KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಬಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. (Hons.) Program

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SYLLABUS

Subject: Chemistry

[Effective from 2021-22]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,

OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and

SKILL ENHANCEMENT COURSE (SEC) FOR SEM I

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in Chemistry for B.Sc. (Hons.)

Effective from 2021-22

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	DSCC 1	Theory	04hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-1	Theory	03 hrs	42	02 hrs	40	60	100	03
	*SEC-1	Practical	03 hrs	30	02 hrs	25	25	50	02
II	DSCC2	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-2	Theory	03 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

*** Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected**

Name of Course (Subject): Chemistry

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in Chemistry students will be able to:

PO 1 Demonstrate, solve and an understanding of major concepts in all the disciplines of chemistry.

PO 2 Provide students with broad and balanced knowledge and understanding of key chemical concepts.

PO 3 Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.

PO 4 To apply standard methodology to the solutions of problems in chemistry.

PO 5 Provide students with knowledge and skill towards employment or higher education in chemistry or multi-disciplinary areas involving chemistry.

PO 6 Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.

PO 7 Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.

PO 8 Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.

PO 9 To prepare students effectively for professional employment or research degrees in chemical sciences.

PO 10 To cater to the demands of chemical industries of well-trained graduates.

PO 11 To build confidence in the candidate to be able to work on his own in industry and institution of higher education.

PO 12 To develop an independent and responsible work ethics.

B.Sc. Semester – I

Subject: Chemistry
Discipline Specific Course (DSC)

The course Chemistry in I semester has two papers (Theory Paper –I for 04 credits & Practical Paper -II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-1 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.1 (Theory): Title of the Course (Theory) **CHEMISTRY: CHM T-1**

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1 Describe the dual nature of radiation and matter; dual behavior of matter and radiation, de Broglie's equations, Heisenberg uncertainty principle and their related problems. Quantum mechanics. Derivation of Schrodinger's wave equation. Orbital shapes of *s, p, d and f* atomic orbitals, nodal planes. Electronic configurations of the atoms.

CO 2 Define periodicity, explain the cause of periodicity in properties, classify the elements into four categories according to their electronic configuration. Define atomic radii, ionisation energy, electron affinity and electronegativity, discuss the factors affecting atomic radii, describe the relationship of atomic radii with ionization energy and electron affinity, describe the periodicity in atomic radii, ionization energy, electron affinity and electronegativity.

CO 3 Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). steric effect and their applications in explaining acidic strength of carboxylic acids, basicity of amines. Understand basic concept of organic reaction mechanism, types of organic reactions, structure, stability and reactivity of reactive intermediates.

CO 4 Describe important characteristics of configurational and conformational isomers. Practice and write conformational isomers of ethane, butane and cyclohexane. Understand the various concepts of geometrical isomerism and optical isomerism. Describe CIP rules to assign E,Z notations and R& S notations. Explain D and L configuration and *threo* and *erythro* nomenclature. Explain racemic mixture and racemisation, resolution of racemic mixture through mechanical separation, formation of diastereomers, and biochemical methods, biological significance of chirality.

CO 5 Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion. Describe the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquid state. Explain properties of liquids in terms of intermolecular attractions.

CO 6 Understand principles of titrimetric analysis. Understand principles of different type's titrations. Titration curves for all types of acids – base titrations. Gain knowledge about balancing redox equations, titration curves, theory of redox indicators and applications.

CO 7 Understand titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences. Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water.

