SYLLABUS (NEP-2020)
ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)

FIRST SEMESTER

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BL101	**Kannada-1**	AECC	2	1	0	3	3

Course Objectives:
ಘಟಕ-1.
ಭ್ಯೆರುವನ ರಥಕ್ಕೋಗನ ಬನ್ನಿರೋ-ಜನಪದ ಗೀತ
ಕೆರೆಗೆ ಹಾರ -ಜನಪದ ಗೀತೆ
ಯಾವ ಕಾಲದ ಶಾಸ್ತ್ರವೇನು ಹೇಳಿದರೇನು – ಕುವೆಂಪು.
ಗಂಗಾವತರಣ- ಅಂಬಿಕಾತನಯದತ್ತ.

ಘಟಕ 2. ವಚನಗಳು
ಆಚಾರವೇ ಸ್ವರ್ಗ, ಅನಾಚಾರವೇ ನರಕ -ಬಸವಣ್ಣನ ವಚನಗಳು
ಬೇವಿನ ಹಣ್ಣ ಮೆಲ್ಲನೆ ಚುಂಬಿಸಿದರೆ ಇನಿದಹುದೆ - ಅಲ್ಲಮಪ್ರಭುವಿನ ವಚನಗಳು
ಕೇಡಿಲ್ಲದ ರೂಹಿಲ್ಲದ ಚೆಲುವಂಗಾನೊಲಿದೆನವ್ವಾ- ಅಕ್ಕಮಹಾದೇವಿ ವಚನಗಳು
ಘಟಕ-3.   ಸಣ್ಣ ಕಥೆಗಳು
ತುರುಚೆ ಸೊಪ್ಪಿನ ಚಿಕಿತ್ಸೆ-ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ
ಧನಿಯರ ಸತ್ಯನಾರಾಯಣ-ಕೊರಡ್ಕಲ್ ಶ್ರೀನಿವಾಸರಾವ್
ಜ್ಯೋತಿಷಿಯ ಒಂದು ದಿನ-(ಆರ್ ಕೆ ನಾರಾಯಣ್) ಅನುವಾದ ಡಾ. ಎಚ್ ರಾಮಚಂದ್ರಸ್ವಾಮಿ

ಘಟಕ 4.   ಆತ್ಮಚರಿತ್ರೆ
ಡಾ. ಎ.ಪಿ.ಜೆ ಅಬ್ದುಲ್ ಕಲಾಂ (ನನ್ನ ಪಯಣ- ಅನುವಾದ-ಜಿ.ಕೆ. ಮಧ್ಯಸ್ಥ)
ಎಂಟರ ವಯಸ್ಸಿನ ಕೆಲಸದ ಹುಡುಗ
ನಾನು ಸೋತಾಗ
ಬೆಂಕಿ ಒಡನೆ ಮುಖಮುಖಿ

ಪರಾಮರ್ಶನ ಪುಸ್ತಕಗಳು
ಕೆ.ಆರ್ ಕೃಷ್ಣಸ್ವಾಮಿ (ಸಂಪಾದಕರು), ಆದಿಚುಂಚನಗಿರಿ- ಜನಪದ ಗೀತೆಗಳ ಸಂಗ್ರಹ,ಶ್ರೀ ಆದಿಚುಂಚನಗಿರಿ ಮಹಾಸಂಸ್ಥಾನ ಮಠ, ನಾಗಮಂಗಲ ತಾಲೂಕು ಮಂಡ್ಯ ಜಿಲ್ಲೆ, 1961.
ಬಿ ಎಂ ಶ್ರೀಕಂಠಯ್ಯ (ಸಂಪಾದಕರು), ಕೆರೆಗೆ ಹಾರ, ಕನ್ನಡ ಬಾವುಟ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು 2004.
ಕುವೆಂಪು,ಕೋಗಿಲೆ ಮತ್ತು ಸೋವಿಯತ್ ರಷ್ಯಾ, ಉದಯರವಿ ಪ್ರಕಾಶನ, ಮೈಸೂರು,1944.
ಅಂಬಿಕಾತನಯದತ್ತ, ಗಂಗಾವತರಣ, 1944
ಪ್ರೊ. ಕೆ ಮರುಳಸಿದ್ದಪ್ಪ ಹಾಗೂ ಪ್ರೊ. ನಾಗರಾಜ(ಸಂಪಾದಕರು),ವಚನ ಕಮ್ಮಟ, ಪ್ರಸಾರಾಂಗ ಬೆಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಬೆಂಗಳೂರು, 1979
ಡಾ.ಎಲ್. ಬಸವರಾಜು (ಸಂಪಾದಕರು) ಬಸವಣ್ಣನವರ ವಚನಗಳು, ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು, 1952.
ಡಾ.ಎಲ್. ಬಸವರಾಜು (ಸಂಪಾದಕರು) , ಮೈಸೂರು, ಅಲ್ಲಮನ ವಚನ ಚಂದ್ರಿಕೆ- ಪ್ರಭುದೇವರ ವಚನಗಳು, ನಳಿನಿ ಶಂಕರ ಪ್ರಕಾಶನ, ಮೈಸೂರು
ಕೆಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ ಅವರ ಅಣ್ಣನ ನೆನಪು ಕೃತಿಯಿಂದ ಆಯ್ದುಕೊಳ್ಳಲಾಗಿದೆ., ಪುಸ್ತಕ ಪ್ರಕಾಶನ,

ಮೈಸೂರು, 1996.

ಕೊರಡ್ಕಲ್ ಶ್ರೀನಿವಾಸರಾವ್, ನಂದಾದೀಪ, 1938.

ಇಂಗ್ಲಿಷ್ ಮೂಲ: ಆರ್ ಕೆ ನಾರಾಯಣ್, (ಅನುವಾದ: ಡಾ.ಎಚ್ ರಾಮಚಂದ್ರಸ್ವಾಮಿ), ಮಾಲ್ಗುಡಿಯ ದಿನಗಳು, ಪ್ರಕಾಶಕರು ಪ್ರಿಸಂ ಬುಕ್ ಪ್ರೈವೇಟ್ ಲಿಮಿಟೆಡ್, ಬೆಂಗಳೂರು, 2009.

ಎ.ಪಿ.ಜೆ ಅಬ್ದುಲ್ ಕಲಾಂ, (ಅನುವಾದ: ಜಿ.ಕೆ. ಮಧ್ಯಸ್ಥ),ನನ್ನ ಪಯಣ,ವಸಂತ ಪ್ರಕಾಶನ,ಬೆಂಗಳೂರು,2013.

ಎ.ಪಿ.ಜೆ ಅಬ್ದುಲ್ ಕಲಾಂ, (ಅನುವಾದ: ಜಿ.ಕೆ. ಮಧ್ಯಸ್ಥ),ಟರ್ನಿಂಗ್ ಪಾಯಿಂಟ್,ವಸಂತ ಪ್ರಕಾಶನ, ,ಬೆಂಗಳೂರು,2012.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BL102	**Hindi-1**	AECC	2	1	0	3	3

पाठ्यक्रम रूपरेखा :
यह पाठ्यक्रम नौसिखिया, अपनी भाषा की क्षमता का विकास करने हेतु तथा विभिन्न साहित्यिक प्रक्रियाओं द्वारा समाज, संस्कृति एवं जीवन के मूल्यों को समझने हेतु अभिकल्पित है |

पाठ्यक्रम उद्देश्य :
- संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
- साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना |
- छात्रों में पुस्तक पठन एवं लेखन की अकृत्रिम प्रवृति स्थापित करना |
- अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

अधिगम परिणाम :
अध्ययन की समाप्ति पर अध्येयता –
- सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
- साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
- समाज में अंतर्निहित पद्धतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |

अध्ययन विषय सूची / पाठ्यक्रम

इकाई – 1: कहानी, संस्मरण   **अध्यापन अवधियाँ :** 12 hrs.
1. कहानी – नशा – प्रेमचंद
2. कहानी – सुखमय जीवन – चंद्रधर शर्मा गुलेरी
3. संस्मरण – शरत के साथ बिताया कुछ समय – अमृतलाल नागर

इकाई – 2: कहानी, आत्मकथा   **अध्यापन अवधियाँ :** 14 hrs.
4. कहानी – मरने से पहले – भीष्म साहनी
5. कहानी – लाल हवेली – शिवानी
6. आत्मकथा – जेल– झलक की जीवन - गणेश शंकर विद्यार्थी

इकाई – 3: कहानी, व्यंग्य रचना   **अध्यापन अवधियाँ :** 14 hrs.
7. कहानी – चाय का एक प्याला – कैथरीन मैन्सफील्ड
8. व्यंग्य रचना – भेड़े और भेडियें – हरिशंकर परसाई

इकाई – 4: अनुवाद, संक्षेपण   **अध्यापन अवधियाँ :** 14 hrs.
अनुवाद : अंग्रेज़ी – हिन्दी (शब्द एवं अनुच्छेद)
संक्षेपण : परिच्छेद का एक तिहाई भाग में |
सन्दर्भ ग्रंथ :
- पाठ्य पुस्तक – रेवा विश्वविद्यालय
- सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
- अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
- हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
- आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
- हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह

- शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
- कार्यालय अनुवाद निदेशिका
- संक्षेपण और पल्लवन - के.सी.भाटिया&तुमन सिंग

सूचना : पाठ ३. प्रणाम और ६. निराला : एक आकर्षित व्यक्तित्व के स्थान पर ३. शरत के साथ बिताया हुआ कुछ समय और ६. जेल जीवन की झलक पाठ को चयन करके, पाठ्यक्रम में संशोधन किया गया है |

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BL103	**ENGLISH - I**	AECC	2	1	0	3	3

Course Objectives:

1. To equip students with the ability to acquire the functional use of language in context.
2. To motivate the students to explore and critique issues related to society and Ethics.
3. To develop in the students a genuine habit of reading and writing leading to effective and efficient communication.

Course Outcomes:

On completion of the course, learners will be able to:
1. Demonstrate ethical responsibilities in taking cognizance of issues relating to society and values.
2. Develop an understanding of literature in context.
3. Interpret and paraphrase their ideas logically and cohesively.
4. Illustrate the systems and ideologies inherent in the society.

Course Contents:

Unit-I: Values and Ethics   **14 Hrs**
Literature:
Rabindranath Tagore - Where the Mind is Without Fear,William Wordsworth – Three Years She Grew in Sun and Shower,Saki – The Lumber-room,William Shakespeare – Extract from *Julius Caesar* (Mark Antony's Speech) Language: Vocabulary Building

Unit-II: Natural & Super Natural   **14 Hrs**
Literature:John Keats – La Belle Dame Sans MerciCharles Dickens – The Signal Man
Hans Christian Anderson - The Fir TreeWilliam Shakespeare – An Excerpt from *The Tempest*
Language:Collective Nouns

Unit-III: Travel and Adventure   **14 Hrs**
Literature:R.L. Stevenson – Travel,Elizabeth Bishop - The Question of Travel,H.G. Wells – The Magic Shop,Jonathan Swift – Excerpt from *Gulliver's Travels Book – I*
Writing Skills:Travelogue

Unit-IV: Success Stories   **14 Hrs**
Literature:Emily Dickinson – Success is Counted SweetestRupert Brooke – Success
Dr. Martin Luther King - I Have a DreamHelen Keller – Excerpt from *The Story of My Life*
Writing Skills:Brochure &Leaflet

Reference Books:

1. Tagore, Rabindranath. *Gitanjal*i. Rupa Publications, 2002.
2. Wordsworth, William. *The Complete Works of William Wordsworth*. Andesite Press, 2017.
3. Munro, Hector Hugh. *The Complete Works of Saki*. Rupa Publications, 2000.
4. Shakespeare, William. *The Complete Works of William Shakespeare*. Sagwan Press, 2015.
5. Chindhade, Shirish. *Five Indian English Poets: Nissim Ezekiel, A.K. Ramanujan, ArunKolatkar, DilipChitre, R. Parthasarathy*. Atlantic Publications, 2011.
6. Dickens, Charles. *The Signalman and Other Horrors: The Best Victorian Ghost Stories of Charles Dickens: Volume 2*. Createspace Independent Publications, 2015.
7. Anderson, Hans Christian. *The Fir Tree*. Dreamland Publications, 2011.
8. Colvin, Sidney (ed). *The Works of R. L. Stevenson. (Edinburgh Edition)*. British Library, Historical Prints Edition, 2011.
9. Bishop, Elizabeth. *Poems*. Farrar, Straus and Giroux, 2011.
10. Swift, Jonathan. *Gulliver's Travels*. Penguin, 2003.
11. Dickinson, Emily. *The Complete Poems of Emily Dickinson*. Createspace Independent Publications, 2016.
12. Brooke, Rupert. *The Complete Poems of Rupert Brooke*. Andesite Press, 2017.
13. King, Martin Luther Jr. &James M. Washington. *I Have a Dream: Writings And Speeches That Changed The World.* Harper Collins, 1992.
14. Keller, Helen. *The Story of My Life*. Fingerprint Publishing, 2016.
15. Green, David. *Contemporary English Grammar Structures and Composition*. New Delhi: MacMillan Publishers, 2010.
16. Thorpe, Edgar and Showick Thorpe. *Basic Vocabulary*. Pearson Education India, 2012.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BL104	**FUNCTIONAL ENGLISH - I**	AECC	2	1	0	3	3

Course Objectives:
1. To develop basic communication skills in English for the learners of Bachelor of Science.
2. To prioritize listening and reading skills among the learners.
3. To simplify writing skills needed for academic as well as workplace context.
4. To examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

Course Outcomes:
On completion of the course, students will be able to:
1. Interpret audio files and comprehend different spoken discourses/ excerpts in different accents (Listening Skills).
2. Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies (Speaking Skills).
3. Make use of reading different genres of texts adopting various reading strategies (Reading Skills).
4. Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic (Writing Skills).

