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SCIENCE COLLEGE
Congress Nagar, Nagpur - 440 012 (M.S.) INDIA

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Program Outcomes, Program-Specific Outcomes and Course Outcomes

For B.Sc. & BCA NEP (Effective from 2024-25)

M.Sc. (Botany, Chemistry, Computer Science, Mathematics, Microbiology, Physics, Zoology) CBCS & NEP (Effective from 2023-24) & MCA

Internal Quality Assurance Cell (IQAC)

Programme Outcomes (POs) and Course Outcomes (COs) for all Programmes offered by the institution

INDEX

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

As per National Education Policy 2020

B.Sc. Four Years (Honors/Research)

Curriculum Framework for Eight Semester Degree Course with Major/Minor Subject

B.Sc. (Botany, Biotechnology, Chemistry, Computer Science, Electronics, Geology, Mathematics, Microbiology, Physics, Statistics, Zoology)

NEP (Effective from session 2024-25)

Notification of University

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

(Established by Government o Central Provinces Education Department by Notification No. 513, dated 1st of August, 1923 & presently a State University governed by Maharashtra Public Universities Act, 2016(Maharashtra. Act No.VI of 2017)

(Academic Section)

Rashtrasant Tukadoji Maharaj Nagpur University, Jamnalal Bajaj Administrative Building, Mahatma Jotiba Phule Educational Premises, Campus Square to Ambazari T-Point Road, Nagpur-440033

No.RTMNU/ Acad. / 2024/ 175 Date: 15 May 2024

NOTIFICATION

It is notified for general information of all the concerned that the Academic Council in its meeting held on 22nd April 2024 vide item No.**1(A to G,J to M,and O to S), 2(A to C & E to H), 3(A to F) and 6 to 08 has approved.** The following recommendations of the respective Board of Studies and all Faculties to be effective from the session 2024-2025 & onwards.

Item No		Examination	Details of the approved recommendations
1.	A	B.Sc. Forensic Science	Minor changes in the Scheme of Examination of B.Sc. Forensic Science Major (NEP 2020) of semester IV, V, VII (Research), VSEC and DSE for implementation from the academic session 2024-2025 and onwards phasewise
	B	B.Sc. (Environmental Science)	Environmental Science and Chemistry have been kept in same group (NEP-2020), hence, students of environmental Science can't take chemistry as minor subject but BOS strongly feels, Environmental Science should be allowed to take chemistry as minor subjects **to be included in Group E Basket** for implementation from the academic session 2024-25 and onwards phasewise.
	C	B.Sc. (Artificial Intelligence)	Syllabus of Artificial Intelligence III, IV,V, and VI semester for Implementation from the academic session 2024-25 and onwards phasewise.
	D	B.Sc. (Artificial Intelligence)	New Syllabus of Artificial Intelligence as per NEP-2020 **so to be included in Group E Basket** for implementation from the academic session 2024-25 and onwards.
	E	B.Sc. (Languages in Science)	New syllabus as per NEP 2020 for implementation from the academic Session 2024-25 and onwards. 1. B.Sc Sem. I English (AEC),2. B.Sc Sem. II Marathi (AEC)3. B.Sc Sem. II HindiAEC),4. B.Sc Sem. II Gujrathi (AEC),5. B.Sc Sem. II Sanskrit (AEC) 6. B.Sc Sem. II Urdu (AEC),7. B.Sc Sem. II Supplementary English (AEC)
	F	B.Sc (Home Science)	Scheme of examination as per NEP 2020 of B.Sc. (Home Science) for implementation from the academic session 2024-25and onwards.
	G	B.Sc. (Home Science)	The admission and eligibility conditions for Undergraduate courses of Home Science (B.Sc. Home Science) 10+2 (Higher Secondary Education) in Science/Home Science/Commerce/ MCVC/Arts with Language English, Marathi or Hindi for implementation from the academic session 2024-25 and onwards.
	J	B.Tech. (All Programms)	Scheme of Examination and new Syllabus as per NEP-2020 of B.Tech for implementation from the session 2024-25and onwards.
	K	B.Sc. (Data Science)	New Syllabus of B.Sc. Data Science Semester V and VI for implementation from the academic session 2024-2025 and onwards.

	L	BCA	ii) ज्या महाविद्यालयांना B.Sc (Computer Application) असे नामांतर हवे आहे. त्या महाविद्यालयांनी BCA च्या ऐवजी B.Sc (Computer Application) अभ्यासक्रमाच्या संलग्नितेची प्रक्रिया पूर्ण करावी.
	M	B.Sc. in BFD and BTS	The following book to be included for BFD and BTS course. Curriculum for all semesters for implementation from the academic session 2024-25 and onwards. तंतुनिर्माण व तंतुनिर्माण खंड– १वस्त्र निर्मीती माहिती कोषसुत निर्माण खंड– २ कापडनिर्माण खंड– ३ रासायनिकप्रक्रिया खंड– ४ फॅशन/वस्त्र प्रावरणे खंड– ५ प्रकाशक, राज्य मराठी विकास संस्था, मुंबई.
	O	B.Tech. Electrical Engineering	Absorption Scheme of 7th& 8th Semester of B.Tech Electrical Engineering for implementation from the academic session 2024-25 and onwards.
	P	B.Tech. Electronics Engineering	Minimum passing marks for 3rd semester (CBCS Scheme) is added for implementation from the academic session 2024-25 and onwards.
	Q	B.Tech. Computer Engineering / Computer Science & Engineering / Information Technology / Computer Technology	The following 1 to 5 for implementation from the academic session 2024-25 and onwards. 1) Third semester Computer Technology Scheme of Examination: Minimum Passing Added. (Copy Enclosed) 2) 4th semester Computer Technology Syllabus Data Structure & Program Design with minor revision. (Copy Enclosed) 3) 6th semester Computer Technology Software Testing and Quality Assurance with minor revision. (Copy Enclosed) 4) 5th semester Computer Technology Artificial Intelligence Syllabus with minor revision. (Copy Enclosed) 5) CSE/CT/IT/CE Absorption Scheme Third to Eight semester. (Copy Enclosed)
	R	Civil Engineering	The Scheme of Examination & Syllabus of Post Graduate Diploma Course for Valuation in Real Estate (of Architecture Course) for implementation from the academic session 2024-25 and onwards.
	S	B.Tech.	The AICTE Guidelines for Working Professionals in AICTE Approved Institutions for Diploma, U.G. and P.G. Courses in Engineering & Technology with effect from the academic session 2024-25 and onwards.
2.	A	M.Com.	M.Com.-I CBCS Pattern as per NEP-2020 Syllabus in the subject Advanced Financial Accounting-I to be implemented from the Session 2024-2025 and onwards.
	B	Commerce U.G	The basket for **"Skill Enhancement Courses"**for implementation of NEP 2020 compliant curriculum of all UG Programms in the Faculty of Commerce & Management.
	C	B.Com. (Languages including English & Other Languages)	The Ability Enhancement Courses for B.Com. B.B.A. & B.Sc.(Finance) courses new Syllabus as per NEP-2020 of English, Marathi, Hindi and Urdu for Semester I to IV for implementation from the Session 2024-2025 and onwards.
	F	M.Com.I	डॉ. मेधा कानेटकर व प्रा. मृण्मयी कानेटकर लिखीत संघटनात्मक वर्तणुक (Organization Behaviour) श्री, साईनाथ प्रकाशन, नागपूर, हे पुस्तक एम. कॉम. प्रथम वर्षाकरिता सत्र २०२४–२५ पासून लागु करण्यात येत आहे.
	G	Lifelong learning Diploma Courses.	विद्यापीठाच्या Lifelong learning विभागातर्फे सादर करण्यात आलेले Financial Management अभ्यासक्रमशी संबंधित Diploma Courses.

	H	M.Com.I	डॉ. मेधा कानेटकर व प्रा. मृण्मयी कानेटकर लिखीत (i) संशोधन पद्धती (ii) व्यावसायीक कायदे सत्र एक करिता आणि सत्र दोन करिता (i) कंपनी कायदा (ii). भारतीय वित्तीय व्यवस्था श्री, साईनाथ प्रकाशन, नागपूर, हे पुस्तके एम. कॉम. प्रथम वर्षाकरिता सत्र २०२४–२५ पासून लागु करण्यात येत आहे.
	I	B.B.A.	ii) ज्या महाविद्यालयांना B.Com (Business Administration)असे नामांतर हवे आहे त्यांनी B.B.A च्या ऐवजी B.Com (Business Administration) अभ्यासक्रमाच्या संलग्नितेची प्रक्रिया पूर्ण करावी.
3	A	B.A. (Marathi)	Revised syllabus and Scheme of Examination B.A. in Marathi (Language & Literature) Sem.-I to Sem.-VIII as per NEP-2020 will come to effect from the Session **2024-2025 & onwards phasewise.**
	B	BA	The revised syllabus and Scheme of Examination (B.A. Honors & BA Research Degree IKS Course for Psychology Major Sem. I), (B.A. Honors & BA Research Degree in Psychology as Minor Sem. II to VI.), (B.A. Honors & BA Research Degree in Psychology as Major Sem. I to VIII) and (Open Elective Courses in Psychology Sem. I to IV) as per NEP-2020 will come to effect from the Session**2024-2025 & onwards phasewise.**
	C	BA (Philosophy)	The Minor Changes in syllabus B.A. in Philosophy Sem.-I to Sem.-VIII as per NEP-2020 will come to effect from the Session **2024-2025 & onwards phasewise.**
	D	B.A. (History) M.A. History	i) The Minor changes in syllabus B.A. in History Sem.-III under (VSC-3 – Cultural Heritage of India, Unit – I Indian Culture Instead of, (b. Tribe, Varna and Jati, Untouchability) to be inserted as (b. Festival-Marbat, Pola, Holi, regional Folk) as per NEP-2020 will come to effect from the Session **2024-2025 & onwards phasewise.** ii) The Minor changes in syllabus M.A. in History (Title of the paper) Sem.-II Ancient India –II (From Earliest time to 12th century) as per NEP-2020 will come to effect from the Session **2024-2025 & onwards phasewise.**
	E	B.A. (Music)	The Minor Changes in syllabus B.A. in Music Sem.-I to Sem.-VIII as per NEP-2020 will come to effect from the Session **2024-2025 & onwards phasewise.**
	F	B.A. (English)	The Minor Changes in syllabus B.A. in English (Language & Literature) Sem.-I to Sem.-VIII as per NEP-2020 will come to effect from the Session **2024-2025 & onwards phasewise.**
6		Academic Calendar	सत्र २०२४–२५ करिता संलग्नित/संचालित महाविद्यालयांतील व्यवसायीक व अव्यवसायीक अभ्यासक्रमाच्या विद्यार्थी प्रवेश, विद्यार्थांच्या परिक्षा, हिवाळी व उन्हाळी सुटया इत्यादी संबंधी बाबीकरिता शैक्षणिक वेळापत्रक.
7		Master of Human Capital Management and Employee Relation	New syllabus and scheme & Exam for Semester –III & IV as per NEP-2020 with effect from the academic session 2024-25 and onwards.
8		B.Tech Mechnical Engineering	The minor changes in the syllabus of semester 4th and 6th of B.Tech Mechnical Engineering for implementation from the academic session 2023-24 and onwards.