Syllabus- Course 1(Theory): Title- Chemistry	Total Hrs: 56
Unit-I ATOMIC STRUCTURE & PERIODICITY OF ELEMENTS	**14 hrs**
Atomic Structure: Review of Rutherford's atomic model, Bohr's theory, Hydrogen atomic spectra. Derivation of radius and energy of an electron in hydrogen atom, limitations of Bohr's theory, dual behavior of matter and radiation, de Broglie's equations, Heisenberg Uncertainty principle and their related problems. Quantum mechanics. Derivation of Schrodinger's wave equation for hydrogen atom and meanings of various terms in it. Significance of ψ and ψ^2. Radial and angular wave functions (atomic orbitals) and their distribution curves for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance. Quantum numbers and their significance. Orbital shapes of *s, p, d and f* atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms (atomic number up to 54). Concept of exchange energy. Anomalous electronic configurations. IUPAC nomenclature of elements with atomic number greater than hundred. **(10 Lectures)** **Periodicity of elements:** Brief account on the following properties of elements with reference to s and p-block and trends in groups and periods. Effective nuclear charge, screening effect, Slater's rules, atomic and ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, Pauling/ Allred-Rochow scales**.** Numerical problems are to be solved wherever applicable. **(04 Lectures)**	
Unit-II FUNDAMENTALS OF ORGANIC CHEMISTRY & STEREOCHEMISTRY	**14 hrs**
Fundamentals of Organic Chemistry: Review of hybridization, *sigma* and *pi* bonds. IUPAC Nomenclature of poly functional organic compounds, comparative study of bond lengths, bond angles, bond energies and dihedral angles, bond polarity, dipole moment and illustration with examples of organic compounds, delocalization, electron displacement effects and their applications: inductive effect, electrometric effect, resonance effect, hyperconjugation, and steric effect. **Organic reaction Mechanism**: Definition, classification of organic reactions: substitution, addition, elimination, rearrangement, oxidation and reduction reactions with suitable examples. Use of curved arrows, types of bond fission, electrophiles, nucleophiles, nucleophilicity, nucleofugacity and basicity. Reactive intermediates: Energy profile diagrams, structure, formation and stability and reactions of carbocations, carbanions, free radicals and carbenes. **(7 Lectures)** **Stereochemistry:** **Stereoisomersim**: Definition of stereoisomerism, conformational isomers and configurational isomers (distinction between conformation and configuration). Newman, Sawhorse and Fischer projection formulae and their interconversions. **Geometrical isomerism:** Definition, reason for geometrical isomerism, E and Z notation -CIP rules and examples, determination of configuration of geometric isomers by dipole moment method and anhydride formation method, *syn* and *anti* isomers in compounds containing C=N. **Optical isomerism:** Chirality/asymmetry, enantiomerism, diastereomerism and meso compounds. R and S notations (compounds with two asymmetric centers), D and L configurations and *threo* and *erythro* nomenclature, racemic mixture and racemization, Resolution: Definition, Resolution of racemic mixture by: i) Mechanical separation ii) Formation of diastereomers iii) Biochemical methods. Biological significance of chirality. Problems are to be solved wherever applicable. **(7 Lectures)**	
Unit-III GASES & LIQUIDS	**14 hrs**

Gaseous state: Review of kinetic theory of gases, van der Waals equation of state Boyle temperature. Molecular velocity: Maxwell's Boltzmann distribution law of molecular velocities (most probable, average and root mean square velocities). Relation between RMS, average and most probable velocity and average kinetic energies (derivation not required), law of equipartition of energy. Collision frequency, collision diameter, Collision cross-section, collision number and mean free path and coefficient of viscosity, calculation of σ and η , variation of viscosity with temperature and pressure. Critical phenomena: Andrews isotherms of CO_2, critical constants and their determination Relation between critical constants and van der Waals equation (Derivation), continuity of states, law of corresponding states. Numerical problems are to be solved wherever applicable. **(7 Lectures)** **Liquid state:** Molecular forces and general properties of liquids**.** **Surface tension:** surface tension, surface energy, effect of temperature on surface tension, shapes of liquid drops and soap bubbles, capillary action, determination of surface tension by capillary rise method, drop weight and drop number methods using stalagmometer. Effect of temperature on surface tension. Parachor, Additive and constitutive properties: atomic and structural parachor. Elucidation of structure of benzene and benzoquinone. **Viscosity**: Definition, viscosity coefficient, fluidity, molecular viscosity, relative viscosity and absolute viscosity, determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces. **Refractive index**: Definition, Specific and molar refraction. Determination of refractive index using Abbe's refractometer. Additive and constitutive properties: Elucidation of structure of molecules. Numerical problems are to be solved wherever applicable. **(7 Lectures)**	
Unit-IV ANALYTICAL CHEMISTRY	**14 hrs**
Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Accuracy, precision, selectivity and sensitivity. Method validation. Types and sources of errors in analytical measurements. Presentation of experimental data and results from the point of view of significant figures. **Titrimetric analysis**: Principle, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparation and dilution of reagents/solutions using $N_1V_1 = N_2V_2$, preparation of ppm level solutions from source materials (salts). **Acid-base titrimetry**: Theory, titration curves for all types of acids – base titrations. **Redox titrimetry**: Theory, balancing redox equations, titration curves, theory of redox indicators and applications. **Precipitation titrimetry:** Theory, titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences. **Complexometric titrimetry:** Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water. Numerical problems are to be solved wherever applicable. (**14 Lectures)**	

Recommended Books/References

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
5. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
6. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
7. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.
8. Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012) Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
9. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
10. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
11. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).
2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
8. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).
11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.
12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.
14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
15. Organic Chemistry- Mehta and Mehta, 2005.