Course Contents:
Unit-I: Functional English 12 Hrs
Grammar: Prepositions; Modal Auxiliaries, Listening: Listening to audio (verbal & sounds)
Speaking: Debating Skills, Reading: Skimming a reading passage; Scanning for specific information,
Writing: Email communication

Unit-II: Interpersonal Skills 12 Hrs
Grammar: Tenses; Wh-questions, Listening& Speaking: Listening and responding to video lectures / talks, Reading: Reading Comprehension; Critical Reading; Finding key information in a given text, Writing: Process descriptions (general/specific); Recommendations

Unit-III: Multi tasking Skills 12 Hrs
Grammar: Conditional Sentences, Listening & Speaking: Listening to specific task; focused audio tracks and responding, Reading: Reading and interpreting visual material, Writing: Channel conversion (flowchart into process); Types of paragraph (cause and effect / compare and contrast / narrative / analytical); Note Taking/ Note Making

Unit-IV: Communicative Skills 12 Hrs
Grammar: Direct and indirect speech, Listening & Speaking: Watching videos / documentaries and responding to questions based on them; Role plays, Reading: Making inference from the reading passage; predicting the content of a reading passage, Writing: Interpreting visual materials (line graphs, pie charts etc.); Different types of Essay Writing

Reference Books:

Green, David. *Contemporary English Grammar Structures and Composition*. New Delhi: MacMillan Publishers, 2010.

1. Thorpe, Edgar and Showick Thorpe. *Basic Vocabulary*. Pearson Education India, 2012.
2. Leech, Geoffrey and Jan Svartvik. *A Communicative Grammar of English*. Longman, 2003.
3. Murphy, Raymond. *Murphy's English Grammar with CD*. Cambridge University Press, 2004.
4. Rizvi, M. Ashraf. *Effective Technical Communication*. New Delhi: Tata McGraw-Hill, 2005.
5. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 2011.
6. Sen et al. Communication and Language Skills. Cambridge University Press, 2015.
7. Leech, Geoffrey and Jan Svartvik. *A Communicative Grammar of English*. Longman, 2003.
8. Murphy, Raymond. *Murphy's English Grammar with CD*. Cambridge University Press, 2004

Theory - 04 Hours/Week (04 Credits); Practical - 04 Hours/Week (02 Credits)
SYLLABUS: DSC-1: Physics-1:

Semester	Discipline Specific Course Theory (DSC) (4+0+0)	Discipline Specific Course Practical (DSCP) (0+0+2)	Discipline Specific Elective (DSE)/ Open Elective (OE) (3+0+0)
I	DSC-1: Physics-1	DSCP-1: Physics Practical-1	OE-1: Chemistry In Daily Life OE-1: Energy sources OE-1: Optional mathematics-1
II	DSC-2: Physics -2	DSCP-2: Physics Practica-2	OE-2: Molecules of Life OE-2: Astronomy OE-2: Optional mathematics-2

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BPT105	**Mechanics and Properties of Matter**	**DSC-1**	3	1	0	4	4

Course Objectives:

The Objectives of this course are to make students to learn:

1. The basics concepts of the behavior of physical bodies it provides the relation of motion of all the objects around us in our daily life.

2. To make the students to have a firm grasp of the theories that forms the basis of mechanics and understands the role of gravity in our life.

3. It gives the details of the physical properties of the materials.

Course Outcomes:

1. Understand the vector representations, motion of the objects and apply them to ascertain the state of the systems.

2. Learned conservation laws of linear and angular momentum and apply them to solve problems

3. Acquire the knowledge of basics of the Kepler's laws, gravitation, potentials and fields.

4. Gain the knowledge about the properties of materials like elasticity, elastic constants and their relation, torsion of the wire and cylinder and bending of the beam.

5. Understand the concepts of the motion of the fluids and gain the knowledge of the different physical properties, such as, surface tension and viscocity.

6. Demonstrate quantitative problem solving skills in all the topics covered. (Application)

DSC-1: Physics-1: Mechanics and Properties of Matter

Unit–1   **14 Hours**

Vector Analysis: Vectors: types and representation, scalar and vector fields, dot product and cross product, triple product, Vector Calculus: Differentiation of vector, Del operator, gradiant, divergence and curl. Gauss, Stoke and Green's theorem.

Mechanics of a particle: **Momentum and Energy**: Work and energy, Principles of conservation of linear momentum, energy and angular momentum with examples, Rotational motion: angular velocity, angular acceleration, angular momentum, torque, Motion of charged particle in crossed electrical and magnetic field (without derivation). Motion of rockets.

Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.

Unit–2 **14 Hours**

Laws of Motion: Newton's Laws of motion. Dynamics of single and a system of particles. Centre of mass.

Dynamics of rigid bodies: Moment of inertia (MI), Physical significance of MI, theroems of parallel and perpendicular axis, formulation of moment of inertia, Pendulums: Compound, Kater's pentdulums and applications**.**

Gravitation: Law of gravitation, Gravitational field and potential, Gravitational potential energy, escape velocity and gravitational potential due to thin uniform spherical shell and solid sphere of uniform density. Conservative forces and inverse square law, Kepler's laws.

Unit–3 **14 Hours**

Elasticity: Hooke's law-Stress-strain diagram, elastic moduli, elastic constants -relation between elastic constants, Poisson's Ratio-expression for Poisson's ratio in terms of elastic constants.

Torsion: Torsion of cylinder and bending of beam, cantilever, shape of girder.

Unit–4 **14 Hours**

Surface Tension: Definition of surface tension. Surface energy, relation between surface tension and surface energy, pressure difference across curved surface example, excess pressure inside spherical liquid drop, angle of contact. Jaegear's method.

Viscosity: Streamline flow, turbulent flow, equation of continuity, determination of coefficient of viscosity by Poisulle's method, Stoke's method, Applications of viscosity.

Reference Books:

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Mechanics by, New Eition	D. S. Mathur	S.Chand & Co.	2000
2	Mechancis and Rela-tivityby 3rd Edition,	Vidwan SinghSoni,	PHI Learning Pvt.Ltd.	
3	Mechanics Berkeley Physics Course, Vol.1:	Charles Kittel, *et.al*.	Tata McGraw-Hill	2007
4	Mechanics – Part I and part II	Narayanamoorthy	National Publishing Company	

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BPP105	Physics Practical-1	DSCP-1	0	0	4	2	4

Course Objectives:

The mechanics related experiments included in this course enable the students to understand the theory better and develop the application skills in a practical situation.

Course objectives are:

1. Enable students to apply knowledge of Physics and engineering in calculating the elastic properties of materials.
2. Impart knowledge to use the techniques, modern engineering tools necessary for material testing.
3. Facilitate students to use the techniques, skills for testing of fluid properties.
4. Develop ability to communicate effectively the mechanical properties of materials.

Course Outcomes:

After successful completion of the courses students shall be able to:

1. Compute the values of moment of inertia, mass and density and elastic properties of a given material through experiment.
2. Compute the liquid properties like surface tension and viscosity of the given liquid through experiment.
3. Calculate acceleration due to gravity through experiment.

List of Experiments

1. Determination of moment of inertia of a Fly Wheel.

2. Determination of rigidity modulus using torsional pendulum.

3. Modulus of rigidity of a rod – Static torsion method.

4. Determination of elastic constants of a wire by Searle's method.

5. Viscosity by Stoke's method.

6. Verification of Hook's law.

7. Determination of surface tension of a liquid and the interfacial tension between two liquids using drop weight method.

8. Study of motion of a spring and to calculate Spring constant, g and unknown mass.

9. Determination of Young's modulus of a bar by the single cantilever method.

10. Determination of Young's modulus of a bar by uniform bending method.

11. Radius of capillary tube by mercury pellet method.

12. Verification of parallel and perpendicular axis theorems.

(Minimum EIGHT experiments have to be carried out)

Reference Book for Laboratory Experiments

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics through experiments	B.Saraf	Vikas Publications	2013
2	A lab manual of Physics for undergraduate classes, 1st Edition,		Vikas Publications.	
3	BSc Practical Physics Revised Ed	CL Arora	S.Chand & Co.	2007
4	An advanced course in practicalphysics.	D. Chatopadhyay, PC Rakshit, B.Saha	New Central Book Agency PvtLtd.	2002

Programme Structure for Bachelor of Science (Basic/Hons.)
Chemistry as Core subject: I and II semesters

Semester	Discipline Specific Course Theory (DSC) (4+0+0)	Discipline Specific Course Practical (DSCP) (0+0+2)	Discipline Specific Elective (DSE)/ Open Elective (OE) (3+0+0)
I	DSC-1: Chemistry-1	DSCP-1: Chemistry Practical-1	OE-1: Chemistry In Daily Life OE-1: Energy sources OE-1: Optional mathematics-1
II	DSC-2: Chemistry-2	DSCP-2: Chemistry Practical-2	OE-2: Molecules of Life OE-2: Astronomy OE-2: Optional mathematics-2

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BCT106	Chemistry-1	**DSC-1**	3	1	0	4	4

Theory - 04 Hours/Week (04 Credits); Practical - 04 Hours/Week (02 Credits)
SYLLABUS: DSC-1: Chemistry-1:

Course Objectives:

To study Concepts of definition of analysis, determination, measurement, techniques and methods. Classification of analytical techniques, calibration of glassware. Bohr's theory, its limitations and atomic spectrum of hydrogen atom Shapes of s, p, d and f orbitals. Classification and nomenclature of organic compounds, Strengths of Organic acid and bases. Phase equilibria and Types of adsorption, characteristics of adsorption.

Course Outcomes:

After studying this course student will be able to understand:

➢ The concepts of chemical analysis, accuracy, precision and statistical data treatment.

➢ Prepare the solutions after calculating the required quantity of salts in preparing the

reagents/solutions and dilution of stock solution..

➢ Pauli's exclusion principle, Hund's rule, Aufbau's principle and its limitation.
➢ The concepts of Organic reactions and techniques of writing the movement of electrons, bond breaking, bond forming.
➢ The Concept of aromaticity, resonance, hyper conjugation, etc.
➢ 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.
➢ Understand the preparation and reactions of alkanes.
➢ Understand the stability and conformational analysis of cycloalkanes.
➢ Understand the concept of resonance, aromaticity and anti-aromaticity.
➢ Describe relative strength of aliphatic and aromatic carboxylic acids.
➢ 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.
➢ Unimolecular and bimolecular reactions

UNIT –I: Analytical chemistry   14 Hours
Periodic Table and Periodicity Modern periodic law: Division of elements into s, p, d & f blocks based on their outer shell configuration. Periodic properties-periodicity & causes of periodicity.
i. Atomic radius – definitions of covalent, metallic & vanderwall's radius; calculation of atomic radius from inter nuclear distance.
ii. Ionic radius –definition; calculation of iso electronic ions by paulings method.
iii. Ionization energy and electron affinity,-definations; principles of methods of determination.
iv. Electronegetivity evaluation by Paulings and Mullikan's methods.
Trends of the above properties across a period and down a group. Application of the above in predicting oxidizing / reducing property across a period. Comparative study of groups 1,2, 16 and 17 with respect to electronic configuration, atomic and ionic radii, ionization energy, electronegetivity and compound (halides, oxides and carbonates of groups 1 and 2; detailed comparative study of diagonal relationship between Li and Mg, cause for diagonal relationship ; hydrides of group 16 and 17) Applications of electronegetivity.

UNIT-II: Inorganic Chemistry.   14 Hours
Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance. Quantum numbers and their significance.
 Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams.Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations-Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening

effect, Slater's rules Problems. Variation of effective nuclear charge in Periodic Table.

UNIT-III: Basic Organic Chemistry   14 Hours

Classification and nomenclature of organic compounds, IUPAC recommendations for naming simple aliphatic, alicyclic and aromatic compounds. Strengths of Organic acid and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphatic and aromatic carboxylic acids-Acetic acid and chloroacetic acid, acetic acid and propionic acid, acetic acid and Benzoic acid. Inductive, resonance, mesomeric, conjugation, electromeric and hyperconjugative effects. Reactive intermediates: Homolytic and heterolytic cleavages - carbocations, carbanions, free radicals, carbenes - stability, generation and fate. Aromaticity – Huckel"s rule – benzene and heterocyclic compounds

UNIT-IV: Physical Chemistry   [14 Hours]

PHASE EQUILIBRIA: Terminology – phase, components, degree of freedom. Gibb"s phase rule, derivation of phase rule. One component system – water, sulphur and carbon dioxide, two component system. lead-silver system, bismuth-cadmium. simple, eutectic system, thermal analysis of cooling curves Freezing mixture: acetone-dry ice. Two component system with compound formation. Three component system (water, toluene and alcohol and Urea, KCl and water).