Note:- All the concerned are requested to take a note of this notification respective changes in the Syllabus. The corrected Syllabus is available on Rashtrasant Tukadoji Maharaj Nagpur University Website (www.nagpuruniversity.ac.in)

(Dr. Raju Hiwase)
Registrar

Copy forwarded for information & necessary action to:

1. The all Principal of affiliated and conducted Colleges
2. Deans of all All Faculties
3. Chairman under the All Faculties
4. The Director Board of Examinations and Evaluation,
5. The Deputy Registrar (Pre/ Post Exams.),
6. The Asstt. Registrar (Gen./Prof./ Confidential/ Exam Enq.)
7. P. A. to Hon'ble Pro-Vice Chancellor,
8. P. A. to Hon'ble Pro-Vice Chancellor,
9. P. A. to Registrar,
10. Co-ordinator, I.T.Cell, publish above document on University Website

RashtrasantTukadojiMaharaj
Nagpur University, Nagpur

(Dr. Rajendra Utkhede)
Deputy Registrar(Acad)

Dr. A. A. Halder
IQAC Coordinator
S.S.E.S.A's
Science College, Nagpur

SEAL

Dr. O. S. Deshmukh
Principal
S. S. E. S. Amravati's
Science College, Nagpur.

Program Outcomes (POs) for B. Sc. Programme

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Problem Solving: Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from sciences/ mathematics/ social sciences/ humanities.

PO3. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO4. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

PO5. Ethics: Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and sustainability: Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.

PO7. Self-directed and life-long learning: Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PO8. Design/Development of Solutions: Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO9. Computational Thinking: Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

PO10. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO11. Global Perspective: Understand the economic, social and ecological connections that link the world's nations and people.

PO12. Aesthetic Engagement: Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

Program Outcomes (POs), Program Specific Outcomes (PSOs) and Course Outcomes (Cos) for B. Sc. (Physics) Programme

Program Outcomes:

- PO-1. Demonstrate a solid understanding of key concepts across all branches of physics.
- PO-2. Employ critical thinking and scientific knowledge to design, conduct, record, and analyze the results of physics experiments.
- PO-3. Solve the problem and also think methodically, and independently and draw a logical conclusion
- PO-4. Create an awareness of the impact of Physics on society, and development outside the scientific community.
- PO-5. To acquaint with modern techniques and decent equipment.

Program Specific Outcomes

- PSO-1. Gain knowledge of Physics through theory and practicals.
- PSO-2. Understand good laboratory practices and safety.
- PSO-3. Develop research-oriented skills.
- PSO-4. Make aware and handle the sophisticated instruments/equipment.

B. Sc. Semester-I

Discipline Specific Core Course (DSC-1)-PHYSICS - Paper-I (BPH1T01)

(Measurements, Mechanics, and Properties of Matter)

After this course the students will be able to

Sr. No	Course outcome
1.	Develop interest in measurement with conceptual knowledge of physics.
2.	Develop practical skills in accurate measurements with minimal errors.
3.	Understand and practice these skills while performing physics practical.
4.	Understand the use of apparatus and their use without fear.
5.	Correlate their physics theory concepts with practical outcomes.
6.	Understand the concepts of errors and their estimation.

Discipline Specific Core Course (DSC-2)-PHYSICS - Paper- II (BPH1T02)

(Kinetic theory of gases and Thermodynamics)

Sr. No	Course outcome
1	Understand the assumptions of kinetic theory of gases, ideal and real gases.
2.	Understand the nature of calorimetry by specific heat of solids and gases.
3.	Analyses different transport phenomena in gases

4	Describe basic concepts of Thermodynamics.
5.	Analyses the laws of thermodynamics in different cases and entropy.
6.	Restate definition of the system, surrounding, closed and open system, extensive and intensive variables and properties.
7.	Design various types of basic heat engines.
8.	Apply Maxwells thermodynamic relations.
9.	Understanding the low-temperature physics

Vocational Skill Course (VSC - 1) - PHYSICS Course Code (BVS1P01)

(Electronic and Electrical Components)

After the completion of this course students will be able to

Sr. No.	Course Outcome
1.	Get acquainted with hands-on practice for electronic components and their uses in electronic circuits
2.	Get acquainted hands-on practice for electrical components and their uses in electrical circuits
3.	Apply the practical knowledge in conducting various practicals during graduation
4.	Apply the practical knowledge in repairing household electronic and electrical

B. Sc. Semester-II

Discipline Specific Core Course (DSC-)-PHYSICS - Paper-III (BPH2T03)

(Acoustic and Ultrasonics)

After completing this course students will be able to

Sr. No.	Course outcome
1.	Understand the different aspects and attributes of musical sounds. Also response of the ear to sound and audible limits of human ear
2.	Learn about various musical scales and musical instruments
3.	Learn about acoustics of a hall and requirement of a good acoustic of a hall
4.	Learn about different microphones their design and action and also about loudspeaker.
5.	Learn about the characteristics and production method as well as detection of USW.
6.	Learn about different applications of USW like SONAR, soldering, cleaning, and medical applications like sonography etc.

Discipline Specific Core Course (DSC-4)-PHYSICS - Paper-IV (BPH2T04)

(Oscillations and Black body radiation)

After completing this course students will be able to

Sr. No.	Course outcome
1	Understand the simple harmonic motion, and properties of different oscillatory motion of an object.
2	Understand the damped and forced oscillation
3	Understand mechanical waves in a medium and wave equation of the transverse waves on string and longitudinal waves in a fluid.
4	Understand black body radiation and development of quantised nature of blackbody radiation.
5	Understand the temperature of heavenly bodies

Vocational Skill Course (VSC) - PHYSICS Course Code (BVS2P03)

(Instrumental Errors in Measurement)

Sr No.	Course outcome
1.	Understand the function of different instruments
2	Choose and apply the proper instrument for the measurement.
3	Handle the instrument carefully and apply the practical knowledge in his further study
4	Find the different man made and instrumental errors in doing different practical.

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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Chemistry) Programme

Programme Specific Outcomes (PSOs):

The B.Sc.(Hons/Res) programme in Chemistry is designed to develop in students in depth knowledge of the core concepts and principles that are central to the understanding of this core science discipline. Undergraduates pursuing this programme of study go through laboratory work that specifically develops their quantitative and qualitative skills, provides opportunities for critical thinking and team work, and exposes them to techniques useful for applied areas of scientific study.

1. ***Knowledge: Width and depth*****:** Students acquire theoretical knowledge and understanding of the fundamental concepts, principles and processes in main branches of chemistry, namely, organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry and biochemistry. In depth understanding is the outcome of transactional effectiveness and treatment of specialized course contents. Width results from the choice of electives that students are offered.
2. ***Laboratory Skills: Quantitative, analytical and instrument based*****:** A much valued learning outcome of this programme is the laboratory skills that students develop during the course. Quantitative techniques gained through hands on methods opens choice of joining the industrial laboratory work force early on. The programme also provides ample training in handling basic chemical laboratory instruments and their use in analytical and biochemical determinations. Undergraduates on completion of this programme can cross branches to join analytical, pharmaceutical, material testing and biochemical labs besides standard chemical laboratories.
3. ***Communication*****:** Communication is a highly desirable attribute to possess. Opportunities to enhance students' ability to write methodical, logical and precise reports are inherent to the structure of the programme. Techniques that effectively communicate scientific chemical content to large audiences are acquired through oral and poster presentations and regular laboratory report writing.
4. ***Capacity Enhancement*****:** Modern day scientific environment requires students to possess ability to think independently as well as be able to work productively in groups. This requires some degree of balancing. The chemistry honours programme course is designed to take care of this important aspect of student development through effective teaching learning process.
5. ***Portable Skills*****:** Besides communication skills, the programme develops a range of portable or transferable skills in students that they can carry with them to their new work environment after Completion of chemistry honours programme. These are problem solving, numeracy and mathematical skills- error analysis, units and conversions, information retrieval skills, IT skills and organizational skills. These are valued across work environments.