Physical Chemistry

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill, 2007.
2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa, 2004.
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi, 2009.
4. P.W. Atkins: Physical Chemistry, 2002.
5. W.J. Moore: Physical Chemistry, 1972.
6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co. 1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.
10. Physical Chemistry - G. M. Barrow, McGraw Hill, 1986.
11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House, 1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York, 1981.

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
2. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.
4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.
6. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.

B.Sc. Semester – I

Subject: Chemistry
Discipline Specific Course (DSC)

Course No.-1 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.1 (Practical): Title of the Course (Practical) **CHEMISTRY LAB: CHM P -1:**

Inorganic and Organic chemistry practicals

Course Outcome (CO):

After completion of course (Practical), students will be able to:

CO1: Understand and practice the calibration of glasswares (burette, pipette, volumetric flask).

CO2: Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standard solutions.

CO3: Explain the principles of acid-base, redox and iodometric titrations.

CO4: Work out the stoichiometric relations based on the reactions involved in the titrimetric analysis.

CO5: Based on principles of titrimetric analysis student can perform

CO6: Describe the significance of organic quantitative analysis.

CO7: Determine the amount of phenol, aniline, amide, ester and formaldehyde in a given solution by performing blank titration and main titrations.

CO8: Determine aspirin in the tablet by hydrolysis method.

List of the Experiments for 52 hrs / Semester

Inorganic chemistry experiments

Calibration of glasswares (burette, pipette, volumetric flask)

(Primary and Secondary standard solutions, normality, molarity, molality, equivalent mass).

1. Determination of sodium carbonate using standard HCl solution (Standardize HCl solution using standard sodium carbonate solution).
2. Determination of carbonate and hydroxide present together in a mixture.
3. Determination of Mohr's salt and oxalic acid using standardized $KMnO_4$ solution.
4. Determination of ferrous and ferric ions in a solution using standard solution of $K_2Cr_2O_7$ by internal indicator method (diphenylamine or N- phenylanthranilic acid).
5. Determination of Magnesium using standard EDTA solution (Standardize EDTA solution using standard zinc sulphate solution).
6. Determination of iodine using sodium thiosulphate (Standardize sodium thiosulphate solution using standard potassium dichromate solution).

Organic chemistry experiments

7. Determination of phenol by bromination method
8. Determination of aniline by bromination method.
9. Determination of acetamide by hydrolysis method.
10. Determination of ethyl benzoate by hydrolysis method.
11. Determination of aspirin in the tablet by hydrolysis method.
12. Determination of amount of formaldehyde in the given solution by sodium sulphite method.

General instructions:

Standard solution is to be prepared by the students for both in regular and in practical examination.

In the practical examination, in a batch of ten students, five students each will be performing inorganic and organic experiments. At least two experiments from inorganic and two experiments from organic may be given. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the examination.*

Scheme of Practical Examination (distribution of marks):

For Internal and Semester end examination

1. Accuracy:	**12 Marks**
2. Technique and presentation :	**02Marks**
3. Reactions and Calculations:	**03 Marks**
4. Viva:	**05 Marks**
5. Journal:	**03 Marks**
Total	**25 marks**

Deduction of marks for accuracy(Inorganic and Organic Practicles) : : ±0.2 CC -12 marks, ± 0.4 CC- 09 marks, ±0.6 CC- 06 marks, ±0.8 CC- 03 marks, ±0.9 CC or above - 01 marks.

Recommended Books/References

1. Vogel's Textbook of Qualitative Chemical Analysis – J Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS, 1986
2. Inorganic Semi-micro Qualitative Analysis V. V. Ramanujam, The National Pub. Co., 1974
3. Practical Inorganic Chemistry G. Marr and B. W. Rackett, Von Nostrand Reinhold, 1972
4. Laboratory manual of Organic Chemistry Day, Sitaraman and Govindachai 1998
5. Text book of Practical Organic Chemistry, A. I. Vogel, 1996
6. A Handbook of Organic Analysis, Clarke and Hayes,1964
7. An introduction to practical Biochemistry, David Plummer,McGraw-Hill Publishing Co.,1992

B.Sc. Semester – I

Subject: Chemistry
Open Elective Course (OEC-1)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-1	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-1: Title of the Course **CHEMISTRY: CHM OEC-1 Chemistry in daily life**

Course Outcome (CO):

After completion of course, students will be able to:

CO1: Understand the chemical constituents in various day to day materials used by a common man like Tooth paste, Cosmetics, Soaps and detergents and Biomolecules .
CO2: Understand the chemical constituents and applications in Food additives, adulterants and contaminants, Artificial food colorants**.**

CO3: Understand the scientific reasons in various aspects and chemotherapy and its applications.

