of C programming and its different features viz. branching & looping, array, user defined functions, structures and pointers

Learning outcomes

On completion of the course, the student should have the following outcomes defined in terms of knowledge, skills and general competence:

Knowledge: The students would gain knowledge about the

 i. basics of C programming i.e., basic structure, keywords, identifiers, operators with operator precedence and associativity, input-output statements.
 ii. concepts of branching & looping and array.
 iii. user defined functions and their use.
 iv. use of structures and pointers.

Skills: The students would be able to

 i. learn the keywords, identifiers, different types of operators with precedence and associativity, use of formatted and non-formatted input-output statements.
 ii. use branching and looping statements for decision making.
 iii. learn the concepts of array, string handling arrays.
 iv. use library and user-defined functions along with string handling functions.
 v. write programs using structures and pointers.

General Competence: The students would gain

 i. general idea about the writing of different C programs using branching & looping statements, arrays, functions, structures and pointers.
 ii. program writing and reasoning skills which improve their thinking power.

Contents:

Introduction, basic structures, character set, keywords, identifiers, constants, variable-type declaration, operators: arithmetic, relational, logical, assignment, increment, decrement, conditional.
[L- 3H & T- 1H]

Operator precedence and associativity, arithmetic expression, evaluation and type conversion, character reading and writing, formatted input and output statements. [L- 3H & T-1H]

Decision making (branching and looping): Simple and nested *if, if – else, switch, while, do-while, for* statements. [L- 5H & T-3H]

Concept of array variables, string handling with arrays – reading and writing, string handling functions. [L- 4H &T-2H]

User defined functions, call-by-value, call-by-reference functions and their uses, return values and their types, nesting of functions, recursion. [L- 5H & T-3H]

Structures: Declaration, initialization, nested structures, array of structures, array within structures.
[L- 4H & T- 2H]

Pointers: Declaration, initialization, accessing variables through pointer, pointer arithmetic, pointers and arrays. [L- 6H & T-3H]

Reading references:

Text Books:
1. Programming in ANSI C-E. Balaguruswamy, (TMH, 2011).
2. Programming with C-B. S. Gottfried, (TMH, 2011).

Reference Books:
1. Programming with C-K. R. Venugopal and S. R. Prasad, (TMH, 1997).
2. The C Programming Language -Brian W. Kernighan and Dennis Ritchie, (Pearson Education India, 2015).
3. C Language and Numerical Methods-C. Xavier, (New Age International (P) Ltd. Pub, 2007).
4. The C Programming Language-Brian W. Kernighan / Dennis Ritchie, (Pearson Education India, 2015).

Semester-II	Course Type with Code	Name of the Course	Credit	Lect.	Tuto.	Pract./ Viva-voce	Full Marks	Distribution of Marks		
								Theory	Pract./ Viva-	Internal Assessment
	Value Added (VA) Course Code:CVA2061	Health & Wellness, Yoga Education, Sports and Fitness	4	3	0	1	100	60	20	20

Value Added (VA) Course

Course Name: Health & Wellness, Yoga Education, Sports and Fitness
Course Code: CVA2061   **Total Lecture Hours (Theory) :** 45
Credit: 4   **Total Lecture Hours (Practical):** 30

Unit- 1: Concepts of Wellness and Illness   (15 Lecture Hours)

Concept of health (Modern and Ancient View); Concept of Wellness and Illness (Modern and Ancient View); Concept of Body (Pancha Kosha according to Taittiriya Upanisada); Potential causes of illness according to Yoga Vasishta- Concept of Adhi and Vyadhi and their consequences on the body

Unit- 2: Yogic Concept on Holistic Health   (15 Lecture Hours)

Total Human Development through Yogic practices for Pancha Kosha (Annamaya Khosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha and Ananda Maya Kosha) and its integration with Ashtanga Yoga of Patanjali.

Unit- 3: Yoga as Preventive Health Care   (15 Lecture Hours)

Concept of stress according to modern science and yoga; Stress as the cause for illness; Role of Yoga in Stress Management: Holistic approach of catering to moderation in eating (yogic Diet), Sleeping (rhythm of the nature), Working (the sense of duty as per BG), Entertainment (moderation), Change in life style;

Unit-4 (Practical) : Asana   (30 Lecture Hours)

Pranayama: Anulome-Vilome, Suryabhidana, Chancrabhedana, Ujjai, Sitali

Meditation: A-U-M Meditation, Yog Nidra

Reference Books:

1. Ajith 'Yoga Pravesh' Rastrotana Paruhad Bangalore.

2. Bachelor of Sports Management Syllabus (Revised) 2008.

3. B. C. Rai Health Education and Hygiene, Published by Prakashana Kendra, Lucknow.

4. B.K.S. Iyenger 'Yoga The Path of Holistic Health', Dorling Kindersley, Delhi 2001.

5. Dixit Suresh (2006) Swasthya Shiksha Sports Publication, Delhi.

6. Puri, K. Chandra, S.S (2005) Health and Physical Education, New Delhi, Surjeet Publication.

7. A Text Book on Physical Education & Health Education Fitness, Wellness and Nutrition, Dr. A. K. Uppal, Dr. P. P. Ranganathan.

8. Warner W. K. Oeger & Sharon A. Hoeger, Fitness & Wellness, Morton Publishing Co., 1990

9. Robert Malt. 90 day Fitness Plan, D. K. Publishing, Inc. 95, Madison Avenue, New York 2001.

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