Course Outcomes (COs):

Course Outcomes CORE PAPERS/ MINOR PAPERS

B.Sc. Semester – I BCH1T01 Inorganic Chemistry-1 (Atomic structure, bonding and main group elements) Theory

1. Course Outcomes By the end of the course, the students will be able to:
2. Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic properties.
3. Draw the plausible structures and geometries of molecules using VSEPR theory.
4. Explain geometries and properties of molecules based on VBT.
5. Understand the concept of lattice energy using Born-Haber Cycle.
6. Rationalize the metallic properties based on various theories.
7. Elaborate structures and properties of common compounds formed by main group elements.
8. Identify acidic and basic radicals in simple inorganic salts

Course Outcomes CORE PAPERS/ MINOR PAPERS

B.Sc. Semester – BCH1T02 Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons) Theory

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

1. Understand and explain the different nature and behaviour of organic compounds based on fundamental concepts learnt.
2. Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
3. Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic Addition and Electrophilic Aromatic Substitution.
4. Understand the fundamental concepts of stereochemistry.
5. Elaborate various properties of aliphatic and aromatic hydrocarbons.
6. Experimentally identify extra element and functional group in the given organic compound.
7. Synthesize various organic compounds making use of selective reagents.

Course Outcomes

B.Sc. Semester I – Vocational Skill Course (VSC) BVS1P01: Soap, detergent and disinfectant Technology Practical

By the end of this course, students will be able to:

1. Gain an understanding of the history and influences behind modern soap creation processes and projected trends in the future of soap.
2. The analytical approach of this course is to enhance the reasoning and to understand the mechanical part of the industry.
3. Learn the most common formulations of soap products by exploring compositions and physical chemistry.
4. Understand the different aspects of industrial processes of Manufacturing disinfectants.
5. Optimise use of limited resources of harmful chemicals.
6. Suggest remedial measures for surfactant quality and threshold quantity improvement

Course Outcomes

B.Sc. Semester I – BVE1T01: ENVIRONMENTAL SCIENCE

At the end of the course, students shall be able to:

1. Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
2. Explicate the importance of Environmental Education.
3. Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
4. Describe the various physical and chemical characteristics and properties of Water and Soil
5. Understand the Ecology and its allied branches
6. Comprehend about Population and Community Ecology
7. Study the changes in Population by understanding the concept of Population ecology

Course Outcomes CORE PAPERS/ MINOR PAPERS

B.Sc. Semester II – BCH2T03 Organic Chemistry-2 (Functional group chemistry) Theory

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

1. Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
2. Use the synthetic chemistry learnt in this course to do functional group transformations.
3. To propose plausible mechanisms for various reactions.
4. Suggest synthesis routes for desired product from initial reactant.
5. Identify given organic compound by systematic chemical analysis.
6. Synthesize derivatives of given organic compound.

Course Outcomes CORE PAPERS/ MINOR PAPERS

B.Sc. Semester II – BCH2T04 Physical Chemistry-1 (Thermodynamics, gaseous and liquid states) Theory

By the end of the course, students will be able to:

1. Solve fundamental mathematical function based problems in chemistry.
2. Understand the three laws of thermodynamics, concept of State and Path functions, extensive and intensive properties.
3. Derive the expressions of ΔU, ΔH, ΔS, ΔG, ΔA for ideal gases under different conditions.
4. Evaluate thermodynamics of various physical and chemical processes.
5. Analyse and explain properties of ideal gas, real gas and liquids.
6. Evaluate thermodynamic constants through calorimetric studies.
7. Use various properties of liquids for determination of their concentration and composition.

Course Outcomes

B.Sc. Semester II – Vocational Skill Course (VSC) BVS2P03: Drug synthesis and analysis Practical

By the end of this course, students will be able to:

1. A foundational understanding of the principles and concepts of medicinal chemistry, including drug design and development.
2. Gaining practical experience in common laboratory techniques used in medicinal chemistry, such as synthesis and purification.
3. Ability to design and perform experiments to test the effectiveness of potential drug candidates, including assays.
4. Develop an understanding of the Physico-Chemical properties of drugs through fundamentals of volumetric analytical skills.

Course Outcomes CORE PAPERS

B.Sc. Semester – III B.Sc. – II, Semester - III in Inorganic Chemistry (CH – 301: Paper- I) Theory

By the end of this course, students will be able to:

1. Understand and apply the Linear Combination of Atomic Orbitals (LCAO) approximation to derive molecular orbital (MO) wave equations, distinguishing between bonding and anti-bonding MOs through energy and electron density distribution.
2. Analyze and construct molecular orbital diagrams for homonuclear diatomic molecules (elements with Z = 1 to 9) and interpret non-bonding molecular orbitals in heteronuclear molecules like HF.
3. Understand the chemistry of lanthanides, including their position in the periodic table, electronic configurations, oxidation states, atomic and ionic radii, and the implications of lanthanide contraction. Evaluate their complex-forming tendencies and methods of separation (ion exchange and solvent extraction).
4. Comprehend the chemistry of actinides, focusing on their periodic table positions, electronic configurations, oxidation states, and atomic and ionic radii.

Course Outcomes CORE PAPERS

B.Sc. Semester – III Inorganic Chemistry (CH – 301: Paper- I) Theory

By the end of this course, students will be able to:

1. Identify and understand the reactivity of different functional groups in organic compounds.
2. Apply knowledge of reaction mechanisms to predict the products of organic reactions.
3. Synthesize and analyze organic compounds, understanding their industrial and practical applications.
4. Develop problem-solving skills and critical thinking in organic chemistry.

Course Outcomes CORE PAPERS

B.Sc. Semester – III CH- 303: Laboratory Course (Inorganic & Organic)

By the end of this course, students will be able to:

1. Develop skills in accurately preparing standard solutions by weighing, essential for precise analytical measurements.
2. Gain expertise in various titrimetric methods for the determination of specific ions and compounds.
3. Develop the ability to solve complex analytical problems using volumetric analysis.
4. Strengthen understanding of chemical reactions and stoichiometry involved in volumetric analysis.
5. Students will gain skills in systematically analyzing organic compounds, including preliminary examination, element detection, functional group identification, melting/boiling point determination, derivative preparation, and specific tests.
6. Gain experience in synthesizing derivatives of organic compounds and determining their melting/boiling points.
7. Enhance awareness of safety protocols and best practices in the organic chemistry laboratory.

Course Outcomes CORE PAPERS

B.Sc. Semester – IV CH- 401:Paper- I (Inorganic Chemistry) Theory

By the end of this course, students will be able to:

1. Students will be able to differentiate between these types of compounds based on their structural and functional characteristics.
2. Students will grasp the foundational theory of coordination chemistry, understand Werner's contributions, and verify these concepts through experimental evidence.
3. Students will acquire the skill to name coordination compounds correctly according to IUPAC standards.
4. Students will understand the application of valence bond theory in explaining the bonding and structure of transition metal complexes.

Course Outcomes CORE PAPERS

B.Sc. Semester – IV CH- 402: Paper- II (Physical Chemistry)

By the end of this course, students will be able to:

1. Define entropy as a state function and calculate entropy changes for various processes, including phase changes in ideal gases.
2. Understand and differentiate between Helmholtz free energy (A) and Gibb's free energy (G).
3. Apply the Gibb's-Helmholtz equation to determine the temperature dependence of free energy.
4. Calculate thermodynamic quantities (ΔG, ΔH, ΔS) and equilibrium constants for cell reactions.
5. Utilize dipole moments to infer % ionic character, molecular shape, and analyze geometrical isomers and substituted benzene molecules.
6. Acquire in-depth understanding and practical skills in thermodynamics, electrochemistry, nuclear chemistry, dipole moments, and spectroscopy.

Course Outcomes CORE PAPERS

B.Sc. Semester – IV CH-403: Laboratory Course (Inorganic & Physical)

By the end of this course, students will be able to:

1. Students will develop skills in gravimetric techniques, learning to accurately precipitate and weigh barium as barium sulfate to determine the concentration of Ba^{2+} ions in a sample.
2. Students will gain expertise in complexometric analysis, learning to form and isolate nickel dimethylglyoxime (Ni-DMG) complexes for precise nickel ion estimation.
3. Develop the ability to conductometrically determine the strength of acids in a mixture by titration with a standard alkali, and understand the principles of conductometric titrations.
4. Develop skills in potentiometric titration to measure the redox potential of the Fe^{2+}/Fe^{3+} system using potassium dichromate and understand the application of redox reactions in potentiometry.
5. Gain experience in determining the molecular state of benzoic acid using the distribution method, enhancing knowledge of molecular interactions and distribution equilibria.

Course Outcomes CORE PAPERS

B.Sc. Semester – V CH-501: Paper- I (Organic Chemistry)

By the end of this course, students will be able to:

1. Demonstrate a comprehensive understanding of the preparation, properties, and chemical reactions of nitroalkanes and nitrobenzene, including nucleophilic substitution mechanisms and their reduction in different media.
2. Develop skills for separating mixtures of primary, secondary, and tertiary amines and understanding the factors affecting their basicity.
3. Gain the ability to synthesize aryl diazonium salts and understand their synthetic transformations.
4. Develop skills in measuring IR spectra, interpreting the fingerprint region, and identifying characteristic absorptions of various functional groups.
5. Learn about the effect of conjugation, chromophores, auxochromes, and interpret UV spectra of conjugated dienes and enones.

Course Outcomes CORE PAPERS

B.Sc. Semester – V CH-502: Paper II (Physical Chemistry)

By the end of this course, students will be able to:

1. Develop a comprehensive understanding of the limitations of classical mechanics through classical phenomena such as black body radiation, photoelectric effect, and heat capacity of solids.
2. Describe the quantum mechanical treatment of the hydrogen atom, including the separation of the Schrödinger equation into radial and angular components and interpret hydrogen-like wave functions and quantum numbers.
3. Analyze the impact of colligative properties on solutions, including the use of Van't Hoff factor and the effects of dissociation and association of solutes.