CO4: Understand the basic constituents and applications in polymers, surface coatings, fertilizers, insecticides and pesticides, chemical explosives etc.

Syllabus- OEC: Title- Chemistry in daily life	**Total Hrs: 42**
Unit-I	**14 hrs**
Household chemicals: Common chemicals used at home. **Tooth paste** – Contents of toothpaste, chemical name, ingredients, flavor and its role. **Cosmetics** – Contents and uses of Face powder, snow, lipsticks and perfumes. Toxic household chemicals and their effects (antifreeze, bleach, drain cleaners, carpet cleaners, ammonia, air fresheners). **Soaps and detergents**- Types of soaps, synthetic detergents (neutral, anionic and cationic), cleansing action of detergents. Advantages and disadvantages of detergents over soaps. **Biomolecules:** Composition and uses of Carbohydrates, proteins, oils and fats minerals and vitamins. Functions of enzymes and hormones in the human body.	
Unit-II	**14 hrs**
Food additives, adulterants and contaminants: Definition types and applications - Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. Flavours: Vanillin, alkyl esters (fruit flavours) and monosodium glutamate. **Artificial food colorants:** Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food. **Science behind** emotions, sunscreen, rust formation, rainbow, motion sickness, salt harvesting, crystallization of sugar and kidney stones. **Chemotherapy:** Drugs and their classification. Therapeutic action of different classes of the drugs *viz*. analgesics, antibiotics, antacids, antihistamines, antimicrobials, contraceptives, antipyretics, antiseptics and neurologically active drugs.	

Unit-III	14 hrs
Polymers: Examples of synthetic polymers and their uses (LDPE, HDPE, PVC, Polypropylene, nylon, teflon, polysiloxanes, polyphosphazenes and polybutadiene). **Surface Coatings:** Classification and brief introduction to surface coatings. Paints and pigments - formulation, composition and related properties. Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, Metallic coatings (electrolytic and electroless), metal spraying and anodizing. **Fertilizers:** Composition of fertilizers, uses of Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime. **Insecticides, weedicides and pesticides**: Examples, content and uses. **Chemical explosives:** Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.	

Recommended Books/References

1. Hawley's Condensed Chemical Dictionary by Richard J. Lewis. Call Number: REF 540.3 H31.
2. Van Nostrand's Encyclopedia of Chemistry by Glenn D. Considine, Call Number: REF 540.3 V33C 2005.
3. Macmillan Encyclopedia of Chemistry by Joseph J. Lagowski.
4. NCERT 12^{th} Standard Book and references therein.
5. Chemistry in Daily Life: Third Edition Paperback – 1 January 2012 by Singh K.

B.Sc. Semester - I

Subject: Chemistry
SKILL ENHANCEMENT COURSE (SEC)-I

Title of Paper: CHM SEC-1 Soil Analysis

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Mode of Examination	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
SEC-I	Theory + Practical	02	03hrs	30	Practical	2hr	25	25	50

Course Outcome (CO)

After completion of Skill Enhancement course, students will be able to:

CO1: Acquire skills for Laboratory management and routine analysis of Soil.

CO2: Improve working ability in analytical laboratory.

CO3: Helpful for obtaining jobs in various fields.

CO4: The student can start his own business /laboratory or can associate with any kind of laboratory or associated jobs with confidence.

List of the Experiments for 52 hrs / Semesters (Theory and Practical= 3Hours/Week)

Theory

1. Introduction: Definition of soil, concept of lithosphere, soil as a natural body.
   Soil Components: Air, Water, inorganic and organic solids. Formation of Soil, Types of soils & basic concepts.
2. Physical properties of Soil: Soil separates, texture, aggregation and structure, temperature and colour. Properties of soil mixture, pore space, bulk density, particle density, aeration and drainage, compaction, surface area, soil water relationships.
3. Chemical Properties of soil: Morphology of colloids, chemistry of clays, ionic exchange, acidity, alkalinity, pH, salinity, reactions in liming and acidification.
4. Biological Properties: Soil organic matter, C: N relationships, nitrogen-transformation, soil organisms, sulfur transformation.
5. Fertility of soil. Soil deficiency with respect to macro and micro nutrient components, brief study of micronutrient & macronutrient sources & importance