SURFACE CHEMISTRY: Types of adsorption, characteristics of adsorption, types of adsorption (physisorption and chemisorption). Adsorption isotherms (Freundlich and Langmuir isotherms derivation)– Unimolecular and bimolecular reactions surface reactions (Langmuir Rideal and Hinshelwood mechanism). Applications of adsorption.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BCP106	Chemistry-1	**DSCP-1**	**0**	**0**	**4**	**2**	**4**

DSCP-1 List of Experiments
Course Objectives:
To study Concepts of
➢ Basic concepts of titrimetric analysis, iodometric titrations.
➢ Organic quantitative analysis .
➢ Preparation of organic compounds.

Course Objectives:
After studying this course and performing the experiments set in it, student will be able to understand:
➢ Basic concepts involved in titrimetric analysis, primary standard substances, preparation ofstandard solutions.
➢ Explain the principles of acid-base, redox and iodometric titrations.
➢ Work out the stoichiometry relations based on the reactions involved in the titrimetric analysis.
➢ Describe the significance of organic quantitative analysis.
➢ Understand the preparation of organic compounds involving addition, substitution, hydrolysis, diazotization and condensation reactions.

PART-A: Inorganic Chemistry
1. Preparation of standard sodium carbonate solution and standardization of hydrochloric acid solution (methyl orange indicator). Estimation of sodium hydroxide present in the solution using phenolphthalein indicator.
2. Determination of carbonate and hydroxide present in a mixture.
3. Determination of oxalic acid and sodium oxalate in a given mixture using standard KMnO4/NaOH solution.
4. Estimation of ferrous and ferric iron in a given mixture using standard potassium dichromate solution.
5. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of hydrogen peroxide present in the solution.
6. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of ferrous ammonium sulphate present in the solution.

PART-B Organic Chemistry
1. Preparation of acetanilide from aniline.

2. Synthesis of p-nitro acetanilide from acetanilide using nitrating mixture.
3. Bromination of acetanilide.
4. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid
5. Synthesis of diazoaminobenzene from aniline.
6. Preparation of dibenzalacetone .

REFERENCE BOOKS

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, 5 Edition, Oxford University Press (2011-2012).
[9]. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry.John Wiley & Sons, 1974.
[10]. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
[11]. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
[12]. 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, PHI Learning Pvt. Ltd, New Delhi,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.

[2]. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.

[3]. 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.

[4]. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.

[5]. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
      Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage

Programme Structure for Bachelor of Science (Basic/Hons.)
Mathematics as Core subject: I and II semesters

Semester	Discipline Specific Course Theory (DSC) (4+0+0)	Discipline Specific Course Practical (DSCP) (0+0+2)	Discipline Specific Elective (DSE)/ Open Elective (OE) (3+0+0)
I	DSC-1: Mathematics -1	DSCP-1: Mathematics Practical-1	MOE-1: Optional mathematics-1
II	DSC-2: Mathematics -2	DSCP-2: Mathematics Practica-2	MOE-1: Chemistry In Daily Life MOE-1: Chemistry In Daily Life

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BMT107	**Mathematics-I**	**DSC-1**	**3**	**1**	**0**	**4**	**4**

Course Objectives:

To study Concepts of matrix representation, theory of equations, polar coordinates and Successive Differentiation and Integral Calculus.

Course Learning Outcomes: This course will enable the students to

• Learn to solve system of linear equations.

• Solve the system of homogeneous and non-homogeneous linear of m equations in n variables by using concept of rank of matrix.

• Students will be familiar with the techniques of integration and differentiation of function with real variables.

• Students learn to solve polynomial equations.

• Learn to apply Reduction formulae.

Theory - 04 Hours/Week (04 Credits); Practical - 04 Hours/Week (02 Credits)
SYLLABUS: DSC-1: Mathematics -1:

Unit-I: 14 Hours

Matrix: Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction to Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof).

Unit-II: 14 Hours

Theory of equations: Euclid's algorithm, Polynomials with integral coefficients, Remainder

theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions.

Unit-III: 14 Hours

Polar Co-ordinates: Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian.

Unit-IV: 14 Hours

Successive Differentiation and Integral Calculus-I: nth Derivatives of Standard functions e^{ax+b}, a^x, $(ax+b)^n$, log(ax+b), sin(ax+b), cos(ax+b), $e^{ax}\sin(ax+b)$, e^{ax}cos(ax+b), Leibnitz theorem. Recapitulation of definite integrals and its properties. Reduction formulae for $\int sin^n x$ dx, $\int cos^n x\, dx$, $\int sin^n x\, cos^m x\, dx$, $\int tan^n x\, dx$, $\int cot^n x\, dx$, $\int sec^n x\, dx$, $\int cosec^n x\, dx$, with definite limits.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BMP107	**Mathematics-I**	**DSCP-1**	0	0	4	2	4

DSCP-1: Mathematics -Practical-1

List of Experiments

Course Objectives: To study the concepts of software programming and solving problems using various software's.

Course Learning Outcomes: This course will enable the students to

1. Learn Free and Open Source Software (FOSS) tools for computer programming

2. Solve problem on algebra and calculus theory studied in MATDSCT 1.1 by using FOSS software's.

3. Acquire knowledge of applications of algebra and calculus through FOSS

Practical/Lab Work to be performed in Computer Lab (FOSS)

Suggested Software's: Maxima/Scilab /Python/R.

 Introduction to the software and commands related to the topic.

 1. Computation of addition and subtraction of matrices,

 2. Computation of Multiplication of matrices.

 3. Computation of Trace and Transpose of Matrix

 4. Computation of Rank of matrix and Row reduced Echelon form.

 5. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.

 6. Solving the system of homogeneous and non-homogeneous linear algebraic equations.

 7. Finding the nth Derivative of e^{ax}, trigonometric and hyperbolic functions

 8. Finding the nth Derivative of algebraic and logarithmic functions.

 9. Finding the nth Derivative of $e^{ax}\sin(ax+b)$, e^{ax}cos(ax+b),

10. Finding the roots of the equation, factoring.

11. Finding the angle between the radius vector and tangent.

12. Finding the curvatures of the given curves

Reference Books:

 1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.

 2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.

 3. Theory of Matrices - B S Vatsa, New Age International Publishers.

 4. Matrices - A R Vasista, Krishna Prakashana Mandir.

 5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.

 6. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.

 7. Calculus – Lipman Bers, Holt, Rinehart & Winston.

 8. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd.,vol. I & II

 9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.

10. Shanthinarayan – Integral Calculus, New Delhi: S. Chand and Co. Pvt. Ltd.

11. Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 201

Programme Structure for Bachelor of Science (Basic/Hons.)
Biochemistry as Core subject: I and II semesters

Semester	Discipline Specific Course Theory (DSC) (4+0+0)	Discipline Specific Course Practical (DSCP) (0+0+2)	Discipline Specific Elective (DSE)/ Open Elective (OE) (3+0+0)
I	DSC-1: Biochemistry	DSCP-1: : Biochemistry Practical-1	OE-1: Basic Biotechnology
II	DSC-2: Biochemistry	DSCP-2: Biochemistry Practical-2	OE-2: Food Biotechnology OE-2: Nutrition and Dietetics

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BCT108	Biochemistry **-I**	**DSC-1**	3	1	0	3	3

DSC-1
Course Title: Chemical Foundation of Biochemistry

Total number of lecture hours: 56   **Total number of credits: 04**

Unit 1: Scope of Biochemistry and Units of measurement   14 h
Origin of life, types of organisms, prokaryotes, eukaryotes, unicellular, multicellular, compartmentation of functions in lower and higher organisms, Ultra structure of prokaryotes and eukaryotes.

Units of measurement: SI units, mass, volume, temperature, amount, length and time.

An overview on the metric system, atomic weight, molecular weight, equivalent weight, basicity of acids, acidity of bases, Avogadro`s number, molarity, normality, molality, Dalton concept, mole concept, concentration, oxidation number and its significance, density and specific gravity and their significances.

Unit 2: Buffers and Colligative properties   14 h
Acids, bases, Lewis concept, Lowry and Bronsted concepts. Buffers, composition, pH, pH scale, Henderson-Hasselbalch equation, formal titration curve, pK value, isoelectric pH.

Biological buffer systems: phosphate, bicarbonate, protein, amino acid and haemoglobin buffer systems.

Colligative properties and anomalous colligative properties of solutions, structure of water, ionic product of water, special properties of water.

Solutions and types, ionizable solutes, non-ionizable solutes, vapor pressure, boiling point, freezing point, de-icing, osmosis and osmotic pressure determination, reverse osmosis, sur-

face tension.

Unit 3: Chemical bonds and Stereochemistry   14 h

Chemical bonds: Definition, Formation and properties of noncovalent and covalent bonds, hydrogen bonds, ionic bonds, van der Waals interactions, London forces, dipole-dipole interactions, electrostatic interactions, and hydrophobic interactions. Sigma, pi and coordinate bonds, back bonding. Corresponding energy associated, outline of theories of bonding.

Stereochemistry: Importance of stereochemistry. Geometric and optical isomerism. Absolute and relative configuration. Symmetry view of chirality, relation between chirality and optical activity. Structure and stereochemistry of sugars and amino acids, anomer, epimer, diastereomer, sterioisomer, D and L, (+) and (-), R and S.

Unit 4: Bioenergetics   14 h

Laws of thermodynamics, entropy and enthalpy, their relation, Gibb`s energy, free energy change, ions, ATP as Universal Currency of Free Energy in Biological Systems, Free Energy of Hydrolysis of ATP, Role of High Energy Phosphates as the 'Energy Currency' of the cell.

Redox reactions, redox potential, application of redox potential, energy linked to redox reactions, reduction of oxygen, oxidation and reduction of iron in hemoglobin, biological active forms of zinc, calcium, nickel, molybdenum, selenium, and cobalt, $NAD^+/NADH$, $NADP^+/NADPH$, $FAD/FADH_2$, $FMN/FMNH_2$.

References:

1.   Advanced Inorganic Chemistry: A comprehensive Text,1999, Cotton A and Geoffrey Wilkinson, 6th edition, Wiley publication

2.   Inorganic Chemistry, 2014, Miessler GL, Paul Fischer PJ, and Tarr DA, 5th edition, Pearson Publication

3.   Inorganic Chemistry, 2004, Catherine E and Sharpe AG, ACS publication

4.   Inorganic Chemistry, 2015, Overton, Rourke, Weller, Armstrong and Hagerman, Oxford Press

5.   Physical Chemistry: A molecular approach ,2019, Donald A, McQuarrie and Simon JD, Viva Books Publication

6.   Physical chemistry 2019, Atkins P, Paula JD, Keeler J, 11th edition, Oxford press

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BCP108	Biochemistry -I	DSCP-1	0	0	4	2	4

DSCP-1
Biochemistry Practical-1

List of Experiments
Volumetric Analysis

1. Preparation of standard Sodium carbonate solution, standardization of HCl (Methylorange) and estimation of NaOH in the given solution. (methyl orange or phenolphthalein).

2. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of H_2SO_4 in the given solution (phenolphthalein).

3. Preparation of standard Oxalic acid. Standardization of $KMnO_4$ and estimation of H_2O_2 in the given solution.

4. Preparation of standard $K_2Cr_2O_7$. Standardization of $Na_2S_2O_3$ and estimation of $CuSO_4$ in the given solution.

5. Preparation of $ZnSO_4$. Standardization of EDTA and estimation of total hardness of water using Eriochrome-Black-T indicator.

6. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).

7. Estimation of sulphuric acid and oxalic acid in a mixture using standard NaOH solution and standard $KMnO_4$ solution.

8. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).

9. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.

10. Preparation of standard potassium bi-phthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids.

11. Preparation of standard Oxalic acid solution. Standardization of KMnO4 solution and estimation of calcium in milk.

References

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.

2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,

4. Principles of Practical Chemistry- M. Viswanathan

5. Instrumental Methods of chemical Analysis B.K Sharma.

6. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata McGraw Hill

7. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House

8. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.

9. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).

10. General Chemistry experiment – Anil J Elias (University press).

11. Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.

12. Quantitative chemical analysis S. Sahay (S. Chand & Co.).

13. Practical Chemistry Dr O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication

14. College Practical Chemistry. V K Ahluwalia, SunithaDingra, Adarsh Gulati

15. Practical Physical Chemistry- B. Viswanathan, P S Raghavan. MV Learning Publication.

OPEN ELECTIVE COURSE (OE)

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE101	**CHEMISTRY IN DAILY LIFE**	OE-1	3	0	0	3	3

(03 Hours/week; 03 credits)

Course Objectives:

To study Concepts of Dairy Products, Vitamins, Chemical and Renewable Energy Sources

Course Outcomes:

On completion of the course students will be able to:

➢ Understand the chemical constituents in various day to day materials using by a common man.
➢ Understand the chemical constituents in vitamins, soaps and detergents.
➢ Understand the renewable chemical energy resources.
➢ Understand different types of polymers and their applications.