4. Describe Raman spectroscopy, including the Raman effect, polarizability concept, and the applications of rotational spectra for analyzing diatomic molecules.

Course Outcomes CORE PAPERS

B.Sc. Semester – V CH-502: Paper II (Physical Chemistry)

By the end of this course, students will be able to:

1. Students will be able to accurately measure the concentration of glucose in a sample using colorimetric or titrimetric methods.
2. Students will gain proficiency in quantitative analysis techniques for amides, including preparation of standard solutions and performing titrations.
3. Students will be able to measure the carboxylic group content in a sample using appropriate chemical assays and titration techniques.
4. Students will be proficient in using an Abbe's refractometer to verify the law of refraction and understand the interaction of light with mixtures.
5. Students will be able to apply the Beer-Lambert law to determine the concentration of KMnO4 solutions and understand the relationship between absorbance and concentration
6. Students will gain hands-on experience in determining molecular mass through the Rast method, involving cryoscopic techniques.

Course Outcomes CORE PAPERS

B.Sc. Semester – VI CH-601: Paper I (Inorganic Chemistry)

By the end of this course, students will be able to:

1. Develop a deep understanding of the limitations of valency bond theory and the fundamentals of crystal field theory, including the splitting of d-orbitals in different geometries (octahedral, tetrahedral, square planar).
2. Apply crystal field theory to calculate the magnitude of 10Dq and the crystal field stabilization energy (CFSE) for various complex geometries.
3. Determine magnetic susceptibility using Gouy's method and apply the spin-only formula to calculate magnetic moments.
4. Assess the magnetic properties of octahedral and tetrahedral complexes based on crystal field theory.
5. Gain knowledge about silicones, including their nomenclature, preparation, properties, and applications.
6. Study phosphonitrilic halide polymers, focusing on their preparation, properties, uses, and structural aspects (e.g., $(NPCl_2)_3$ and $(NPCl_2)_4$).

Course Outcomes CORE PAPERS

B.Sc. Semester – VI CH-602: Paper II (Organic Chemistry)

By the end of this course, students will be able to:

1. Solve problems related to the structure elucidation of organic molecules using NMR spectroscopy.
2. Study the structure and reactions of various sugars and polysaccharides, including maltose, sucrose, and cellulose.

3. Understand protein structures (primary and secondary) and the double helical structure of DNA.
4. Study the preparation, properties, and uses of synthetic drugs, including aspirin, paracetamol, and chloroquine.
5. Understand polymerization techniques, including addition (chain-growth) and condensation (step-growth) polymerizations, and study the properties of various synthetic polymers.

Course Outcomes CORE PAPERS

B.Sc. Semester – VI CH-602: Paper II (Organic Chemistry)

By the end of this course, students will be able to:

1. Students will be able to prepare and analyze coordination complexes and understand their bonding, magnetic properties, and colors based on Valence Bond Theory (VBT).
2. Students will gain hands-on experience in colorimetric and spectrophotometric techniques to estimate and analyze metal ions and complex formation.
3. Students will develop practical skills in the separation, identification, and derivatization of organic mixtures.

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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Computer Science) Programme

Programme Specific Outcomes (PSOs):

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity.
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer- based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Computer Science - Major) SC-DSC (Paper I) BCS1T01

PROGRAMMING IN 'C' Credits : 2 Duration : 30 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

B.Sc. Sem-I (Computer Science - Major) SC- DSC (Paper II) BCS1T02 COMPUTER FUNDAMENTALS Credits : 2 Duration : 30 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

1. Confidently operate computers to carry out computational tasks
2. Understand working of Hardware and Software and the importance of operating systems
3. Understand number systems, peripheral devices, networking, multimedia and internet concepts

B.Sc. Sem-I (Computer Science) OFFICE AUTOMATION (BVS1P01) Credits : 2 Duration : 60 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

1. Understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. Prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

B.Sc. SEMESTER – I BVE1T01: ENVIRONMENTAL SCIENCE

Course Outcomes (COs):

At the end of the course, students shall be able to:

1. Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
2. Explicate the importance of Environmental Education.
3. Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
4. Describe the various physical and chemical characteristics and properties of Water and Soil
5. Understand the Ecology and its allied branches
6. Comprehend about Population and Community Ecology
7. Study the changes in Population by understanding the concept of Population ecology.

Indian Knowledge System (IKS) SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes (COs):

This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. Gain test taking skills & creativity of calculations

B.Sc. Sem -II (Computer Science - Major) SC- DSC (Paper I) BCS2T03
Object Oriented Programming Using 'C++' Credits : 2 Duration : 30 Hours

Course Outcomes (COs):

After completion of this course, students will be able to:

1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

B.Sc. Sem -II (Computer Science - Major) SC- DSC (Paper II) BCS2T04
OPERATING SYSTEMS Credits : 2 Duration : 30 Hours

Course Outcomes (COs):

1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.

B.Sc. Sem-II (Computer Science) BVS2P03 COMPUTER ANIMATION
Credits : 2 Duration : 60 Hours

Course Outcomes (COs):

After completion of this course, students will be able to:

1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. Produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. Apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation.

Indian Knowledge System (IKS) SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes (COs):

This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Electronics) Programme

Programme Specific Outcomes (PSOs):

1. Discipline knowledge: Acquiring knowledge on basics of Electronics and ability to apply to design principles in the development of solutions for problems of varying complexity.
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to electronics science.
3. Design and Development of Solutions: Ability to design circuits and development of algorithmic solutions to real world problems.
4. Programming a computer/kit: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer- based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Electronics.

B.Sc. Sem-I (Electronics - Major)
Semester – 1; Paper – 2: Digital Electronics

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand the fundamentals of semiconductor components such as diode, BJT, FET and MOSFET.
2. Plot V-I characteristics of electronic components to observe its performance parameters.
3. Understand the simple applications of circuit made using these semiconductor components.
4. Analyse and solve circuits of electronic devices.

B.Sc. Sem-I (Electronics - Major)
Semester – 1; Paper – 1: Semiconductor Devices and Circuits

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand number systems conversions and apply the principles of Boolean algebra to manipulate, minimize and design logic circuits using logic gates.
2. Demonstrate knowledge of various combinational logic circuits like code converters, multiplexers, adders.
3. Demonstrate knowledge of sequential logic circuits elements like latches, flip-flops and use them in the design and analysis of counters, registers.
4. Demonstrate knowledge of design and analysis of complex combinational and simple finite state machine and similar circuits.

B.Sc. Sem-I (Electronics)
Semester – 1: VSC Basic Electronic Components and Instruments (BVS1P01)

Course Outcomes (COs):

At the end of this course students will have ability to

1. Identify various passive and active components
2. Make series and parallel combinations of components.
3. Design various types of simple linear power supply.
4. Demonstrate knowledge and use of various instrument used in electronics lab.

B.Sc. Sem-I (Electronics)
B.Sc. SEMESTER – I BVE1T01: ENVIRONMENTAL SCIENCE

Course Outcomes (COs):

At the end of the course, students shall be able to:

1. Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
2. Explicate the importance of Environmental Education.
3. Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
4. Describe the various physical and chemical characteristics and properties of Water and Soil
5. Understand the Ecology and its allied branches
6. Comprehend about Population and Community Ecology
7. Study the changes in Population by understanding the concept of Population ecology.

B.Sc. Sem-I (Electronics)
Indian Knowledge System (IKS)
SEM-1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes (COs):

This course will enable the students to

1. Improve speed and accuracy in numerical calculations.
2. Acquire IQ skills and high-end technical knowledge.
3. Gain test taking skills & creativity of calculations.

B.Sc. Sem-II (Electronics)
Semester – 2; Paper – 1: Network Analysis

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Apply network theorems for the analysis of electrical circuits.
3. Apply Laplace Transform for steady state and transient analysis.

B.Sc. Sem-II (Electronics)
Semester – 2; Paper – 2: Programming in C

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. To formulate simple algorithms and translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration, and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays to solve various matrix operation, searching, sorting and Pointers, Structures for the formulation of algorithm and Programs.

B.Sc. Sem-II (Electronics)
Semester – 2; VSC – 2: Arduino and applications (BVS2P03)

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to-

1. Understand the architecture of a Arduino boards & comparison.
2. Understand the operation and interfacing with peripheral devices.
3. Implement various applications.

B.Sc. Sem-II (Electronics)
Indian Knowledge System (IKS)
SEM2: INDIAN ASTRONOMY (BIK2T0 2)

Course Outcomes (COs):

This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Geology) Programme

Programme Specific Outcomes (PSOs):

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity.
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer- based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Geology - Major)
Semester I Paper I: (Introduction to Geology)

Course Outcomes (COs):

1. Identify and describe various physical processes and understand branches of geology
2. Compare various domains of geological science.
3. Outline application of different terminologies of geological science.
4. Categorize applications and economic importance of geological science.
5. Justify selection of geological science to utilize in social benefit of human kind in terms of wealth and culture.
6. Create a base to understand geological hazards and cope-up policy.

B.Sc. Sem-I (Geology - Major)
Semester I Paper II (Mineralogy)

Course Outcomes (COs):

1. Identify and describe various physical properties of megascopic specimens and optical properties of minerals under microscope.
2. Compare various crystals based on symmetry, symmetry functions and explain crystal system, mineral groups based on physical and optical properties.
3. Outline application of different micro analytical tools used in mineral analysis.
4. Categorize industrial applications and economic importance of various minerals.
5. Justify selection of microanalytical technique selected for the mineral analysis.
6. Prepare a report on a mineral sample by performing the necessary tests and suggest its applications in various fields.