Practical

6. Visit to soil testing laboratory & report writing. Visit to farmers fields for collection of different types of soil samples.
7. Determination of pH and electrical conductivity of different types of soil samples
8. Determination of alkalinity and salinity of the soil sample and determination of total organic matter in the given soil Sample.
9. Determination of Ca (II) and Mg(II) ions from soil sample
10. Determination of Fe (II) and Fe (III) ions from soil sample.
11. Determination of Na and K from soil sample by flame photometry.

General instructions:

In the practical examination, in a batch of ten students, minimum three sets of experiments may be given. Selection of experiment may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the examination*

Scheme of Practical Examination (distribution of marks)

For internal and Semester end examination

1. **Three questions on the theory may be given. Student has to answer any two questions: 06 Marks**
2. **Accuracy in the practical : 08 Marks**
3. **Reactions and Calculations: 03 Marks**
4. **Viva: 05 Marks**
5. **Journal: 03 Marks**

Total 25 marks

Deduction of marks for accuracy: : ±0.2 CC -08 marks, ± 0.4 CC- 06 marks, ±0.6 CC- 04 marks, ±0.8 CC- 02 marks, ±0.9 CC or above - 01 marks.

Recommended Books/References

1. Laboratory manual for Environmental Chemistry: Sunita Hooda and Sumanjeet Kaur by S. Chand & Company 1999.
2. Soils and soil fertility, Troch, F.R. And Thompson, L.M. Oxford Press.
3. Fundamentals of soil science, Foth, H.D. Wiley Books.
4. Soil Science and Management, Plaster, Edward J., Delmar Publishers.
5. Principles of Soil Chemistry (2Wed.) Marcel Dekker Inc., New York.
6. Handbook of Agricultural Sciences, S.S. Singh, P. Gupta, A. K. Gupta, Kalyani Publication.
7. Introduction to soil laboratory manual - J. J. Harsett Stipes.
8. Introduction to soil science laboratory manual, Palmer and troch – Iowa State.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme: 2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

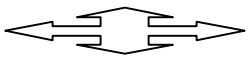
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



B.Sc. Semester – II

Subject: Chemistry
Discipline Specific Course (DSC)

The course Chemistry in I semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-2 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.2 (Theory): Title of the Course (Theory) **CHEMISTRY: CHM T-2**

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO1: Explain ionic bond, Born Lande equation ,Born Haber cycle and Fajan's rules. State VSEPR theory, hybridisation and shapes of various molecules. Understand the concept of resonance and write resonating structures of NO_3^-, CO_3^{2-} and SO_4^{2-}.

CO2: Explain MO Theory and draw the MO diagrams for homonuclear diatomic molecules and ions of 1^{st} and 2^{nd} periods and heteronuclear diatomic molecules such as CO, NO and NO^+. Compare MO and VB theory.

CO3: Learn preparation and reactions of alkanes, alkenes and alkynes. Clear the concept learning mechanism of Free radical mechanism of halogenations of alkanes. Understand the mechanisms of addition reactions of alkenes and alkynes.

CO4: Learn the concept of polymerization, ozonolysis in alkenes and alkynes. Learn acidity of alkynes, formation of metal acetylides and their applications. Explain cycloalkanes and their relative stability. Explain conformational analysis of cyclohexane with Karplus energy diagram. Axial and equatorial bonds. Relative stability of mono substituted cycloalkanes.

CO5: Expected to learn symmetry elements, unit cells, crystal systems. Learn Bravais lattice, types and identification of lattice planes. Explain laws of crystallography - law of constancy of interfacial angles, law of rational indices.

CO6: Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Explain defects in crystals. Learn the applications of liquid crystals. Learn the concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates.

CO7: Understand the concept of order and molecularity of a reaction and their applications. Define half–life of a reaction. Explain methods for determination of order of a reaction by half life period and differential equation method. Understand the concept of activation energy and its calculation from Arrhenius equation. Explain theories of reaction rates: Collision theory and activated complex theory of bimolecular reactions.

CO8: Learn principles of gravimetric analysis. Learn the precipitation, mechanism of precipitation, factors influencing precipitation, co-precipitation and post-precipitation. Learn structure, specificity, conditions and applications of organic reagents. Advantages of organic reagents over inorganic reagents.