OE-1: CHEMISTRY IN DAILY LIFE

Unit- I: Dairy Products: **14 hours**

Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages. Food additives, adulterants, and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate. Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food.

Unit- II: **Vitamins:**   **14 hours**

Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K. Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test. Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition and uses.

Unit- III: Chemical and Renewable Energy Sources: **14 hours**

 Principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer. Polymers: Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers**.**

REFERENCE BOOKS

[1]. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
[2]. Ashtoush Kar: Medicinal Chemistry.
[3]. H.E. Cox: Analysis of Foods.
[4]. H.E. Cox and Pearson: Chemical Analysis of Foods.
[5]. N. Shakuntala Many and S. Swamy: Foods: Facts and Principles. 4th Ed. New Age International (1998).
[6]. P.l. Atkins and J. de Paula: Physical Chemistry, 7th Ed. 2002, Oxford University Press.
[7]. Swaminathan and Goswamy: Handbook on Fertilizer Technology 6th Ed. 2001, FAI.
[8]. I.L. Finar: Organic Chemistry by Vol. 1 & 2.
[9]. J. R. Fired: Polymer Science and Technology, PrenticeH

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE102	**ENERGY SOURCES**	**OE-1**	3	0	0	3	3

Course Objectives:

To study the concepts of energy resources, renewable and non-renewable energy, wind and tidal energy, solar energy sources.

Course Outcomes:

On completion of the course students will be able to:

1. Understand the Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy

2. Understand the Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, and Hydroelectricity.

3. Understand the Solar Energy, Merits & demerits of solar energy, Applications of solar energy, Photovoltaics, Need and characteristics of photovoltaic (PV) systems.

4. Understand Geothermal Resources, Geothermal Technologies. Hydropower resources, hydropower technologies, Carbon captured technologies, cell, batteries, and power consumption.

OE-1: - ENERGY SOURCES   **(03 Hours/week; 03 credits)**

UNIT-I: 14 hours
Introduction: Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations. Importance of Non-commercial energy resources.

Conventional energy sources: Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations. Impact on environment and their issues & challenges. Need of eco-friendly & green energy & their related technology.

UNIT-II: 14 hours
Introduction: Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, Hydroelectricity.

Solar energy: Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, solar cooker, solar green houses, solar cell - brief discussion of each. Photovoltaics, Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits.

UNIT-III: 14 hours
Wind and Tidal Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.

Geothermal and hydro energy: Geothermal Resources, Geothermal Technologies. Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Carbon captured technologies, cell, batteries, and power consumption.

Reference Book
1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
7. http://en.wikipedia.org/wiki/Renewable_energy

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE103	**OPTIONAL MATHEMAT-ICS-1**	**OE-1**	**3**	**0**	**0**	**3**	**3**

OE-1: - OPTIONAL MATHEMATICS-1
(03Hours/week 03 credits)

Course Objectives: To study the concept of linear equations and to solve the equations and to learn the techniques of differentiation of function using real variables.

Course Learning Outcomes: This course will enable the students to
- Ability to learn and solve system of linear equations.
- To Solve the system of homogeneous and non-homogeneous m linear equations.
- Students will be familiar with the techniques of differentiation of function with real variables.

Unit 1: Matrices   **14 hours**
Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction, Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof).

Unit-II: Theory of equations: **14 hours**
Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions.

Unit-III: Polar Co-ordinates: **14 hours**
Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of curvature, circle of curvature.

Reference Books:

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.

2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.

3. Theory of Matrices - B S Vatsa, New Age International Publishers.

4. Matrices – A. R. Vasista, Krishna Prakashana Mandir.

5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.

6. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.

7. Calculus – Lipman Bers, Holt, Rinehart & Winston.

8. Calculus – S. Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., 15 vol. I & II.

9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.

10. Shanthinarayan – Integral Calculus, New Delhi: S. Chand and Co. Pvt. Ltd.

11. Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE104	**Basic Biotechnology**	**OE-1**	**3**	**0**	**0**	**3**	**3**

OE-1 ; Course Title: Basic Biotechnology

Total number of lecture hours: 42   **Total number of credits: 03**

Unit I: Introduction   **14 h**
Definitions of Biotechnology, Historical account of traditional biotechnology, Chemical nature of the genetic material, properties and functions of the genetic material, organization of the genetic material in bacteria, eukaryotes and viruses Chemical nature of the genetic material, properties and functions of the genetic material, Overview of transcription and translation, types of RNA, genetic code.

Unit II: Microbial and Agriculture Biotechnology   **14 h**
Introduction, classification of microorganisms - a brief account (Yeast, Mould and Bacteria); Microbiological Techniques - Sterilization, Cultivation of Microorganisms, culture media and types of culture media, Nutritional requirements of microorganisms, Growth curve, Measurement of growth; Isolation of microorganisms - serial dilutions, streak plate, pour plate & spread plate methods; Staining Techniques - Simple and differential, fluorescent, negative, Structural staining - capsule, spore, cell wall and reserved food material, Preservation of cultures.

Agriculture Biotechnology: Soil and water conservation, soil fertility and fertilizer use; Cropping patterns and weed control; Diseases, insect pests and nematodes of crops: Agricultural Engineering; Agriculture marketing and storage; Farm management; Field crops, Plantation crops: Commercial crops, Horticultural crops; Foliage crops and Grasses; Condiments, Spices, Medicinal and Aromatic plants.

Unit III: Bioprocess Technology   **14 h**

The fundamental concept of Fermentation and bioprocess technology, Types of bioprocesses, Design and formulation of Media for industrial bioprocess, Criteria for medium design, carbon/nitrogen sources, nutrients, Sterilization of media.

Bioreactors, bioreactor design, criteria, operation and types of bioreactors. Agitation and aeration in the bioreactor, impeller and sparger design. Influence of various bioprocess parameters viz. pH, temperature, medium components on product synthesis.
Commercial production of various bioprocess-based products (Bioethanol, citric acid, penicillin)

Reference Books:

1. Basic Biotechnology: Bullol & Bullok

2. Basic Biotechnology: S. Ignacimuthu

3. Introduction of Biotechnology: Brown, Camball&Triest

4. Fundamentals of Biochemistry: A.C. Deb

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SKILL ENHANCEMENT COURSE

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Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BSE101	**DIGITAL FLUENCY**	**SEC-1**	**1**	**0**	**2**	**2**	**3**

Course Objectives

1. To understand the services provided by and the design of an operating system.
2. To understand what a process is and how processes are synchronized and scheduled.
3. Students should be able to use system calls for managing processes, memory and the file system.
4. The main objective of this course is to enable students to the fundamental concepts of database analysis and design.
5. To create and manage a professional, responsible digital presence and are accountable for what they share and produce online.

Course Outcomes:
1. Understands the different services provided by Operating System at different level.
2. Ability to understand, connect up and explain basics of modern scientific perspective.
3. The student will be able to explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission.
4. Networking boosts self-confidence and develops social skills.
5. Understand the basic principles of database management systems.

6. Students are introduced to new technologies and information resources.
7. Students reflect on and analyze their technology use and information sources.

DIGITAL FLUENCY
(02Hours/week; 02 credits)

Unit 1: 14 hours

Operating systems, types of operating systems, major functions of the operating systems, types of user interface, examples of Operating systems: MS-DOS, Windows, Mac OS, Linux, Android. Office **automation tools**: Word processor, Power point, and spread sheet.

Unit 2: 14 hours

Introduction to computer networks, Evolution of networking, types of networks, network devices-Modem, ethernet card, RJ45, Repeater, Hub, Switch, Router and gateways, Identification of nodes in a networked communication, Internet, Web and the internet things, Domain Name systems.

Security Aspects-Threats and prevention, Malware-Virus, Worms, Ransomware, Trojan, Spyware, adware, Key loggers, Modes of Malware distribution, Antivirus, HTTP vs HTTPS, Firewall, Cookies and crackers.

Unit 3: 14 hours

Database management systems, Relational data model. Introduction to e-learning platform such as Swayam and MOOC. Virtual meet: Technical Requirements, Scheduling a meeting, joining virtual meet, recording the meeting, Online Forms: creating Questionnaire, Publishing Questionnaire, conducting online responses, copying graphics into power point, Downloading the response to spreadsheet. Introduction to societal impacts, Digital footprints.

Laboratory Activities:

1.Identifying the configuration of a computer system, laptop and a mobile phone.

2.Identifuying the version and the configuration of the operating system of a computer, laptop and a mobile phone.

3.Identifying the network components like patch card, switch, RJ 45 Jack, Socket, and wireless router.

4.Creating the google forms and send it to five members.

5.Sheluding a virtual meet and invite three people to join the Google meet, record the virtual meet.

6.Composing word document, creating tables, creating charts.

7.Preparing power point slides.

8.Simple computation using spreadsheet.

References:

1.Operating systems: Operating system concepts, **Abraham Silberschatz and Peter Galvin 9ᵗʰ edition.**

2.operating systems, **Archer J Harris Schaugm's outlines.**

3.**Computer networks-** https://www.spiceworks.com/tech/networking/articles/what-is-a-computer-network/

4.**Security Ascpects-https://ncert.nic.in/textbook/pdf/lecs112.pdf**

5.**Network concepts-** https://ncert.nic.in/textbook/pdf/keip107.pdf

6.**Social impact-** https://ncert.nic.in/textbook/pdf/kecs111.pdf

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BSE102	**Physical Education Health, Wellness & Yoga**	**SEC-2**	**0**	**0**	**4**	**2**	**4**

Skill Enhancement Courses (SEC-1) PHYSICAL EDUCATION
Title of the Course: Health, Wellness & Yoga
Practical - 04 Hours/Week (02 Credits)

Activity Based Practical Course Content   **56 Hours**

Unit 1:- Introduction

   a. Meaning, Definition and Importance of Health & Wellness.
   b. Dimensions of Health and Wellness.
   c. Factors influencing Health and Wellness.
   d. Physical Fitness, Nutrition, Habits, Age, Gender, Lifestyle'
   e. Health & Wellness through Physical Activities.
   f. Sports, Games, Yoga, Recreation and Leisure time activities'
   g. Causes of Stress & Stress relief through Exercise and Yoga**.**

Unit 2:- Practical- Exercises for Health and Wellness

   a. Warm-Up and Cool Down - General & Specific Exercises.
   b. Physical Fitness Activities.
   c. Stretching Exercises.
   d. Strengthening Exercises.
   e. Cardiovascular Exercises.
   f. Flexibility and Agility Exercises.
   g. Assessment of BMI.
   h. Relaxation techniques

Unit 3:- Yoga
   a. Shitalikarna Vyayama.
   b. Suryanamaskara.
   c. Basic Set of Yoga Asanas.
   d. Basic Set of Pranayama & Meditation

Note: The activities in the Curriculum shall be modified/redesigned at the BOS level of the concerned universities to benefit the Physically / Visually Challenged students

Formative Assessment	
Assessment type	**Weightage in Marks**
Activity Based Practical	**IA-Internal Assessment- 50 Marks** ● Skills/Physical Fitness Test =20 ● Classroom Activity (Discipline, Mass ParticipationActivity, Punctuality)= 20 ● Performance = 10*
Total	**50 Marks**

Note: 1.*Due Weightage in the Internal Assessment shall be given to the Achievement of Sportsmen of the institution.
2. IA Guidelines shall further be modified at the University Level

References:

   1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
   2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
   3. Nagendra,H. R.&   Nagarathna,   R.(2002).SamagraYogaChikitse. Bengaluru: Swami Vivekananda Yoga Prakasana.
   4. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana.
   5. D.M Jyoti, Yoga and Physical Activities (2015) lulu.com3101, Hillsborough, NC27609, United States.
   6. AAPHERD   "Health   related Physical   Fitness Test   Manual."1980   Published by Association drive Reston Virginia.
   7. Bucher.C.A (1979) foundation of   Physical Education (5th Edition Missouri CV Mosby Co.).
   8. Puri .k. Chandra S.S (2005) "Health and Physical Education" New Delhi : Surjeet Publication.
   9. Thomas D Fahey and others. Fit and well : 6th Edition New York :McGraw Hill Publishers, 2005.

10. Dixit Suresh (2006) SwasthyaShiksha sports Publications Delhi.
11. Uppal A K &Gautam G P (2008) Health and Physical Education. Friends Publication New Delhi.
12. Pinto John and Roshan Kumar (2021) "Introduction to PhysicalEducation", Louis Publication. Mangalore.
13. Shanti K Y (1987) "The Science of Yogic Breathier" (Pranayama) D B Bombay.
14. Pinto John and Ramachandra K (2021)Kannada Version "Dahika Sikshanada Parichaya" Louis publications. Mangalore.

SECOND SEMESTER

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BL201	**Kannada - II**	AECC	2	1	0	3	3

Course Outline:

ಭಾಷೆಯನ್ನು ಮಾತನಾಡುವ ಬರೆಯುವ ಕೌಶಲ್ಯ, ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸ್ಥೂಲವಾಗಿ ಪರಿಚಯಿಸುವ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸ ಹಾಗು ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು, ಪ್ರಸ್ತುತ ಸಂದರ್ಭಕ್ಕೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸಲು ಪಠ್ಯವನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ಕಲೆ ಮತ್ತು ವಿಜ್ಞಾನದ ವಿಚಾರಗಳಿಗೆ ಒತ್ತನ್ನು ನೀಡಲಾಗಿದೆ. ಇದು ಮೂರು ಕ್ರೆಡಿಟ್ ಹೊಂದಿದೆ.

Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ಎರಡನೆಯ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಲೇಖನಗಳು ಹಾಗು ಪ್ರವಾಸ ಕಥನ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಸನದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
- ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

Course Outcomes:

ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಹೊಸಗನ್ನಡದ ಲೇಖನಗಳು ಹಾಗು ಪ್ರವಾಸ ಕಥನ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

- ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳಿಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
- ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
- ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.

ಘಟಕ-1. ಕವನಗಳು   **14 Hrs**

1. ಕತ್ತೆ ಮತ್ತು ಧರ್ಮ - ಸಿದ್ದಲಿಂಗಯ್ಯ
2. ರಾಣಿ ತಿಮ್ಮಿಯ ಸಿಂಹಾಸನ-ವಿಜಯದಬ್ಬೆ
3. ಅಮ್ಮ, ಆಚಾರ, ನಾನು- ಕೆ.ಎಸ್. ನಿಸಾರ್ ಅಹಮದ್
4. ಪೆಟ್ರೋಮ್ಯಾಕ್ಸ್ ಹೊತ್ತವರು- ಜಂಬಣ್ಣ ಅಮರಚಿಂತ

ಘಟಕ 2. ಕೀರ್ತನೆಗಳು ಮತ್ತು ತತ್ವ ಪದಗಳು.   **14 Hrs**
1. ಆಚಾರವಿಲ್ಲದ ನಾಲಿಗೆ ನೀಚ ಬುದ್ದಿಯ ಬಿಡು ನಾಲಿಗೆ- ಪುರಂದರದಾಸರ ಕೀರ್ತನೆ
2. ಸತ್ಯವಂತರ ಸಂಗವಿರಲು ತೀರ್ಥವೇತಕೆ- ಕನಕದಾಸರ ಕೀರ್ತನೆ
3. ಎಂಥಾ ಮೋಜಿನ ಕುದರಿ- ಸಂತ ಶಿಶುನಾಳ ಶರೀಫರ ತತ್ವ ಪದಗಳು.

ಘಟಕ-3. ಲೇಖನಗಳು   **14 Hrs**
1. ನಾಸ್ಮ್ಯ ಗೆರೆಗಳ ಮೇಲೆ-ನೇಮಿಚಂದ್ರ (ಪ್ರವಾಸಿ ಕಥನ).
2. ಆಟಿ ತಿಂಗಳ ಆಚರಣೆಯ ಅಚ್ಚರಿಗಳು-ಐತಿಚಂಡ ರಮೇಶ್ ಉತ್ತಪ್ಪ.
3. ಬೆಂಗಳೂರು ನಗರವೆಂಬ ಒಂದು ಹಳ್ಳಿ- ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ.
ಘಟಕ 4. ನಾಟಕ   **14 Hrs**
1. ಜಲಗಾರ – ಕುವೆಂಪು

ಪರಾಮರ್ಶನ ಪುಸ್ತಕಗಳು

• ಕೆ.ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ ಅವರ ಅಣ್ಣನ ನೆನಪು ಕೃತಿಯಿಂದ ಆಯ್ದುಕೊಳ್ಳಲಾಗಿದೆ., ಪುಸ್ತಕ ಪ್ರಕಾಶನ, ಮೈಸೂರು, 1996.
•ಕೊರಡ್ಕಲ್ ಶ್ರೀನಿವಾಸರಾವ್, ನಂದಾದೀಪ, 1938.
•ಇಂಗ್ಲಿಷ್ ಮೂಲ: ಆರ್ ಕೆ ನಾರಾಯಣ್,ಮಾಲುಡಿಯ ದಿನಗಳು, (ಅನುವಾದ: ಡಾ.ಎಚ್ ರಾಮಚಂದ್ರಸ್ವಾಮಿ), ಪ್ರಕಾಶಕರು ಪ್ರಿಸಂ ಬುಕ್ ಪ್ರೈವೇಟ್ ಲಿಮಿಟೆಡ್, ಬೆಂಗಳೂರು, 2009.
•ಎ.ಪಿ.ಜೆ ಅಬ್ದುಲ್ ಕಲಾಂ,(ಅನುವಾದ: ಜಿ.ಕೆ. ಮಧ್ಯಸ್ಥ),ನನ್ನ ಪಯಣ,ವಸಂತ ಪ್ರಕಾಶನ,ಬೆಂಗಳೂರು,2013.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BL202	**Hindi – II**	AECC	2	1	0	3	4

अध्ययन विषय सूची / पाठ्यक्रम

इकाई – 1: प्राचीन कविता, आधुनिक कविता   **अध्यापन अवधियाँ : 14 Hrs**.
1.कबीर के दोहे
2.कविता –जलियाँवाला बाग में बसंत- सुभद्राकुमारी चौहान
3.कविता – सुभाष की मृत्यु पर - धर्मवीर भारती
इकाई – 2: मध्यकालीन कविता, आधुनिक कविता   **अध्यापन अवधियाँ : 14 Hrs**.
4.रसखान के दोहे
5.कविता – हमारी जिन्दगी - केदारनाथ अग्रवाल
6.कविता –चलना हमारा काम है।- शिवमंगल सिंह सुमन
इकाई – 3: मध्यकालीन कविता, आधुनिक कविता   **अध्यापन अवधियाँ : 14 Hrs**.
7.मीराबाई के पद
8.कविता – मेरे सपने बहुत नहीं हैं- गिरिराज कुमार माथुर
9.कविता – अभी न होगा मेरा अंत – निराला
इकाई – 4: अनुवाद, निबंध   **अध्यापन अवधियाँ : 14 Hrs**.
अनुवाद : हिन्दी – अंग्रेजी
निबंध :
1.भारत में किसानों की स्थिति

2.निर्वाचन आयोग का महत्व

3.प्रेस की आजादी कितनी सार्थक

4.भारतीय नारी

5.साहित्य का उद्देश्य

सन्दर्भ ग्रन्थ :

- पाठ्य पुस्तक – रेवा विश्वविद्यालय
- सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
- अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
- हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
- आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
- हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
- शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
- कार्यालय अनुवाद निदेशिका
- हिन्दी निबंध संग्रह

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BL203	**English – II**	AECC	2	1	0	3	4

Course Outline:

This is a 3 credit course designed to help the learner gain a deeper understanding of the society and the world at large, which will be not only beneficial for his professional competence but also contribute towards his/her social and cultural development.

Course Objectives:
- To help the student understand the multiple values of the society.
- To develop a cultural understanding in the student to sharpen his/her social skills.
- To ensure a gradual development of literary interest in the student.

Course Outcomes:

On completion of the course, learners will be able to:
- Demonstrate a deep understanding of the society and its values.
- Develop a constructive understanding of the cultural dimensions of the human world.
- Make use of his understanding to become a responsible global citizen of tomorrow.

Course Content:

Unit – I   **14 Hrs**

Literature: Toru Dutt - Casuarina Tree**;** Robert Frost – Stopping by Woods on a Snowy Evening**;** Tomas Rivera–The Harvest**;** C.V. Raman – Water – The Elixir of Life; **Language:** Degrees of Comparison

Unit – II   **14 Hrs**

Literature: Tadeusz Rozewicz – Pigtail**;** Jyoti Lanjewar – Mother**;** Sowvendra Shekhar Hansda – The Adivasi Will Not Dance**;** Harriet Jacobs – Excerpt from *Incidents in the Life of a Slave Girl***; Language:** Prefix and Suffix

Unit – III   **14 Hrs**

Literature: Kamala Das – An Introduction**;** Usha Navrathnaram – To Mother; Rabindranath Tagore – The Exercise Book**;** Jamaica Kincaid – Girl**; Writing Skills:** Dialogue Writing

Unit – IV   **14 Hrs Literature:** Rudyard Kipling – The Absent-minded Beggar; Sir Arthur Conan Doyle – The Hound of the Baskervilles; Aldous Huxley – The Beauty Industry**; Writing Skills:** Story Writing

Reference Books:

1. Agrawal, K.A. *Toru Dutt the Pioneer Spirit of Indian English Poetry - A Critical Study*. Atlantic Publications, 2009.
2. Latham, Edward Connery (ed). *The Poetry of Robert Frost*. Holt Paperbacks, 2002.
3. Gale, Cengage Learning. *A Study Guide for Tomas Rivera's The Harvest*. Gale, Study Guides, 2017.
4. Basu, Tejan Kumar. *The Life and Times of C.V. Ram*an. PrabhatPrakashan, 2016.
5. Rozewicz, Tadeusz. *New Poems*. Archipelago, 2007.
6. Manohar, Murli. *Critical Essays on Dalit Literature*. Atlantic Publishers, 2013.
7. Hansda, SowvendraShekhar. *The Adivasi Will Not Dance: Stories*. Speaking Tiger Publishing Private Limited, 2017.
8. Jacobs, Harriet. *Incidents in the Life of a Slave Girl*. Createspace Independent Publication, 2014.
9. Das, Kamala. *Selected Poems*. Penguin Books India, 2014.
10. Tagore, Rabindranath. *Selected Short Stories of Rabindranath Tagore*. Maple Press, 2012.
11. Gale, Cengage Learning.*A Study Guide for Jamaica Kincaid's Girl*. Gale, Study Guides, 2017.
12. Kipling, Rudyard. *The Absent-Minded Beggar*. Hardpress Publishing, 2013.
13. Doyle, Arthur Conan. *The Hound of the Baskervilles*. General Press, 2017.
14. Dixson, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
15. Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
16. Samson, T. (ed.) *Innovate with English.* Cambridge University Press, 2010.
17. Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BL204	**Functional English - II**	AECC	2	1	0	3	3

Course Outline:
This is a 3 credit course for second semester consisting of 4 hours of teaching learning per week, inclusive of direct classroom teaching and practice in language lab.

Course Objectives:
- To utilize the ability of using language skills effectively in real-life scenarios.
- To develop the learners' competence in employability skills.
- To improve the habit of writing, leading to effective and efficient communication.
- To prioritize specially on the development of technical reading and speaking skills among the learners.

Course Outcomes:

On completion of the course, learners will be able to:

- Organize their opinions clearly and meaningfully.
- Demonstrate the ability to speak appropriately in social and professional contexts.
- Build inferences from the text.
- Take part in interviews confidently.
- Develop accurate writing skills using different components of academic writing.

Course Content:

Unit – I **14 Hrs**

Grammar: Active and passive voice; **Listening & Speaking:** Listening to informal conversations and interacting; **Reading:** Developing analytical skills; Deductive and inductive reasoning; **Writing:** Giving Instructions; Dialogue Writing

Unit – II **14 Hrs**

Grammar: Compound words; Phrasal verbs; **Listening:** Listening to situation based dialogues; **Speaking:** Group Discussions; **Reading:** Reading a short story or an article from newspaper; Critical reading; **Writing:** Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives)

Unit – III **14 Hrs**

Grammar: Homonyms; Homophones; **Listening:** Listening to conversations; Understanding the structure of conversations; **Speaking:** Presentation Skills; **Reading**: Extensive reading; **Writing:** Report Writing (Feasibility/ Project report - report format – recommendations/ suggestions - interpretation of data using charts, PPT); Precise Writing.

Unit – IV   **14 Hrs**

Grammar: Idioms; Single Word Substitutes; **Listening:** Listening to a telephone conversation; Viewing model interviews (face-to-face, telephonic and video conferencing); **Speaking:** Interview Skills, Mock Interviews; **Reading:** Reading job advertisements and the profile of the company concerned; **Writing:** Applying for a job; Writing a cover letter with résumé / CV.

Reference Books:

1. Bansal, R.K. and J.B. Harrison. *Spoken English*. Orient Blackswan, 2013.
2. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication*. Oxford University Press, 2015.
3. Thorpe, Edgar and Showick Thorpe. *Objective English*. Pearson Education, 2013.
4. Dixson, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
5. Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
6. Samson, T. (ed.) *Innovate with English.* Cambridge University Press, 2010.
7. Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.
8. Goodale, Malcolm. *Professional Presentation*. Cambridge University Press, 2013.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BPT205	**Thermodynamics, Waves and Oscillations**	DSC-2	3	1	0	4	4

Theory - 04 Hours/Week (04 Credits); Practical - 04 Hours/Week (02 Credits)
SYLLABUS: DSC-2: PHYSICS-2:
DSC-2: PHYSICS-2 Thermodynamics, Waves and Oscillations

Course Objectives:
1. Impart the knowledge of basic physics of temperature and acoustics.

2. Express the relationship between the laws of radiation.

3. Impart the knowledge of Principles of Thermodynamics for practical applications such as transform heat into work.

4. Apply fundamental acoustics such as waves and oscillations.

Course Outcomes:
On the successful completion of this course, the student shall be able to:
1. Gain the knowledge of the laws of thermodynamics and concepts.