B.Sc. Sem-I (Geology)
Semester I BVE1T01: ENVIRONMENTAL SCIENCE)

Course Outcomes (COs):

At the end of the course, students shall be able to:

1. Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
2. Explicate the importance of Environmental Education.
3. Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
4. Describe the various physical and chemical characteristics and properties of Water and Soil
5. Understand the Ecology and its allied branches
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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Mathematics) Programme

Programme Specific Outcomes (PSOs):

1. PSO1: Rational Thinking: Students be able to formulate and develop Mathematical arguments in a logical manner to unravel the gist hidden in the problem at hand.
2. PSO2: Problem solving ability: Student should be able to think in a critical manner to process the data, and develop Mathematical problem-solving ability.
3. PSO3: Revisiting the question: Students should be able to recall basic facts, important milestones, discoveries in Mathematics and inculcate habit of rational thinking by which the problem at hand can be revisited, time and again, that helps in solving it.
4. PSO4: Analytical ability: In the growing field of research, it is necessary for students to learn to use some packages like Matlab, Scilab, Mathematica, Maxima, etc, so that analytical tools be available to investigate the functions, problems through graphs, programming, etc.
5. PSO5: Numerical Ability: Using packages, students can make programs to solve some problems of which exact solutions are not available, using tools of Numerical analysis.
6. PSO6: Simulation Ability: The problems that cannot be solved directly, can at times be solved through techniques of simulation by honors/research students.
7. PSO7: Research: Students thus motivated would prepare themselves for research studies in Mathematics and related fields.
8. PSO8: Application: Student will be able to apply their skills and knowledge in Mathematics to various fields of studies including, science, engineering, commerce and management etc.

B.Sc. Sem-I (Mathematics - Major)
Semester I Paper I: (Algebra and Trigonometry)

Course Outcomes (COs):

1. CO1: Foundational Knowledge: Students will be able to update their basics of Set Theory, Matrices, Theory of equations and Complex variables and its applied aspects.
2. CO2: Elementary Skills: Students will be able to understand the importance of hyperbolic functions and their relationships with trigonometric functions.
3. CO3: Basic Analytic skills: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving.
4. CO4: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.

B.Sc. Sem-I (Mathematics - Major)
Semester I Paper I: (PRACTICAL: BMT1P01: Algebra and Trigonometry)

Course Outcomes (COs):

1. CO1: Students will be able to learn implications of equivalence relations in determining equivalence classes.
2. CO2: Students will understand properties of divisibility through problem solving.
3. CO3: Students will be able to perform different operations on the given congruence.
4. CO4: Solution of linear congruence will be studied by students.
5. CO5: Students will be able to perform matrix operations to determine invertible matrices, row canonical and normal form of the matrices.
6. CO6: Students will be able to apply matrix operations to solve system of linear equations.
7. CO7: Students will be able to find roots of a cubic and biquadratic equation.
8. CO8: Students will be able to apply De Moivre's theorem to find nth roots of a complex number find.

B.Sc. Sem-I (Mathematics - Major)
Paper II: (Differential Calculus)

Course Outcomes (COs):

1. CO1: Foundational Knowledge: Students will be able to update their basic knowledge of Maxima and Minima of functions of single variables and their application.
2. CO2: Elementary Skills: Students will undergo problem solving training by learning Indeterminate forms and L' Hospital's Rule and their applicability.
3. CO3: New Concepts learning: Students will be able to learn new concept of functions of two variables, Taylor series, and maxima and minima of such functions.
4. CO4: Analytic Skills: The problem-solving skills will bring forth the importance of Jacobian in understanding the existence of inverse transformation and other aspects of independence of pair of functions.
5. CO5: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.

B.Sc. Sem-II (Mathematics - Major)
Paper II: (PRACTICAL: BMT1P02: Differential Calculus)

Course Outcomes (COs):

1. CO1: Students will be able to make out the maximum or minimum nature of the functions by applying different conditions on the functions.
2. CO2:Working on Geometric interpretation of Mean value theorems through graphs of a function will make students grasp the subject admirably.
3. CO3: Students will learn application of Leibnitz, Maclaurin's and Taylor's theorems.

4. CO4: Students will be able to apply L' Hospital's Rule to solve the problems
5. CO5: Solving problems when functions involved are homogeneous
6. CO6: Students will able to solve Jacobians and learn properties due to Jacobian.
7. CO7: Analyzing Maxima and Minima of functions of two variables

B.Sc. Sem-I (Mathematics)
Semester I (VSC – 01 : Sage Math Software System)

Course Outcomes (COs):

Students will be able

1. to explore topics in Calculus, Applied Linear Algebra and Numerical Method along with several applications
2. to learn an alternative software as against the commercial products Magma, Maple, Mathematica and MATLAB
3. to learn the most recent algorithms and tools for many domains of mathematics
4. to use as wonderful scientific and graphical calculator.

B.Sc. Sem-II (Mathematics)
Paper I (Integral Calculus and Ordinary Differential Equations)

Course Outcomes (COs):

1. CO1: Foundational knowledge: Students to update their knowledge of improper integrals, Beta and Gamma functions and their applicability.
2. CO2: Basic skills: Students will be able to understand the importance of varied methods of solving differential equations of first and second order.
3. CO3: Analytical skills: The main objective of the course is to equip students with necessary analytic skills due to integrability and solutions of differential equations.
4. CO4: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.

B.Sc. Sem-II (Mathematics)
Paper I (PRACTICAL: BMT2P03: Integral Calculus and Ordinary Differential Equations)

Course Outcomes (COs):

1. CO1: Students will be able to solve problems using reduction formulae, Beta and Gamma functions.
2. CO2: Application of double integration in solving problems on area of a region.
3. CO3: Students will able to solve problems by changing the order of integration
4. CO4: Students will learn application of triple integration

5. CO5: Students will be able to apply integrating factor in solving nonexact differential equations
6. CO6: Students will be able to solve Euler's Equi-dimensional Eqs
7. CO7: Students will able to use concept of Wronskian in solving problems by method of variation of parameters

B.Sc. Sem-II (Mathematics)
Paper II (Vector Analysis)

Course Outcomes (COs):

1. CO1: Foundational knowledge: To impart foundational knowledge of vector algebra and vector differentiation.
2. CO2: Basic skills: To inculcate in students foundational base of gradient of a scalar function, divergence and curl.
3. CO3: Concept learning: New concept of vector integration shall be introduced and problems of work done by force shall be solved.
4. CO4: Application of Vector Theorems: To solve variety of practical problems in science and engineering by applying Greens theorem, divergence theorem, Stokes' theorem.
5. CO5: Application: The course curriculum is so prepared that it has wide application in physics, and in other Science and Engineering subjects.

B.Sc. Sem-II (Mathematics)
Paper II (PRACTICAL: BMT2P04: Vector Analysis)

Course Outcomes (COs):

1. CO1: Students will be able to update themselves with foundational knowledge of vector algebra and vector differentiation by solving examples.
2. CO2: The basic skills required in science will be ingrained in students through foundational base of gradient of a scalar function, divergence and curl by solving examples.
3. CO3: New concept of vector integration shall be learnt by students and problems of work done by force shall be solved by them.
4. CO4: Students will be able to solve variety of practical problems in science and engineering by applying Greens theorem, divergence theorem, Stokes' theorem.
5. CO5: The course curriculum is so prepared that it has wide application in physics, and in other Science and Engineering subjects, and this will help students immensely in their future.

B.Sc. Sem-II (Mathematics)
VSC -02 : Maxima Software System)

Course Outcomes (COs):

Students will be able

1. to develop skills to deliver practical knowledge in its application
2. to explore topics in Calculus, ordinary differential equations, systems of linear equations, polynomials, sets, lists, vectors, matrices
3. to provide algorithms and tools for many domains of mathematics
4. to use as wonderful scientific and graphical calculator

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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Biotechnology) Programme

Programme Specific Outcomes (PSOs):

1. **Fundamental Understanding of Biotechnology:**
   Students will gain a solid foundation in core concepts of biotechnology, including molecular biology, genetics, microbiology, biochemistry, and bioinformatics. They will be able to apply this knowledge in understanding the complexities of biological systems.
2. **Application of Biotechnology in Real-World Problems:**
   Graduates will develop skills to apply biotechnology techniques such as gene cloning, tissue culture, and recombinant DNA technology in sectors like healthcare, agriculture, environment, and industry to address real-world problems.
3. **Biotechnological Entrepreneurship and Innovation:**
   The curriculum, aligned with NEP's focus on entrepreneurship, will encourage students to think innovatively, promoting a mindset towards creating startups, patents, and biotechnological solutions to market needs.
4. **Skill Development for Industry and Research:**
   The program will equip students with the professional and technical skills necessary for careers in the biotechnology industry, pharmaceutical companies, research institutes, and governmental or non-governmental organizations.