CO9: Learn about quality of surface water, ground water. Impurities in water, standards of water quality (color, pH, hardness, TDS, sulphate, fluoride, chloride) for potable, domestic, industrial and agricultural purpose. Learn Water treatment technologies – house hold water treatment, municipal water treatment, industrial treatment (primary and secondary treatment of industrial effluent), softening of water, and disinfection of water. Determinations of DO, BOD and COD, and their significance.

Syllabus- Course 2(Theory): Title- CHEMISTRY: CHM T-2	**Total Hrs: 56**
Unit-I CHEMICAL BONDING & MOLECULAR STRUCTURE	**14 hrs**
Ionic Bonding: General characteristics of ionic compounds. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Landé equation and calculation of lattice energy. Born-Haber cycle and its applications. **Polarizing power and polarizability**: Fajan's rules, ionic character in covalent compounds and percentage of ionic character. **Covalent bonding:** General characteristics of covalent compounds. VB approach, shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures of NO_3^-, CO_3^{2-} and SO_4^{2-}. **Molecular Orbital Theory:** LCAO method, bonding and antibonding MOs and their characteristics for *s-s, s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules and ions of 1^{st} and 2^{nd} periods and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches. Numerical problems are to be solved wherever applicable.	
Unit-II ALIPHATIC HYDROCARBONS	**14 hrs**
Alkanes: Methods of preparation by catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis and from Grignard reagent. Free radical mechanism of halogenations, relative reactivity and selectivity of halogenation. Conformational analysis of ethane and butane. **Alkenes**: Methods of preparation by dehydration of alcohols and dehydrohalogenation of alkyl halides. Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. *cis* Alkenes by partial catalytic hydrogenation and *trans* alkenes by Birch reduction. Reactions: Addition of HX (Markownikov's and anti-	

Markownikov's addition) Stereospecificity of halogen addition, regioselectivity and relative rates of addition reaction. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes. Oxidative cleavage of alkenes with $KMnO_4$. Ozonolysis, mechanism of ozonolysis in propene and polymerization. **Alkadienes:** Classification, mechanism of addition of halogen and hydrogen halides in 1,3-diene, kinetically and thermodynamically controlled addition of HBr to 1,3-butadiene, polymerization and Diels-Alder reaction. **Alkynes:** Preparation: Acetylene from CaC_2 and conversion into higher alkynes by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: Acidity of 1-alkynes and formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. **(11 Lectures)** **Cycloalkanes:** Types of cycloalkanes and their relative stability. Baeyer strain theory and theory of strainless rings. Conformational analysis of cyclohexane with Karplus energy diagram. Axial and equatorial bonds. Relative stability of mono substituted cyclohexanes. **(3 Lectures)**	
Unit-III SOLIDS & CHEMICAL KINETICS	**14 hrs**
Solids: Types of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X-Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl. Defects in crystals. Liquid Crystals: Explanation, classification with examples- Smetic, nematic, cholesteric, disc shaped and polymeric. Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing. Numerical problems are to be solved wherever applicable. **(7 Lectures)** **Chemical Kinetics:** Review of reaction rates, order and molecularity. Factors affecting rates of reaction: concentration pressure, temperature, catalyst, etc. Examples for different orders of reactions. Derivation of integrated rate equations for zero and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction (numerical problems). Methods for determination of order of a reaction by half life period and differential equation method. Effect of temperature on reaction rates, temperature coefficient, Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Numerical problems are to be solved wherever required. **(7 Lectures)**	
Unit-IV ANALYTICAL CHEMISTRY	**14 hrs**
Gravimetric Analysis: Stages in gravimetric analysis, requisites of precipitation, theories of precipitation, factors influencing precipitation, co-precipitation and post-precipitation. Structure, specificity, conditions and applications of organic reagents such as salcylaldoxime, oxine, dimethyl glyoxime, cupron and cupferron in inorganic analysis. Advantages of organic reagents over inorganic reagents. **(6 Lectures)** **Water analysis:** Water availability, requirement of water. Quality of surface water and ground water. Impurities in water. Standards of water quality for potable, domestic, industrial and agricultural purpose (color, pH, alkalinity, hardness, TDS, sulphate, fluoride, chloride etc.) Water treatment technologies – house hold water treatment, municipal water treatment and industrial treatment (primary and secondary treatment of industrial effluent). Softening of water. Disinfection of water. Definition and determinations of DO, BOD and COD, and their significance. Numerical problems are to be solved wherever required. **(8 Lectures)**	

Recommended Books/References

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
5. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
6. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
7. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.
8. Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012) Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
9. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
10. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
11. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).
2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
8. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).
11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.
12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.
14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
15. Organic Chemistry- Mehta and Mehta, 2005.