2. Concept of Low Temperature Physics to analyse and explain the problems in thermodynamics

3. Apply the concept of different laws to explain the nature of radiation emitted by various bodies

4. Use Lissajous figures to understand simple harmonic vibrations.

5. Understand the oscillations and reonance with examples.

 UNIT-I   **14 hours**
Thermodynamics: Basic concepts: Temperature, internal energy, quasistatic process, isothermal and adiabatic process, zeroth law of thermodynamics. First law of thermodynamics: thermodynamic equilibrium, differential form of first law, Application of first law. Reversible and irreversible processes, second law of thermodynamics, work and heat energy, work done during isothermal and adiabatic process. Heat engine, Carnot cycle, Carnot engine and its efficiency, Carnot theorem, second law of thermodynamics. Internal combustion engines, petrol engine. Entropy change in reversible and irreversible process, principles of increase in entropy, Clausius theorem, Nernst's therem.
 UNIT-II   **14 hours**
Thermodynamic Relations: Maxwell thermodynamic relations: Derivation and applications. Specific heat of a substance, relations between Cp and Cv, Clausius Claperyron equation. Relations of thermodynamics potentials (U, H, F and G) and variables.
Radiation: Black body radition, Kirchoff's law, Energy distribution in Black body radiation, Wein's radiation law, Reyleigh Jean's law, Stefan Boltzmann Law and Wein's displacement law. Ultravoilet Catastrophe. Deduction of Planck's law of Black Body Radiation, Deduction of Wein's law, Rayleigh law and Wein's displacement law from Planck's law.

UNIT-III   **14 hours**

Waves: Basic Characteristics of Simple Harmonic Motion, Oscillations of a Spring-Mass System; Differential Equation of SHM and its Solution. Phase of an oscillator executing SHM, Velocity and Acceleration, Transformation of Energy in Oscillating Systems, Kinetic and Potential Energies. Examples of Physical Systems Executing SHM: Simple Pendulum, Compound Pendulum and Torsional Pendulum.

Wave motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Characteristics of wave motion, Plane Progressive (Travelling) Wave and its equation, Wave Equation – Differential form (derivation).

UNIT-IV: **14 hours**

Oscillations: Principle of superposition, Superposition of two collinear harmonic oscillations of same/different frequencies, Oscillations in two dimensions. Superposition of two mutually perpendicular harmonic oscillations of the same/different frequencies; Lissajous Figures. Differential equation of a damped and undamped oscillator and its solutions differential equation of a weakly damped forced harmonic oscillator and its solutions, steady state solution, resonance. Examples of forced vibrations and resonance, power absorbed by a forced oscillator, quality factor.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BPP205	**Physics Practical-2**	**DSCP-2**	**0**	**0**	**4**	**2**	**4**

Course Objectives:
1. Impart knowledge about various laws of thermodynamics through experiments
2. Facilitate with the concepts of thermal conductivity through experiments
3. Familiarise with the various experiments in thermodynamics and mechanics Lab
4. Impart knowledge about determination of physical constant through experiments

Course Outcomes:
After successful completion of this course the students shall be able to:
1. Verify various laws of thermodynamics through experiments
2. Analyse the concepts of thermal conductivity through experiments
3. Demonstrate the various experiments in thermodynamics and mechanics Lab
4. Determination of physical constant through experiments

DSCP-2: Physics Practical-2
List of Experiments
1. Verification of Gaussian distribution law and calculation of standard deviation –Monte Carlo experiment.
2. Specific heat of a liquid by cooling (graphical method).
3. Determination of thermal conductivity of a bad conductor by Lee-Charlton method.

4. Verification of Stefan - Boltzmann law by using Ohm's law.
5. Determination of boiling point of a liquid using platinum resistance thermometer.
6. Charging and discharging of a capacitor (energy dissipated during charging and time constant measurements.
7. Series and parallel resonance circuits (LCR circuits).
8. Determination of moment of inertia of irregular body using Torsional pendulum.
9. Kundt's tube experiment - velocity of sound in air at room temperature.
10. Study of stationary wave on a stretched string- Determination of speed of the transverse waves over the sonometer wire.
11. Helmholtz resonator—Determination of frequency of a tuning fork.
12. Determination of Stefan's constant for Black body radiation.

(Minimum EIGHT experiments have to be carried out)

References

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Heat &Thermodynamics	D.S.Mathur	3rd edition Sulthan Chand & Sons,NewDelhi	1978
2	Heat & Thermodynamics	Brijlal & N. Subramanyam	S.Chand & Co, NewDelhi	2000
3	Waves and Oscillations	Brijlal and N.Subramanyam	Vikas Publishing house,New Delhi	

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BCT206	**Chemistry-2**	DSC-2	3	1	0	4	4

II SEMESTER:
Theory - 04 Hours/Week (04 Credits); Practical - 04 Hours/Week (02 Credits)
SYLLABUS: DSC-2: Chemistry-2:

Course Objectives
➢ To study Concepts of titrimetric analysis, different type's titrations, titration curves, theory of redoxindicators and applications. Classification and properties of s p d and f

block elements.chemistry of the hydrides, carbides, oxides and halides of group 13-17nucleophilic substitution at saturated carbon, energy profile diagram. liquid crystals, classification with examples

Course Outcomes:
After studying this course student will be able to:
➢ Understand principles of titrimetric analysis.
➢ Understand principles of different type's titrations. Titration curves for all types of acid–base titrations.
➢ Gain knowledge about balancing redox equations, titration curves, theory of redox indicators and applications.
➢ 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.
➢ Understand periodic table, classification and properties of s p d and f block elements.
➢ Understand different scales for the measurement of electro-negativity and factors affecting it.
➢ Understand chemistry of the hydrides, carbides, oxides and halides of group 13-17.
➢ Understand nucleophilic substitution at saturated carbon, energy profile diagram.
➢ Stereochemistry and factors affecting S_N1 and S_N2 reactions.
➢ Aromatic electrophilic substitution reactions like nitration sulphonation Friedel-Crafts reactions.
➢ Understand liquid crystals, classification with examples.
➢ Understand the different forms of solids, laws of crystallography, miller indices and its calculation, X-ray diffraction studies. Brags law and its equation.
➢ Defects in solids, properties of glasses and concept of liquid crystals.

UNIT-I: Analytical Chemistry   **14 hours**
Titrimetric analysis: Basic principle of titrimetric analysis. Classification, Preparation and dilution of reagents/solutions. Normality, Molarity and Mole fraction. Use of $N_1V_1 = N_2V_2$ formula, Preparation of ppm level solutions from source materials (salts), conversion factors. Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weakbase vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity. Complexometric titrimetry: Indicators for EDTA titrations - theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application- determination of hardness of water.
Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using

Nernst equation. Applications. Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations indicating silver nitrate- Volhard's and Mohr's methods and their differences.

Unit – II: Inorganic chemistry   14 hours

s, p, d and f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block elements: a) Atomic radii (van der Waals), b)Ionic and crystal radii, c) Covalent radii, d) Ionization enthalpy, successive ionization enthalpies and factors affecting ionization enthalpy Applications of ionization enthalpy, e) Electron gain enthalpy, trends of electron gain enthalpy, f) Electronegativity, Pauling's, Mulliken's, electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides and halides) are to be discussed.

Unit – III: Organic chemistry   14 hours

Nucleophilic substitution at saturated carbon. Mechanism of SN1 and SN2 reactions with suitable examples. Energy profile diagrams, Stereochemistry and factors effecting SN1 and SN2 reactions. Aromatic Electrophilic substitution reactions, Mechanisms, σ- and π- complexes, Halogenation, Nitration,   Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio. Aromatic nucleophilic substitution reaction: SNAr and Benzyne mechanism with suitable examples.

Unit–IV: Physical Chemistry   14 hours
UNIT-III

Properties of liquids: Viscosity- Coefficient of viscosity, effect of temperature, size, weight, shape of molecules and intermolecular forces on it. Surface tension and Parachor-Definition, mathematical expression, numerical problems and factors affecting them.

Liquid mixtures: Classification of, completely miscible and completely immiscible pairs of binary mixtures – partially miscible liquids (explanation with examples for each type). Raoult's law, definition of ideal and non- ideal solutions based on Raoult's law.

Partially miscible liquids: Critical solution temperature (CST) – types – phenol-water system, triethylamine-water system, (mutual solubility temperature (MST) vs composition curves to be drawn). Effect of addition of non-volatile solute on CST.Binary mixtures of completely miscible liquids.

Vapour pressure – definition, vapor pressure – composition diagrams and boiling point – composite diagrams. Classification into the types – obeying Raoult's law (type I), showing positive deviation from Raoult's Law (type II) and showing negative deviation from Raoult's Law (type III) – examples for each type.

DSCP-2: Chemistry Practical-2

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BCP206	**Chemistry-2**	DSCP-2	0	0	4	2	4

Course Objective:
➢ To study Concepts of titrimetric analysis. acid-base, redox and iodometric titrations, inorganic quantitative analysis, Determination of rate constant in the decomposition reaction of hydrogen peroxide.

Course Outcome:
After studying this course and performing the experiments set in it, student will be able to understand:
➢ Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standard solutions.
➢ Explain the principles of acid-base, redox and iodometric titrations.
➢ Describe the significance of inorganic quantitative analysis.
➢ Determine of density followed by the determination of viscosity and surface tension of different liquid samples.
➢ Determination of partition coefficient of different liquid mixtures.
➢ Determination of rate constant in the decomposition reaction of hydrogen peroxide.

List of Experiments

PART-A: Physical Chemistry
1. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald's viscometer (Ethyl acetate, Toluene, Chloroform, Chlorobenzene or any other non-hazardous liquids).
2. Determination of the density using specific gravity bottle and surface tension of liquids using Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardous liquids.
3. Determination of partition/distribution coefficient - i) Acetic acid in water andcyclohexane ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.
4. Determination of rate constant of decomposition of H_2O_2 catalyzed by $FeCl_3$.
5. Phase diagram of three component system (solid-solid).

PART-B: Analytical Chemistry
1. Comparison of detergent action of detergents and soaps.
2. Determination of pH of buffer and dissociation constant of weak acid.
3. Determination of oxalic acid using standard potassium permanganate solution.
4. Determination of hardness of water Standardized EDTA solution.
5. Determination of alkali content in antacids using standard HCl solution.

REFERENCE BOOKS

Inorganic Chemistry

[13]. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.

[14]. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed.,Wiley.

[15]. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.

[16]. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.

[17]. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.

[18]. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.

[19]. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.

[20]. Mark Weller and Fraser Armstrong, 5 Edition, Oxford University Press (2011-2012).

[21]. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry.John Wiley & Sons, 1974.

[22]. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.

[23]. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).

[24]. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

[16]. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).

[17]. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.

[18]. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

[19]. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

[20]. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.

[21]. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

[22]. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

[23]. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).

[24]. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).

[25]. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).

[26]. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.

[27]. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.

[28]. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.

[29]. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.

[30]. Organic Chemistry- Mehta and Mehta, PHI Learning Pvt. Ltd, New Delhi,2005.

Physical Chemistry

[14]. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill, 2007.

[15]. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa, 2004.

[16]. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt.Ltd., New Delhi, 2009.

[17]. P.W. Atkins: Physical Chemistry, 2002.

[18]. W.J. Moore: Physical Chemistry, 1972.

[19]. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.

[20]. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.

[21]. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co. 1987.

[22]. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.

[23]. Physical Chemistry - G. M. Barrow, McGraw Hill, 1986.

[24]. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House, 1985.

[25]. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.

[26]. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York, 1981.

Analytical Chemistry

[6]. Jeffery, G.H., Bassett, J., Mendham, J.& Denney, R.C.

[7]. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.

[8]. 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.

[9]. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.

[10]. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.

[11]. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.

[12]. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BMT207	**Differential Calculus-I and Integral Calculus-II**	**DSC-2**	**3**	**1**	**0**	**4**	**4**

Theory - 04 Hours/Week (04 Credits); Practical - 04 Hours/Week (02 Credits)
SYLLABUS: DSC-2: Mathematics -2:
DSC-2: Mathematics - Differential Calculus-I and Integral Calculus-II

Course Objectives: to study the concept of divisibility, prime and composite numbers, concept of congruence and the learn the concept of intermediate value theorems.

Course Learning Outcomes: This course will enable the students to

1. Learn the concept of Divisibility.

2. Learn about prime and composite numbers.

3. Learn the concept of congruences and its applications.

4. Identify and apply the intermediate value theorems and L'Hospital rule.

5. Understand the concept of differentiation and fundamental theorems in differentiation and various rules.

 6. Find the extreme values of functions of two variables.

7. Students learn to find areas and volumes using integration.

Unit-I: Number Theory: **14 hours**

Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems**.**

 Unit-II: Differential Calculus-I: **14 hours**

Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Indeterminate forms and evaluation of limits using L'Hospital rule.

 Unit-III: Partial Derivatives: **14 hours**

 Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples.

Unit-IV: Integral Calculus-II: **14 hours**

Line integral: Definition of line integral and basic properties, examples on evaluation of line integrals. Double integral: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Triple integral: Definition of triple integrals and evaluation change of variables.

DSCP-2: Mathematics Practical-2

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BMP207	**Mathematics-I**	**DSC-2**	**0**	**0**	**4**	**2**	**4**

Course Objectives: To study the concepts of computer programming and to solve the problems using software.