B.Sc. Sem-I (Biotechnology - Major) Semester I

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Describe at conceptual level the microbial cell suitability for execution of biotechnological principles.
2. Diagrammatically demonstrate structure of various categories of microorganisms routinely utilized for biotechnological purposes.
3. Conceptualize handling of microbes for biotechnology applications.
4. Establish correlation of macromolecular organization and function at cellular level.
5. Design basic strategy for associating changes in DNA with cellular functioning.
6. Establish enzymatic correlation for execution of DNA manipulations
7. Select technical methods for analysis of manipulated Biomolecules

B.Sc. Sem-I (Vocational Skill Courses Semester – I Basic Transformation Techniques Course Code: BVS1P01 Total Contact Hours:60

Course Outcomes (COs):

After successful completion of this Course, students will be able to:

1. Get an insight about the principles of bacterial/yeast cell transformation techniques.
2. Learn handling and development of genetically engineered organisms in the laboratory.
3. Design strategies to screen genetically modified organisms.
4. Work around the working principles behind various screening strategies

B.Sc. Sem-I SEMESTER – I BVE1T01: ENVIRONMENTAL SCIENCE

Course Outcomes (COs):

At the end of the course, students shall be able to:

1. Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
2. Explicate the importance of Environmental Education.
3. Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
4. Describe the various physical & chemical characteristics and properties of Water and Soil
5. Understand the Ecology and its allied branches
6. Comprehend about Population and Community Ecology
7. Study the changes in Population by understanding the concept of Population ecology

B.Sc. Sem-I Vocational Skill Courses
SEMESTER – II DAIRY TECHNOLOGY

Course Outcomes (COs):

1. This course will help students learn various methods of isolation, detection and identification of spoilage microorganisms in milk.
2. Understand the application of principle of effect of temperature on spoilage of milk products.
3. Develop technician level human resource for dairy industry.
4. Develop young entrepreneurs for self-employment through dairy technology and associated activities.
5. Impart knowledge and technical proficiency in processing of milk, testing and quality control of milk and milk products

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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Microbiology) Programme

Programme Specific Outcomes (PSOs):

1. To enrich Knowledge and train them in field of Microbiology
2. To aware students about applied Microbiology as well as in research field
3. To inculcate sense of scientific responsibilities and social and environment awareness
4. To get successful career in the Microbiology field

B.Sc. Sem-I (DSC-1)-MICROBIOLOGY - Paper-I (BMI1T01) (FUNDAMENTALS OF MICROBIOLOGY)

Course Outcomes (COs):

1. Students will understand the contributions of different scientists in the fields of Microbial science..
2. Students will have knowledge about the established and emerging fields of science with respect to Microbiology.
3. Students will have knowledge about basic structure & nutritional requirement of bacteria
4. Develop practical skills to handle microorganism aseptically
5. Understand the use of apparatus and their use without fear.
6. Correlate their Microbiology theory concepts with practical outcomes.

B.Sc. Sem-I (DSC-2)-MICROBIOLOGY - Paper- II (BMI1T02) (BASIC TECHNIQUES IN MICROBIOLOGY)

Course Outcomes (COs):

1. Students will be able to understand the needs and basics of techniques used inobserving microbes.
2. Students will be aware of applications of basic techniques.
3. Students will learn sterilization and disinfection principles and procedures
4. Students will learn cultivation & aseptically handling of microorganism.

B.Sc. Sem-I VSC (Calibration, Validation & Handling of Laboratory Equipments

Course Code: (BVS1P01)

Course Outcomes (COs):

1. Student will learn the basic knowledge of calibration, validation handling oflaboratory instruments
2. The knowledge is very useful for opting job in industries.

B.Sc. Sem-II (DSC-)-MICROBIOLOGY - Paper-III (BMI1T03) (MICROBIAL DIVERSITY)

Course Outcomes (COs):

1. Acquire basics and importance of Microbiology
2. Learn about basic characteristics features of microorganisms
3. Describe the classification of Bactria
4. Gain insights into the important characters, classification & life cycle of viruses.

B.Sc. Sem-II (DSC-4)-MICROBIOLOGY - Paper-IV (BMI1T04) (CHEMISTRY OF BIOMOLECULES)

Course Outcomes (COs):

1. Students will learn about different types of biomolecules and their functions.
2. To categorize on the types of enzymes and their mechanism.
3. Students will learn about the various diseases due to deficiency of vitamins.

B.Sc. Sem-II VSC (DSC-4)-MICROBIOLOGY - Paper-IV (BMI1T04) (CHEMISTRY OF BIOMOLECULES)

Course Outcomes (COs):

1. Student will learn the basic knowledge of solution and reagents preparation.
2. The knowledge is very useful for opting job in industries.

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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Statistics) Programme

Programme Specific Outcomes (PSOs):

Upon completion of the program, students would be able to

1. Recall basic facts about statistics and should be able to display knowledge of conventions such as notations, terminology.
2. Get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.
3. Be equipped with statistical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
4. Apply their skills and knowledge that is translate information presented verbally into statistical form, select and use appropriate statistical formulae or techniques in order to process the information and draw the relevant conclusion.
5. Develop a positive attitude towards statistics as an interesting and valuable subject of study.
6. Acquire basic knowledge of diagrammatic & graphical representation of Data with and without software.

B.Sc. Sem-I Paper I CODE - BST1T01
DSC I - Probability Theory (2 Credits – 30 Hrs)

Course Outcomes (COs):

Students acquire knowledge about : independence of random variables, applications of Bayes' theorem, expectation of a random variable, etc.

B.Sc. Sem-I Paper II CODE - BST1T02
Descriptive Statistics (2 Credits – 30 Hrs)

Course Outcomes (COs):

Students learn various measures of dispersion, correlation coefficient, measures ofcentral tendency and their applications.

B.Sc. Sem-II Paper IV DSC 4 CODE– BST2T04
ECONOMIC STATISTICS (2 CREDITS –30 Hrs)

Course Outcomes (COs):

1. Students have gained knowledge about the market statistics, inflation and deflation, consumers price index, wholesale price index, etc
2. How to compute National income and understand the purchasing power of money
3. Market demand and price relation, supply and its relation to price, elasticities of price and effect of time series on market

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Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Zoology) Programme

Programme Specific Outcomes (PSOs):

1. Students will be able to describe, identified, classified and differentiate the animals of different taxonomic ranks. They could differentiate morphological, anatomical, and histological features of different organs and organ-systems of different animal groups. They could understand and analyze the different evolutionary trends among different animal groups.
2. Students could describe different component of environment and ecosystems an could understand and explain the significance of consequences of deterioration of ecosystem and biodiversity. They could estimate and evaluate the different physic-chemical parameters of waters like DO, dissolved CO2, pH, hardness etc. to deduce its status.
3. Students could able to describe, sketch and differentiate different cell organelles of animal cell and could examine normal and abnormal cellular physiology. Students could demonstrate cells organelles and acellular components in tissues as well as able to estimate protein, lipid and carbohydrates in tissues.
4. They could able to describe, interpret inheritance pattern in animals. They could differentiate varied mechanisms controlling inheritance in animals.
5. They could describe, analyze the different aspect of Applied Zoology. They could understand the practices of apiculture, sericulture, fisheries etc. and acquainted themselves with economic benefit of these practices as well as explain it to others.
6. Students understand, analyze, interpret the innate and learned behaviour of different animal groups.
7. Students will be able to perform different experiments which could help them to prove their hypotheses. They could able t o analyze the data with help of different statistical tools. Students will develop capabilities which help them to design and investigate the scientific research work. They could able to draft a scientific write up and could argue, defend his findings based on standard practices of research in Life Science.

B.Sc. Sem-I DSC: BZO1T01 Life and Diversity of Animals - Nonchordates (Protozoa to Annelida) Theory- 2 Credits + Practical - 1 Credit)

Course Outcomes (COs):

1. Students will able to understand about early phyla viz., Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes and Annelida.
2. Students could able to identify, classify and analyze different animals belonging to phylum Protozoa to Annelida on the basis of levels or grades of organization, symmetry, coelom etc. upto class.
3. Students will learn, analyze, describe a representative animal belonging to phylum Protozoa to Annelida

4. Students could elucidate and explain uniqueness of phylum Protozoa to Annelida and they could able to demonstrate peculiar tissues, organs of animals belonging to these phyla.

B.Sc. Sem-I DSC: BZO1T02 Environmental Biology
Theory- 2 Credits + Practical - 1 Credit)

Course Outcomes (COs):

1. Students will able to describe and explain atmosphere,hydrosphere, lithosphere and energy resources.
2. Students could describe, elucidate different types and components of ecosystems. They could identify, describe and explain different biotic components and could explain and analyze their role in ecosystem.
3. Students will describe, explain and aware about the significance and need of biodiversity conservation. They also understand, describe and explain legislations passed to conserve the biodiversity and acquainted themselves to nearby National Parks and Wildlife Sanctuaries.
4. They will elucidate and differentiate causes of different types and hazards of pollution.
5. Students will estimate the different physico-chemical parameters of water to analyze.

B.Sc. Sem-I VSC course : Vermicomposting BVS1P01 Credit: 2

Course Outcomes (COs):

1. Get acquainted with hand on training of vermicomposting.
2. Get acquainted with hand on training of vermiwash.
3. Able to understand and learn about the vermicompost marketing.
4. Able to do internship in any commercial vermicompost or vermiwash unit.

B.Sc. Sem-II DSC: BZO1T03 Life and Diversity of Animals – Non-Chordates:
Life and Diversity of Animals (Arthropoda to Hemichordata)
Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

1. Students will learn, identify, explain and analyze the taxonomic position of animals belonging to phylum Arthropoda to Hemichordata
2. They could describe, explain and analyze phylogeny to understand the course of evolution in animals from phylum Arthropoda to Hemichordata
3. They will able to describe, explain and differentiate various morphological, anatomical structures and functions of animals of phyla from Arthropoda to Hemichordata.
4. Students will able to understand , describe, explain and differentiate the larval forms and development of the invertebrates from phylum Arthropoda to Hemichordata

5. Students will able to describe, explain and analyze the ecological and economic importance of invertebrates.
6. Students will understand, able to describe, explain and analyze the ecological role of invertebrates in the biodiversity.

B.Sc. Sem-II DSC: BZO1T04 Cell Biology
Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

1. Students will able to describe, sketch, analyze, and explain the structure and function of the cell organelles.
2. Students could describe, sketch, analyze, and explain the structure and function of nucleus and chromatin structure, its location.
3. Students will able to describe, sketch, analyze, and explain the basic principle of life. Theu could also demonstrate and explain how a cell divides leading to the growth of an organism.
4. Students will able to describe, sketch, analyze, and explain the abnormality in structural and functional aspects of cells.
5. Students will able handle and use microscopes and oculometer to elucidate and measure and explain the minor details of tissues.
6. Students will able to demonstrate osmosis. They could also demonstrate and explain mitochondria, salivary gland chromosome and Barr body in cells.