Physical Chemistry

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill, 2007.
2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa, 2004.
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi, 2009.
4. P.W. Atkins: Physical Chemistry, 2002.
5. W.J. Moore: Physical Chemistry, 1972.
6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co. 1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.
10. Physical Chemistry - G. M. Barrow, McGraw Hill, 1986.

11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House, 1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York, 1981.

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
2. Environmental Chemistry-A K De
3. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.
4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.

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B.Sc. Semester – II

Subject: Chemistry
Discipline Specific Course (DSC)

Course No.-2 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.2 (Practical): Title of the Course (Practical)

CHEMISTRY LAB CHM P- 2 :Analytical and Physical chemistry practicales

Course Outcome (CO)

After completion of course (Practical), students will be able to:

CO1: Learn regarding errors, types of errors, accuracy, precision, significant figures and standard deviation. To determine the total alkalinity in antacids, Vitamin C in lemon juice/formulations. To determine free alkali present in different soaps/detergents. Learn analysis of DO in waste water sample.

CO2: To determine Chemical Oxygen Demand (COD) in waste water sample.

CO3: To determine temporary, permanent and total hardness of water by collecting different samples of water.

CO4: Enable to understand the applications of experiments like methods of determination of viscosity, surface tension, refractive index.

List of the Experiments for 52 hrs / Semesters

Analytical chemistry experiments

Explanation regarding errors, types of errors, accuracy, precision, significant figures and standard deviation (students should write in the journal regarding the above).

1. Determination of total alkalinity in antacids.
2. Determination of Vitamin C in lemon juice/formulations.
3. Determination of free alkali present in different soaps/detergents.
4. Analysis of DO in waste water sample / pond water / river water etc.
5. Determination of Chemical Oxygen Demand (COD) in waste water sample.
6. Determination of temporary, permanent and total hardness of water using standard EDTA solution
7. Determination of Ni (II) using DMG by gravimetric method.

Physical chemistry experiments

1. Determination of surface tension and parachor of alcohol series.
2. Determination of surface tension of soap solutions for various concentrations.
3. Determination of the viscosity of liquids (ethylacetate & ethyl alcohol /toluene, & chlorobenzene or any other two non hazardous liquids) using Ostwald's viscometer.
4. Study of the variation of viscosity of sucrose solution with different concentrations.
5. Determination of specific and molar refraction by Abbes refractometer (ethyl acetate, methyl acetate, ethylene chloride)
6. Determination of the composition of liquid mixture by refractometry (toluene & alcohol, water & sucrose solution).

General instructions:

In the practical examination, in a batch of ten students, five students each will be performing analytical and physical experiments. At least two experiments from analytical and two experiments from physical may be given. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. *Manual is not allowed in the examination.*

Scheme of Practical Examination (distribution of marks):

For Internal and Semester end examination

For Analytical chemistry practicals

1. Accuracy:	**12 Marks**
2. Technique and presentation :	**02Marks**
3. Reactions and Calculations:	**03 Marks**
4. Viva:	**05 Marks**
5. Journal:	**03 Marks**
Total	**25 marks**

Deduction of marks for accuracy: : ±0.2 CC -12 marks, ± 0.4 CC- 09 marks, ±0.6 CC- 06 marks, ±0.8 CC- 03 marks, ±0.9 CC or above - 01 marks.

For Physical chemistry practicals

1. Accuracy:	**12 Marks**
2. Graphs and Calculations:	**05 Marks**
3. Viva:	**05 Marks**
4. Journal:	**03 Marks**
Total	**25 marks**

Deduction of marks for accuracy: Error up to 5% - 12 marks, 6 - 10% 09 marks, 11-15% 6 marks, 16 or above 3 marks.

Recommended Books/References

1. Findlay 's practical physical chemistry revised by levitt, Longman's, London, 1968
2. Experiments in Physical Chemistry, Shoemaker and Garland, McGraw Hill International, 1996
3. Colorimetric Determination of Traces of metals B. Sandell
4. Analytical Chemistry G. D. Christian, 4th ed., Wiley, 1986

B.Sc. Semester – II

Subject: Chemistry
Open Elective Course (OEC-2)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-2	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-2: Title of the Course: **CHEMISTRY: CHM OEC-2 Molecules of Life**

Course Outcome (CO)

After completion of course, students will be able to:

CO1: Acquire knowledge about different types of sugars and their chemical structures. Identify different types of amino acids and determine the structure of peptides.