Course Learning Outcomes: This course will enable the students to

1. Learn Free and Open Source Software (FOSS) tools for computer programming

2. Solve problem on algebra and calculus by using FOSS software's.

3. Acquire knowledge of applications of algebra and calculus through FOSS.

Practical/Lab Work to be performed in Computer Lab

Suggested Software's: Maxima/Scilab /Phython/R.

1. Programs related to Number Theory.
2. Program to verify Mean value theorems.
3. Program for finding the Taylor's and Maclaurin's expansions of the given functions.
4. Program to verify the Euler's theorem and its extension.
5. Programs to construct series using Maclaurin's expansion for functions of two variables.
6. Program to evaluate the line integrals with constant and variable limits.
7. Program to evaluate the Double integrals with constant and variable limits.
8. Program to evaluate the Triple integrals with constant and variable limit

Reference Books:
1. Differential Calculus, Shantinarayan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, New Delhi: S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shantinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6th edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

Theory - 04 Hours/Week (04 Credits); Practical - 04 Hours/Week (02 Credits)
SYLLABUS: DSC-2:: Biomolecules

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BCT208	**Biomolecules**	**DSC-2**	**3**	**1**	**0**	**4**	**4**

Total number of lecture hours: **Total number of credits: 04**

Unit I   14 h

Carbohydrates: Structure and classification of carbohydrates,

Monosaccharides: Pentoses, hexoses, deoxysugars, amino sugars, muramic acid, neuraminic acid.,

Disaccharides: Linkages in sucrose, lactose and maltose.

Polysaccharides: Homopolysaccharides (starch, cellulose and glycogen) and heteropolysaccharides (hyaluronic acid, chondroitin sulphate).

Unit II   14 h

Amino acids: Nomenclature and classification of amino acids. Zwitter ionic structure, reaction of amino acids, Physical and chemical properties. Essential and non-essential amino acids. Non-standard, non-protein and biologically active amino acids.

Peptide bond, Features of the peptide bond, naturally occurring peptides - glutathione, enkaphalins and endorphins.

Proteins: Isolation and purification of proteins. Primary structure of proteins, Determination of N-terminal and C-terminal of primary structure. Secondary structure of proteins: α helix, β sheet, β bend and β turn. Tertiary and quaternary structures.

Unit III   14 h

Lipids: Alcohol and Fatty acids, Alcohols – Saturated and Unsaturated, Occurrence and properties of fatty acids, Fatty acids – Nomenclature (Genevan system), Saturated and unsaturated fatty acids. Biological Roles of Lipids. esters of fatty acids, cholesterol, phospholipids, glycolipids, sphingolipids, cerebrosides and gangliosides.
Saponification, Hydrolytic rancidity, reactions involving double bond, Hydrogenation, Halogenation, Oxidation, Oxidative rancidity, dehydration (=Acrolein test).
Vitamins - Fat soluble and water-soluble vitamins.

Unit IV   14 h

Nucleic acids: Physico-chemical properties of nucleic acids- melting of DNA, Tm and factors affecting Tm. Cot curve. Chemical reactions of DNA and RNA.

Watson and Crick model. Chargaff's rule. A, Z DNA other models of DNA structure. Hoogsten base pairing. Cruciform - Supercoiled, Denaturation- hypochromic and hyperchromic effect. Renaturation kinetics - effect of salts and complexity. Hybridization and its significance.

Structures of mRNA, rRNA, tRNA.

DSCP-2 : Biochemistry Practical-2

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BCP208	**Biochemistry Practical-2**	**DSC-2**	0	0	4	2	4

1. Estimation of sugars by DNS and phenol-sulfuric acid method.
2. Determination of pka value of an amino acid.
3. Estimation of protein by Lowry's, Biuret and Bradford's method.
4. Analysis of fats: saponification number, iodine number and acid value of oil.
5. Determination of total phenolic content.
6. Determination of total flavonoid content.
7. Determination of Curcumin content.
8. Determination of Ascorbic acid content.

References
1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,
4. Principles of Practical Chemistry- M. Viswanathan
5. Instrumental Methods of chemical Analysis B.K Sharma.
6. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata McGraw Hill
7. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House
8. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.
9. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
10. General Chemistry experiment - Anil J Elias (University press).
11. Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.
12. Quantitative chemical analysis S. Sahay (S. Chand & Co.).
13. Practical Chemistry Dr O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication
14. College Practical Chemistry. V K Ahluwalia, SunithaDingra, Adarsh Gulati
15. Practical Physical Chemistry- B. Viswanathan, P S Raghavan. MV LearningPublication

OPEN ELECTIVE COURSE (OE)

OE-2: GENERAL CHEMISTRY
(03 Hours/week; 03 credits)

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE201	**GENERAL CHEMISTRY**	**OE-2**	**3**	**0**	**0**	**3**	**3**

Course Objectives:
Course Objectives:
On completion of the course students will be able to:

UNIT I 14hrs
Inorganic Chemistry
General introduction, electronic configuration, general trends in physical (atomic radii, ionization energy, enthalpy, electron affinity and electronegativity) and chemical properties of elements (reaction with water, oxygen and halogens). Anomalous properties of the first element of each group and diagonal relationship.
Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance. Quantum numbers and their significance.
Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams.Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations- Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening effect, Slater's rules Problems. Variation of effective nuclear charge in Periodic Table

UNIT II 14hrs
ORGANIC CHEMISTRY
Introduction
Organic compounds: General classification and nomenclature (in brief), hybridization, structure and shapes of ethane, ethene and ethyne.
Bond cleavage
Homolysis and heterolysis with examples. Electrophilic and nucleophilic reagents with examples.
Electronic effects
Inductive effect– definition, +I and –I effect with suitable examples. Resonance effect– definition, +R and –R effect with suitable examples. Electromeric effect–definition with examples. Hyperconjugation–definition, explanation for the stability of carbocations and alkenes by Hyperconjugation .
Strength of organic acids and bases
Comparative study with emphasis on inductive effect affecting pK_a values (Examples: Comparison of acetic acid, mono, di and trichloro acetic acids; fluoro, chloro, bromo and iodo acetic acids; 2–chloro and 3-chloropropanoic acids).
Basicity of amines
Comparative study with emphasis on inductive and resonance effects affecting pK_b values (Examples: Comparison of basicity of methyl amine, ammonia: methyl amine, dimethyl amine, tri methyl amine, and aniline, ammonia).
Aromaticity–conditions for aromaticity, Huckel's rule (examples: cyclopentadienyl anion and benzenoids), aromaticity of pyrrole and pyridine.

PHYSICAL CHEMISTRY
PHASE EQUILIBRIA: Terminology – phase, components, degree of freedom. Gibb"s phase rule, derivation of phase rule. One componentsystem – water, sulphur and carbon dioxide, two component system - simple eutectic system, thermal analysis of cooling curves, lead-silversystem, bismuth-cadmium. Freezing mixture: acetone-dry ice. Two component system with compound formation.
SURFACE CHEMISTRY: Types of adsorption, characteristics of physisorption and chemisorption, adsorption isotherms and its types, Freundlich and derivation and treatment of Langmuir isotherms – Unimolecular and bimolecular reactions applications of adsorption.

Recommended Books/References:
1. Concise Inorganic Chemistry, J. D. Lee, Wiley, 5thedition (2008).
2. Concepts and Models of Inorganic Chemistry, B. E. Douglas, D.H. McDaniel, J.J. Alexander John Wiley and Sons, 3rdedition (1999).
3. Atkin's Physical Chemistry, P.W. Atkins, J. De Paula, Oxford University Press, 6thedition (2014).
4. Inorganic and Solid State Chemistry, G.E. Rodger, Cengage Learning, 3rdedition (2011).
5. 1. Bahl, A. & Bahl, B.S. Advanced Physical Chemistry, S. Chand, 2010.
6. 2. J. N. Gurtu and Aayushi Gurtu, Undergraduate Physical Chemistry, Vol I, Vol II and Vol III
7.   Pragati Prakashan.
8. 3. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
9. 4. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
10. 5. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt.
11.   Ltd., New Delhi (2009).
12. 6. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
13. 7. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).

OE-2: ASTRONOMY
(03 Hours/week; 03 credits)

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE202	**ASTRONOMY**	**OE-2**	3	0	0	3	3

Course Objectives:
To study Concepts of Ancient Astronomy Indian Astronomy, vedic astronomy, Planets, Stars Galaxies, Asteroids, Meteors, Comets, Experimental tools for Astronomy and Space Science, Fundamental Particles and basic forces.

Course Objectives:
On completion of the course students will be able to:
1. Acquire knowledge about Ancient Astronomy, Indian Astronomy, and Vedic astronomy.
2. Acquire knowledge about Planets, and Stars, Galaxies, Asteroids, Meteors, Comets.
3. Understand the Experimental tools for Astronomy and Space Science and Fundamental Particles and basic forces.
4. Understand and learn the basic concepts of astrophysics and basic forces.

UNIT-I   14 hours

Ancient Astronomy, Greek observations, sumerian observations, mayan observations, Arabic observations , chinese observations, Indian Astronomy, vedic astronomy, ancient astronomy – Aryabhata, Varahamihira, Bhaskara, Astronomy in Indian Scriptures, Medieval & Modern Astronomy, Invention of Telescopes, Models of the Solar System & Universe, Observations by Tycho Brahe, Kepler, Galileo, Herschel and other, Optical tools for Astronomy, Pin Hole, Binoculars, Telescopes & Imaging. Observational Terminologies, Cardinal Directions, Azimuth, Altitude, Measurements using Compass and, Hand. Equatorial Co-ordinates, Light years, magnitude, colors etc.

UNIT-II   14 hours

Planets: Formation of Solar System - planet types, atmospheres and magnetic fields of planets and their moons

Stars: Measuring stellar characteristics (temperature, distance, luminosity, mass, size) - HR diagram - stellar structure   (equilibrium, nuclear reactions, energy transport) - stellar evolution.

Galaxies: Our Milky Way - Galactic structure - Galactic rotation - Galaxy types - Galaxy formation.

Asteroids: Discovery and designation, Origin, Nature and Orbits of Asteroids.

Meteors: Meteor showers and sporadic meteors.

Comets: Periodic comets, brightness variation in comets.

UNIT-III   14 hours

Observational and Experimental tools for Astronomy and Space Science: In-situ measurements of chemical, physical and dynamical parameters using Kites, Balloons, Aeroplanes, Rockets and Satellite Payloads.

Fundamental Particles and basic forces: Protons, Electrons, Neutrons, Neutrinos, Mesons, leptons, and quarks. The concept of Basic forces viz., strong, weak, electromagnetic and gravitational forces.

Reference Book

1. BW Carroll & DA Ostlie, An Introduction to Modern Astrophysics, Latest Edition, Addison-Wesley.
2. Frank Shu, The Physical Universe, Latest Edition, University Science Books
3. Martin Harwit, Astrophysical Concepts, Latest Edition, Springer.
4. T. Padmanabhan, Invitation to Astrophysics, Latest Edition, World Scientific Publishing Co.
5. T. Padmanabhan, Theoretical Astrophysics vols 1-3, Latest Edition, Cambridge University Press.
6. Astronomy structure of the Universe. A.E. Roy and D. Clarke, Adam Hilger Pub.
7. Source Book of Space Sciences, Samuel Galsstone; D.VanNostrand Co. Inc.
8. Research in Geophysics:Vol.1- Sun, Upper Atmosphere and space edited by Hugh Odishaw, National Academy of Sciences. Washington D.C.

9. Source book on the Space Sciences - Samuel Glasstone, Princeton, New Jersey.
10. The Upper Atmosphere - S K Mitra.

OE-2: OPTIONAL MATHEMATICS-2
(03 Hours/week; 03 credits)

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE203	**OPTIONAL MATHE-MATICS-2**	**OE-2**	**3**	**0**	**0**	**3**	**3**

Course Objectives:
To study Concepts of divisibility, prime and composite numbers and understanding the concept of differentiation and theorems using various rules.

Course Learning Outcomes: This course will enable the students to
1. Learn the concept of Divisibility.
2. Learn about prime and composite numbers.
3. Learn the concept of congruences and its applications.
4. Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
5.Find the extreme values of functions of two variables.
6. To understand the concepts of multiple integrals and their applications.

Unit-I: Number Theory: 14 hours
Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems**.**

Unit-II: Partial Derivatives: 14 hours
Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples**.**

Unit-III: Integral Calculus: 14 hours
Line integral: Definition of line integral and basic properties, examples on evaluation of line integrals. Double integral: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Triple integral: Definition of triple integrals and evaluation-change of variables.

Reference Books:
1. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi.
 2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
 4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
 5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill, 2008.
 6. Integral Calculus, Shanthinarayan, S. Chand and Co. Pvt. Ltd.
 7. Integral Calculus, Shantinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
 8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6th edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

OE-2 : Course Title: Food Biotechnology

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE204	**Food Biotechnology**	**OE-2**	**3**	**0**	**0**	**3**	**3**

Unit I: Introduction to Food Biotechnology   **14 hrs**

Fermentation Technology, Principles of fermentation and Historical Back ground. Microbial Strain Improvement. Natural and synthetic media; Media formulations, Media sterilization, batch and continuous media sterilization processes; Sterilization of fermenter. Configurations and functions of batch, fedbatch and continuous fermenters.