B.Sc. Sem-II VSC course: Culture of Indian Major Carps BVS1P03
Credit: 2

Course Outcomes (COs):

1. Able to sketch, describe, Identify and classify the Indian major carps.
2. Design the layout of the various types of ponds for the rearing of various stages of IMC.
3. Get acquainted with hands on training of various breeding techniques.
4. Get acquainted with hands on training of rearing of fry to fingerlings.
5. Able to understand the different types of crafts and gears used in fish harvesting (Catching).
6. Get hands on training of handling of various gear, crafts used in fish harvesting (Catching).
7. Able to do internship and work in any commercial breeding centre.

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RASHTRASANT TUKDOJI MAHARAJ
NAGPUR UNIVERSITY, NAGPUR

As per National Education Policy 2020

BCA Four Years (Honors/Research)

Curriculum Framework for Eight Semester Degree Course with Major/Minor Subject

NEP (Effective from session 2024-25)

POs & PSOs for BCA Programme

(Computer Application-Major)
Four Year (Eight Semester Degree Course)

Program Outcomes (POs):

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.
2. It helps students analyze the requirements for system programming and exposes students for information systems
3. This programme provides students with options to specialize in various software system.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

Program Specific Outcomes (PSOs):

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

Course Outcomes (COs) for BCA Programme

BCA Sem-I (Computer Application-Major)
SC-DSC (Paper I) BCA1T01 PROGRAMMING IN 'C'
Credits : 2 Duration : 30 Hours

Course Outcomes:

After completing this course satisfactorily, a student will be able to:

1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

BCA Sem-I (Computer Application-Major)
SC- DSC (Paper II) BCA1T02 COMPUTER FUNDAMENTALS
Credits : 2 Duration : 30 Hours

Course Outcomes:

After completing this course satisfactorily, a student will be able to:

1. Confidently operate computers to carry out computational tasks
2. Understand working of Hardware and Software and the importance of operating systems
3. Understand number systems, peripheral devices, networking, multimedia and internet concepts.

BCA Sem-I (Computer Application)
OFFICE AUTOMATION (BVS1P01) Credits : 2 Duration : 60 Hours

Course Outcomes:

After completing this course satisfactorily, a student will be able to:

1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

BCA SEMESTER – I
BVE1T01: ENVIRONMENTAL SCIENCE

Course Outcomes:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil.
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

BCA SEMESTER – I
Indian Knowledge System (IKS)
SEM-1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes (COs):

This course will enable the students to

1. Improve speed and accuracy in numerical calculations.
2. Acquire IQ skills and high-end technical knowledge.
3. Gain test taking skills & creativity of calculations.

BCA Sem-II (Computer Application-Major)
SC- DSC (Paper I) BCA2T03
OBJECT ORIENTED PROGRAMMING USING 'C++'
Credits : 2 Duration : 30 Hours)

Course Outcomes (COs):

After completion of this course, students will be able to:

1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

BCA Sem-II (Computer Application-Major)
SC- DSC (Paper II) BCA2T04 OPERATING SYSTEMS AND LINUX
Credits : 2 Duration : 30 Hours

Course Outcomes (COs):

After completion of this course, students will be able to:

1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.
7. Working on Linux OS.

BCA Sem-II (Computer Application)
BVS2P03 COMPUTER ANIMATION
Credits : 2 Duration : 60 Hours

Course Outcomes (COs):

After completion of this course, students will be able to:

1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. Produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. Apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation.

BCA Sem-II (Computer Application)
Indian Knowledge System (IKS) SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes (COs):

This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

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Program Outcomes (PO), Program Specific Outcomes (PSO) and Course Outcomes (CO)

Before NEP-2020

Program Outcomes: Bachelor of Science (B.Sc.)

- PO1: Understand the core fundamentals of Basic Sciences
- PO2: Understand the diverse day to day applications of various fields.
- PO3: Develop interdisciplinary approach amongst students
- PO4: Demonstrate, solve and an understanding of major concepts in all disciplines of science.
- PO5: To inculcate sense of scientific responsibilities and social & environment awareness
- PO6: Develop skills in handling scientific instruments, planning and performing in laboratory experiments..
- PO7: Apply ethical principles and commit to professional ethics and responsibilities and norms of the scientific practice.
- PO8: Apply the acquired knowledge and the applications of basic sciences to community.
- PO9: Have sustainable development.
- PO10: Go for higher studies i.e. MSc and then do some research for the welfare of mankind.
- PO11: To help student to build-up a progressive and successful career in academics and industry
- PO12: To motivate the students to contribute in the development of Nation
- PO13: Look for professional job-oriented courses, Indian Army, Indian Navy, Indian Air Force as officers, Indian Civil Services.

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DEPARTMENT OF BOTANY

Program Outcomes: B.Sc. Botany

Department of Botany

After successful completion of three years degree program in the subject Botany, the students are able to:

Program Outcomes

PO1: Students know about different types of lower & higher plants their evolution in from algae to angiosperm &also their economic and ecological importance.

PO2: Cell biology gives knowledge about cell organelles & their functions.

PO3: Molecular biology gives knowledge about chemical properties of nucleic acid and their role in living systems.

PO4: Genetics provides knowledge about laws of inheritance, various genetic interactions, chromosomal abrasions & multiple alleles.

PO5: Structural changes in chromosomes.

PO6: Student can describe morphological & reproductive characters of plant and also identified different plant families and classification.

PO7: They know economic importance of various plant products & artificial methods of plant propagation.

PO8: Various concepts in ecology and phytogeography.

PO9: Use modern Botanical techniques and decent equipment.

PO10: To inculcates the scientific temperament in the students and outside the scientific community.

Program Specific Outcomes

PSO1: Students acquire fundamental Botanical knowledge through theory and practical.

PSO2: To explain basis plant of life, anatomy, reproduction and their survival in nature.

PSO3: Helped to understand role of living and fossil plants in our life.

PSO4: Understand good laboratory practices and safety.

PSO5: To create awareness about cultivation, conservation and sustainable utilization of biodiversity.

PSO6: To know advance techniques in plant sciences like tissue culture, plant disease management, artificial gene transfer etc.

PSO7: Students understand about the phytogeography of India, ethno-botanically important plants and their use.

Course Outcomes B.Sc. Botany

Course Outcome for Semester-I

Paper-I: Viruses, Prokaryotes, Algae & Biofertilizers

CO1: Study of Microbes and algae to understand their Diversity.
CO2: Know the systematics, morphology and structure of Viruses, bacteria, Mycoplasma and algae.
CO3: Know life cycle pattern of microbes and their economic importance.
CO4: Know evolution of microbes and algae.
CO5: Learn skill of preparation and use of biofertilizers for sustainable development.

Paper-II: Fungi, Lichen, Plant Pathology, Bryophyta & Mushroom Cultivation

CO1: Study of Fungi, Lichens, plant pathology and Bryophyta.
CO2: Know the systematics, morphology and structure of fungi, Lichens, plant pathogens, hosts and Bryophytes
CO3: Know life cycle pattern of fungi, lichens, plant pathogens and bryophytes.
CO4: Know economic importance of fungi, lichens and Bryophytes.
CO5: Kknow evolution of fungi, lichens and Bryophytes.
CO6: Learn skill of cultivation and importance of mushrooms for human consumption.

Lab Work:

- To get acquainted with ultrastructure of viruses and bacteria, to study staining method of bacteria
- To study structure and reproduction of Nostoc
- To study the structure and reproduction in Algae, like Chara, Vaucheria, Ectocarpus and Batrachospermum
- To learn the method of identification and characterization of bacteria useful in biofertilizers
- To learn staining method of fungi and bryophytes.
- To get acquainted with different plant pathogens and lichens
- To learn the technique of mushroom cultivation

Course Outcome for Semester-II

Paper-I: **Palaeobotany, Pteridophyta, Gymnosperms & Soil Analysis**

CO1: Study of Palaeobotany, geological time scale and morphology of angiosperms.
CO2: To know life cycle pattern of Pteridophyta and Gymnosperms.
CO3: To know the systematics, morphology and structure of Pteridophyta and Gymnosperms.
CO4: To know economic importance of Pteridophyta and Gymnosperms.
CO5: To know evolution of Pteridophyta and Gymnosperms.
CO6: To learn the skill of soil analysis for cultivation of variety of plants.

Paper-II: Morphology of Angiosperms & Floriculture

CO1: To study the morphology of angiosperms with respect to evolution of plants.
CO2: To the evolution of different floral organ for sexual reproduction in angiosperms.
CO3: To know the variation among the reproductive organs of the angiosperms.
CO4: To know the systematics, morphology and structure of

angiosperms.
CO5: To know the adaptive pollination and reproductive biology of angiosperms.
CO6: To learn the skill of floriculture and its tools and techniques.

Course Outcome for Semester-III

Paper-I: Angiosperm Systematics, Embrology & Indoor Gardening	CO1: To Study vegetative and floral characters of angiosperms.
	CO2: To know the preparation of floral formulae and floral diagrams of angiosperms.
	CO3: To know economic importance of angiosperms families.
	CO4: To know the pattern of embryogenesis in various angiosperms plants.
	CO5: To learn the skill for development of indoor gardening and its importance.
Paper-II: Angiosperm Anatomy & Horticulture	CO1: To gain knowledge of different plant tissue and tissue systems.
	CO2: To understand structure and type of cells and tissues in plants, type of vascular bundles and stellar systems.
	CO3: To know the simple and complex tissues and its functions.
	CO4: To know the process of secondary growth and its role in formation of wood and periderm
	CO5: To learn the skill for horticultural practices used.