CO2: Explain the actions of enzymes in our body and interpret enzyme inhibition. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism. Differentiate RNA and DNA and their replication. Explain production of energy in our body.

Syllabus- OEC: Title- CHEMISTRY: CHM OEC-2 Molecules of Life	**Total Hrs: 42**
Unit-I	**14 hrs**
Carbohydrates: Sugars, non sugars, reducing and non-reducing sugars. Occurrence and general properties of glucose and fructose. Open chain and Haworth ring structures of glucose and fructose. Epimers, mutarotation and anomers. Disaccaharides: Occurance of disaacharides (Sucrose, Maltose and Lactose). Glycosidic linkage in disaccharides. Ring structures of sucrose, maltose and lactose. Polysaccharides: Starch – monomer units, glycosidic linkage, components-difference in their structure (explanation only) and solubility in water. Cellulose and glycogen– monosaccharide, glycosidic linkage, structure (explanation only). Biological importance of carbohydrates. **(8 Lecturers)** **Amino Acids, Peptides and Proteins :**α- amino acids , general formula, zwitter ion form of α- amino acid, general formula. Isoelectric point and its importance. Classification of amino acids as essential and non-essential- examples. Configuration of optically active α-amino acids (found in proteins). Peptide bond. Proteins: classification based molecular shape –fibrous and globular, examples. Structure of protein – qualitative idea about primary, secondary, tertiary, and quaternary structures (diagrams not required). Denaturation of protein. **(6 lectures)**	

Unit-II	14 hrs
Enzymes and correlation with drug action: Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Noncompetitive inhibition including allosteric inhibition). **(6 lectures)** **Drug action**- Receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH_2 group, double bond and aromatic ring. **(3 lectures)** **Oils and fats** Biological Importance of oils and fats. Fatty acids (saturated, unsaturated fatty acids, formation of triglycerides and general formula of triglycerides. Chemical nature of oils and fats-saponification, acid hydrolysis, rancidity and its prevention methods, refining of oils, hydrogenation of oils, drying of oils. Iodine value. Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol). **(5 lecturers)**	
Unit-III	**14 hrs**
Nucleic Acids : Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation. **(8 lectures)** **Vitamins and Hormones:** Classification and biological significance, source and structure of Vitamin A, B1 (thiamine), B2 (riboflavin), B6 (pyridoxine), α-tocopherol, K1 (phylloquinone), C (ascorbic acid). Deficiency diseases of vitamins. **Hormones:** definition, classification with examples, functions and deficiency diseases of hormones. **(6 lectures)**	

Recommended Books/References

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed.,
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, 2002.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

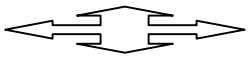
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



KARNATAK UNIVERSITY, DHARWAD

B. Sc. CHEMISTRY SEMESTER I

Name of College: **Code No. :**

Key to distribution format for practical Examinations (Inorganic Chemistry and Organic Chemistry)

Month and Year: **Date:** **Time:** **Batch No. :**

TABLE No.	Exam. Reg. No.	Vol. of solution / amount of substance given	Expected result (B. R / amount)	Found result (B. R / amount)	Difference or % of error	Marks for Accuracy (Max. 12)	Marks for Reactn. and calctn. (Max. 3)	Marks for Tech. and Presnt. (Max. 2)	Marks for Journal (Max. 3)	Marks for Viva (Max. 5)	Total (Max. 25)

Name and Signature of internal Examiner

Name and Signature of External examiner

KARNATAK UNIVERSITY, DHARWAD

B. Sc. CHEMISTRY SEMESTER II

Name of College: **Code No. :**

Key to distribution format for practical Examinations (Analytical Chemistry and Physical Chemistry)

Month and Year: **Date:** **Time:** **Batch No. :**

TABLE No.	Exam. Reg. No.	Vol. of solution / experiment given	Expected result (B. R / values)	Found result (B. R / values)	Difference or % of error	Marks for Accuracy (Max. 12)	Marks for Reactn. and calculations (Max. 5)	Marks for Tech. and Presnt. (Max. 5)	Marks for Journal (Max. 5)	Marks for Viva (Max. 5)	Total (Max. 35)

Name and Signature of internal Examiner

Name and Signature of External examiner