Fermenter devices: baffles, impellers, foam separators, sparger, culture vessel, cooling and heating devices. Mass transfer in reactors: Transport phenomena in fermentation- Gasliquid exchange and mass transfer, oxygen transfer, critical oxygen concentration, Cell disintegration physical, chemical and enzymatic methods. Microbiological fermentation

Products: Alcohol - Ethanol, Alcoholic beverage - Wine & Beer, Organic acids - Citric acid.

Unit II: Enzymes in food processing   **14 hrs**

Fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases) used in food industry and their downstream processing. Enzymes for production of protein hydrolysates and bioactive peptides, maltodextrins and corn syrup solids (liquefaction, saccharification, dextrinization, isomerization for production of high-fructose-corn-syrup), fructose and fructo-oligosaccharides.

Unit III: Food Biotechnology Applications   **14 hrs**

Biosensors: Classification and application in food industry Application of biotechnology in food, Extraction- solvent, two phase, liquid extraction, whole broth and aqueous multi-phase extraction.

Purification – Chromatography, ultra-filtration, reverse osmosis, drying and crystallization. Immobilization of enzymes: Arresting of cell in insoluble matrix, immobilized cell systems, large scale cell immobilization, uses and applications in industries.

References:

1. B.D. Singh. 2014. Biotechnology - Expanding Horizons. Kalyani Publishers, New Delhi.

2. James D. Watson. 2013. Molecular Biology of the Gene, 7th Ed. Benjamin Cummings, San Francisco, USA.

3. Oliver Brandenberg, Zephaniah Dhlamini, Alessandra Sensi, Kakoli Ghosh and Andrea Sonnino 2011.

4. Ashok Agarwal and Pradeep Parihar. 2005. Industrial Microbiology: Fundamentals and Applications. Agrobios India, Jodhpur.

5. Bharatbhushan (2010). Handbook of Nanotechnology. Springer Publications.

OE-2: NUTRITION AND DIETETICS
(03 Hours/week; 03 credits)

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BOE205	**NUTRITION AND DIE-TETICS**	**OE-2**	**3**	**0**	**0**	**3**	**3**

Unit 1: Basic Concepts of Nutrition: **14 hours**

Introduction, Basic principles of a balanced diet to provide energy and nutrients. Composition of foods and proximate analysis of foods. Calorific value of foods and Basal metabolism. Basal Metabolic Rate (BMR), Factors affecting BMR, Energy requirements for different physical activities, Specific dynamic action of food, Nutritive value of proteins. Energy requirements and recommended dietary allowance (RDA) for infants, children and pregnant women. Protein calorie malnutrition.

Unit 2: Macronutrients and Micronutrients: **14 hours**

Carbohydrates- Digestible and non-digestible, Dietary fibers, Essential fatty acids, lipoproteins and cholesterol. Essential amino acids, Fortification of foods, Protein requirement for different categories.

Vitamins-Sources, requirements, functions and deficiency symptoms of Vitamin-C, Thiamine, Riboflavin, Pyridoxine, Folic acid, Vitamin B12. Absorption of fat-soluble vitamins-A, D, E and K. Micronutrients: Source, Daily requirement, functions and deficiency disease symptoms of Macro-minerals (Ca, P, and Cl) and micro minerals/trace elements (I, Fe, Zn and Se).

Unit 3: Dietetics and Diet Therapy: **14 hours**

Introduction. Food pyramid. Diet planning and introduction to diet therapy. Nutritional requirements for different age groups, anemic child, expectant women, and lactating women. Diet planning for prevention and cure of nutritional deficiency disorders.

Diet therapy: Functional foods, Anthropometric measurements, dietary considerations during fever, malaria, and tuberculosis. Prevention and correction of obesity, underweight, and metabolic diseases by diet therapy. Dietary interventions to correct and or manage the gastrointestinal diseases (indigestion, peptic ulcer, constipation, diarrhea, steatorrhea, irritable bowel syndrome. Functional foods-based diet therapy for diabetes, cardiovascular disease and cancer.

References

1. Clinical Dietetics and Nutrition, 2002, Antia FP and Abraham P. Oxford UniversityPress; 4th Edition. ISBN-10: 9780195664157.
2. Oxford Handbook of Nutrition and Dietetics, 2011, Webster-Gandy J, Madden A andHolds worth M. Oxford University Press, Print ISBN-13: 9780199585823. Krause's Food, Nutrition and Diet therapy, 2003, Mahan KL and Escott-Stump S. Elsevier, ISBN: 9780721697840.
3. Human Nutrition and Dietitics. 1986, Passmore R. and Davidson S. ChurchillLivingstone Publications, ISBN-10: 0443024863.
4. Rosemary Stanton's Complete Book of Food & Nutrition, 2007, Simon &Schuster Publishers, Australia, ISBN 10: 0731812999
5. Food Science and Nutrition, 2018, Roday S. Oxford University Press Publishers,ISBN: 9780199489084/0199489084.
6. Food Science, 2007, Srilakshmi S. New Age International (P) Limited Publishers,ISBN: 9788122420227/ 8122420222.

ABILITY ENHANCEMENT COURSE (AECC)
(02Hours/week; 02 credits)
ENVIRONMENTAL STUDIES

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BAE201	**ENVIRONMENTAL STUDIES**	AEC-2	2	0	0	2	2

Unit-I   **14hrs**

Multidisciplinary Nature of Environmental Studies: Introduction to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment.

Environmental protection – Role of Government-Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Initiative and Role of Non-government organizations in India and world.

Self study: Need for public awareness on the environment, Gaia Hypothesis

Unit-II   **14 hrs**

Environmental pollution, degradation & Waste management:

Environmental Pollution – Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Soil pollution, Automobile pollution-Causes, Effects & control measures.

Self study: Case studies of London smog, Bhopal gas tragedy, marine pollutions and study of different waste water treatment processes.

Environmental degradation – Introduction, Global warming and greenhouse effect, Acid rain-formation & effects, Ozone depletion in stratosphere and its effect.

Solid Waste management – Municipal solid waste, Biomedical waste, Industrial solid waste and Electronic waste (E-Waste).

Self study: Disaster management, early warning systems-bio indicators for Tsunami and other natural disasters.

Unit-III   **14 hrs**

Energy & Natural resources:

Energy – Definition, classification of energy resources, electromagnetic radiation-features and applications, Conventional/Non-renewable sources – Fossil fuels based(Coal, petroleum & natural gas), nuclear energy, Non-conventional/renewable sources – Solar, wind,hydro, biogas, biomass, geothermal, ocean thermal energy, Hydrogen as an alternative as a future

source of energy.

Self study: Remote sensing and its applications, Chernobyl (USSR) nuclear disaster and Fukushima (Japan) nuclear disaster.

Natural resources –water resource (Global water resource distribution, Water conservation methods,

Water quality parameters, Uses of water and its importance), Mineral resources (Types of minerals, Methods of mining & impacts of mining activities), Forest wealth (Importance's, Deforestation-Causes, effects and controlling measures)

 Self study: Hydrology & modern methods adopted for mining activities.

Reference Books:

 1. "Environmental Studies", by R.J. Ranjit Daniels and JagadishKrishnaswamy, (2017), Wiley India Private Ltd., New Delhi, Co-authored &Customised by Dr.MS Reddy & Chandrashekar.

 2. "Environmental Studies", by R.J. Ranjit Daniels and JagadishKrishnaswamy, (2009), Wiley India Private   Ltd., New Delhi.

3. "Environmental Studies" by Benny Joseph, Tata McGraw – Hill Publishing Company Limited.

4. Environmental Studies by Dr.S.M.Prakash, Elite Publishers Mangalore, 2007

5. Rajagopalan R. 2005,"Environmental Studies – from Crisis to cure", Oxford University Press

 6. Environmental Science by Arvind walia, Kalyani Publications, 2009.

7. Environmental Studies by AnilkumarDey and Arnab kumarDey.

Course Code	Course Title	Course Type	L	T	P	C	Hrs/Week
23BSE201	**Physical Education & Sports/ NCC/NSS**	**SEC-1**	**0**	**0**	**4**	**2**	**4**

Title of the Course: **SPORTS /NCC/NSS**
    Conditioning Exercises
    Aerobics & Calisthenics
    One Major Game and One Indigenous Game (Basic Skills)
    NSS/NCC Volunteering/Camp/Shramadhan/Social Work
    Participating in Mutt events
    Project/Record
    Proficiency in particular Sport
> ➢   Rules & Regulations
> ➢   Marking & Ground Management
> ➢   Officiating

Note:
1. Colleges may offer required no: of games as per students' strength and available facilities.
2. Students shall opt any one game in each of the semester and shall not repeat the same game in other semesters.
3. For Specially Challenged Students, the Program shall be designed at college level.

Note: Due Weightage in Assessment shall be given to Elite Sportsmen of the College.

Formative Assessment	
Assessment type	**Weightage in Marks**
Activity Based Practical	**IA-Internal Assessment- 50 Marks** ● Skills/Physical Fitness Test =20 ● Classroom Activity (Discipline, Mass ParticipationActivity, Punctuality)= 20 ● Performance = 10
Total	**50 Marks**

Note: IA Guidelines shall be formulated at the University Level

References:

1. Muller, J. P. (2000). Health, Exercise and Fitness. Delhi: Sports.

2. IAAF Manual

3. Vanaik.A (2005) Play Field Manual, Friends Publication New Delhi

4. M.J Vishwanath, (2002) Track and Field Marking and Athletics Officiating Manual, Silver Star Publication, Shimoga

Note: Skills of Sports and Games (Game Specific books) may be referred

I and II SEMESTER: SCHEME OF VALUATION (Theory) IN CHEMISTRY/ PHYSICS/ MATHEMATICS/ BIOCHEMISTRY
Evaluation of Internal Assessment Marks* for DSC, AECC and OE Papers

	C1 Marks	C2 Marks
Test	10	10
Assignment/Report	10	10
Total	20	20

QUESTION PAPER PATTERN for I and II SEMESTER
Discipline Specific Course (DSC-1, DSC-2 Papers)

Duration: 2h.30min		Max. Marks: 60	
Instructions:			
PART-A		Answer any six of the following	6 X 2 = 12
1	a)	(Two questions from each unit)	
	b)		
	c)		
	d)		
	e)		
	f)		
	g)		
	h)		
PART-B: Unit-I			
Answer any two of the following			2 X 6 = 12
2	a)		
	b)		
3	a)		
	b)		
4	a)		
	b)		
PART-C: Unit-II			
Answer any two of the following			2 X 6 = 12
5	a)		
	b)		
6	a)		
	b)		
7	a)		
	b)		
PART-D: Unit-III			
Answer any two of the following			2 X 6 = 12
8	a)		
	b)		
9	a)		
	b)		
10	a)		
	b)		
PART-E: Unit-IV			
Answer any two of the following			2 X 6 = 12
11	a)		

	b)		
12	a)		
	b)		
13	a)		
	b)		
The sub-questions in Part-B, Part-C, Part-D and Part-E shall be of (3 + 3) or (4 + 2) or (6)			

QUESTION PAPER PATTERN for I and II SEMESTER
Open Elective Course (OE-1, OE-2 Papers)

Duration: 2h.30min	Max. Marks: 60	
Instructions:		
PART-A	Answer all of the following	10 X 1 = 10
1 a)	(Two questions from each unit)	
b)		
c)		
d)		
e)		
f)		
g)		
h)		
i)		
j)		
PART-B:		
Answer any five of the following		10 X 5 = 50
2 a)		
b)		
c)		
3 a)		
b)		
c)		
4 a)		
b)		
c)		
5 a)		
b)		
c)		
6 a)		
b)		
c)		

7	a)		
	b)		
	c)		
8	a)		
	b)		
	c)		
The sub-questions shall be of (3 + 3 +4) or (5 + 5) or (6 + 4) or (5 + 3 +2) or (3 + 3 +2+2)			

QUESTION PAPER PATTERN for I and II SEMESTER
AEC/ SEC (Digital Fluency/ Env. Science/Indian Constitution)

Duration: 2h.		Max. Marks: 30	
Instructions:			
PART-A		Answer any five of the following	5 X 1 = 05
1	a)	(Two questions from each unit)	
	b)		
	c)		
	d)		
	e)		
	f)		
PART-B:			
Answer any two of the following			5 X 5 = 25
2	a)		
	b)		
3	a)		
	b)		
4	a)		
	b)		
5	a)		
	b)		
6	a)		
	b)		
7	a)		
	b)		
The sub-questions shall be of (5) or (3+2)			

I & II SEMESTER: SCHEME OF VALUATION (PRACTICALS) IN CHEMISTRY/ PHYSICS/ MATHEMATICS/ BIOCHEMISTRY

DSCP-1, DSCP-2 –Practical   **Max Marks: 50**
Internal Assessment Marks = 25

	C1 Marks	C2 Marks	Record Marks	Total Marks
Test	10	10	05	25

I & II Semester End Examination (C3) = 25 Marks   **Duration: 03 Hours**
Note: Duly certified practical record shall be submitted at the practical examination (No evaluation of record).