Course Outcome for Semester-IV

Paper-I: Cell Biology, Plant Breeding, Evolution & Seed Technology	CO1: Gain knowledge about cell and its function.
	CO2: Learn the scope and importance of Cell and Molecular biology.
	CO3: To understand ultrastructure of cell wall, plasma membrane and cell organelles
	CO4: To understand the morphology and structure of chromosomes.
	CO5: To understand the different techniques used in plant breeding.
	CO6: To know the process of evolution of plants in universe
	CO6: To learn the skill used in seed technology
Paper-II: Genetics, Molecular Biology & Plant Nursery	CO1: To study structure, biochemical nature and role of nucleic acids.
	CO2: To understand the type and applications of mutations.
	CO3: Understand the Mendelian and neo-Mendelian genetics.

	CO4: Know about interaction of genes, multiple alleles and linkage and crossing over.
	CO5: To learn the skill for preparation of plant nurseries and its importance for nature conservation
	Course Outcome for Semester-V
Paper-I: Plant Physiology, Mineral Nutrition & Hydroponics	CO1: To know the scope and importance of plant physiology.
	CO2: To understand plant & water relation and mineral nutrition.
	CO3: Understand process of photosynthesis, C3, C4, CAM pathways.
	CO4: Understand the process of respiration, nitrogen metabolism and plant movement
	CO5: To learn the technique of development of hydroponics.
Paper-II: Plant Ecology & Organic Farming	CO1: To study concept of ecology and ecosystems.
	CO2: To understand climatic and edaphic factors.
	CO3: To know physiographic factors and interrelations among the living organisms.
	CO4: To understand the components of ecosystems, autecology, synecology and plant succession.
	CO5: To know the adaptations of plants.
	CO6: To learn the skill and importance of organic farming for healthy life.
	Course Outcome for Semester-VI
Paper-I: Biochemistry, Biotechnology & Herbal Technology	CO1: To study carbohydrates, lipids, amino acids and enzymology.
	CO2: To know the plant tissue culture techniques and applications.
	CO3: To understand tools and techniques used in genetic engineering.
	CO4: To know the artificial gene transfer techniques.
	CO5: To learn the skill used in formation of dye and cosmetics from plants.
	CO6: To know the basic concept of herbal technology.
Paper-II: Phytogeography, Utilization Of Plants, Techniques & Pharmacognosy	CO1: To know the phytogeography of India and world
	CO2: To know the natural resources and various types of pollutions and its impact on living organism.
	CO3: To study the natural resources and its conservation strategies.
	CO4: To know the economic importance of plants and ethnobotany.

CO5: To study microscopy, electrophoresis, centrifugation and chromatography.

CO6: To learn the basics of pharmacognosy and skill for used of plants in pharmacognosy.

Lab Work:

- To study the biochemical experiments
- To study the different instruments and equipment used in biotechnology
- To study the different techniques used in herbal technology
- To learn types of pollution parameters.
- To get acquainted with ethnobotany and economic botany with suitable examples
- To study the techniques used in pharmacognosy

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DEPARTMENT OF BIOTECHNOLOGY

Program Outcomes: B.Sc. Biotechnology

Department of Biotechnology	After successful completion of three years degree program in the subject Biotechnology, the students are able to:
Program Outcomes	PO1: Acquire knowledge on the fundamentals of biotechnology for sound and solid base which enables them to understand the emerging and advanced engineering concepts in life sciences.
	PO2: Acquire knowledge in domain of biotechnology enabling their applications in industry and research.
	PO3: Students get the information about cell & its importance in biology.
Program Specific Outcomes	PSO1: Empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology
	PSO2: Students know about the contribution of microbiology scientist, types of microbes, and branches of microbiology & anatomy of microbes.
	PSO3: Students take the methodological review of cultivation of microbes, pure culture, staining, sterilization & disinfection.
Course Outcomes	CO1: Comprehend about the introduction and history of biotechnology
	CO2: The scopes in agriculture, medicinal, agriculture and environment.
	CO3: The cell biology and basic structural and functional study of prokaryotic and eukaryotic cells
	CO4: The growth, nutrition and factors affecting microbial growth
	CO5: Principle, general features and significance of biophysical terms like density, sedimentation, centrifugation, surface tension, adsorption
	CO6: Monochrome staining, Negative staining, Gram´s staining.

CO7: Motility testing by hanging drop method

CO8: The definition, classification, biological function, chemical and physical properties, structural characteristic of proteins and nucleic acids

CO9: Principle, working and applications of instruments viz, pH meters, spectrophotometer, centrifuge, viscometer, and laminar air flow

CO10: Concept of enzyme activity and enzyme inhibition

CO11: Metabolic pathways EMP, TCA, ETC, Gluconeogenesis

CO12: The fundamentals of DNA damage and repair, including types of mutation and repair mechanisms.

CO13: The Transcription, enzymes involved in transcription and its inhibitors.

CO14: The Translation, enzymes involved in translation and its inhibitors.

CO15: The concept of operon and its structure and regulation

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DEPARTMENT OF CHEMISTRY

Program Outcomes: B.Sc. Chemistry

Department of Chemistry

After successful completion of three years degree program in the subject Chemistry, the students are able to:

Program Outcomes

PO1: The program enables the students to understand basic facts and concepts in Chemistry.

PO2: To develop the ability to apply the principles of Chemistry, to develop problem solving skills, to become familiar with the emerging areas of Chemistry and their applications in various spheres of Chemical sciences and to apprise the students of its relevance in future studies.

PO3: Students know about importance of Qualitative and Quantitative analysis used for different samples like soil samples, alloys estimation, water analysis. New technological world using nano-materials, properties of nano-materials magnetic properties of materials.

PO4: Thermodynamic and Thermochemistry useful in our daily life and related with our surrounding atmosphere.

PO5: Nuclear Magnetic resonance spectroscopy allows the molecular structure of a material to be analyzed by observing the measuring the interaction of nuclear spins when placed in a powerful magnetic field and extensively used in medicine in the form of magnetic resonance imaging and for analysis of chemicals.

PO6: Bioinorganic chemistry provides knowledge about significant role of metal ions in biological system which is required for the maintenance of life.

PO7: Student can describe the process It also develops skills in the proper handling of apparatus and chemicals and also gets exposure to the different processes used in industries and their applications.

PO8: Use modern techniques used in analysis of materials and handling of the new equipment during the practical.

PO9: To inculcates the scientific temperament in the students during the experiments and how to correlate with outside the scientific community.

Program Specific Outcomes

PSO1: The B.Sc. program enabled the students to enhance their critical thinking, during the three years period of study and the curriculum motivates the mental thoughts and suppositions of the students. This helps the students to take up practical work and compare the results with their assumptions, there by leading to accuracy and validity of the practical knowledge. This Analysis leads to take

decisions at intellectual, directorial and personal from different perspectives of life.

PSO2: Understand the basic principles and concepts underlying the inorganic, organic and physical chemistry.

PSO3: Comprehend the applications of chemistry in various walks of life.

PSO4: Students gained functional knowledges of the fundamental theoretical concepts and experimental methods of Chemistry.

PSO5: The students will be benefited to equip themselves to job requirements in the quality control, analytical laboratory or production wing of any Chemical or Pharmaceutical industry.

PSO6: Able to use instrumental methods of chemical analyses.

Students acquire fundamental Botanical knowledge through theory and practical.

Course Outcomes B. Sc. Chemistry

Course Outcome for Semester-I

Paper-I: Inorganic Chemistry

CO1: Basic knowledge of atomic structure, inorganic fundamental of a periodic property.

CO2: Conceptualization of Valence bond theory (VBT) and Molecular Orbital theory (MOT), and VSPER theory.

CO3: Differentiation in ionic and metallic bond, and S-block elements.

CO4: A study of P-block elements, oxyacids of Sulphur, hydride of Phosphorus, and noble gases.

CO5: Food adulteration process and detection, test for detection physical adulteration and chemical adulteration and how to identify the food adulterant which are used various food products

Paper-II: Physical Chemistry

CO1: Basic knowledge of thermodynamics and calculations of problems related to Thermo-chemistry.

CO2: Difference between Ideal gas and Real gas and their related equation.

CO3: Understanding of Liquid State with emphasis on properties of liquid.

CO4: Concept of adsorption isotherm and principles of catalysis.

CO5: Types of colloidal, electrophoresis and electro-osmosis, emulsion and gels

Course Outcome for Semester-II

Paper-I: Organic Chemistry

CO1: Understand the concept structure, bonding in organic compounds and different types of reaction mechanisms.

CO2: Understand the concept of stereochemistry in detail.

CO3: Understand the nomenclature, synthesis, chemical and physical properties of alkanes, cycloalkanes and alkenes

CO4: Understand the nomenclature, synthesis, chemical and physical properties of dienes, alkynes and also the concept of aromaticity of organic compounds.

CO5: Fuels and its calorific values properties and uses application of lubricants in industries

Paper-II: Physical Chemistry

CO1: Second law of thermodynamics and free energy work functions.

CO2: Understanding of Phase rule and liquid-liquid mixture.

CO3: Insight into Nuclear Chemistry and Molecular Structure.

CO4: Laws of Chemical kinetics.
CO5: Types of pollutions and its control measures, types of pollutants, adsorption techniques

Course Outcome for Semester-III

Paper-I: Inorganic Chemistry
CO1: Diagrammatic representation of molecules according to MOT, and properties of inter-halogen compounds
CO2: Chemistry of first transition elements and non-aqueous solvents
CO3: Comparative study of the second and third transition series and error in chemical analysis
CO4: Chemistry of lanthanides and actinides, and lanthanide contraction

Paper-II: Organic Chemistry
CO1: Understand nomenclature, synthesis, chemical properties of alkanes in aryl, alkyl halides.
CO2: Understand nomenclature, synthesis, chemical properties of dihydric, trihydric alcohols and phenols in detail
CO3: Understand nomenclature, synthesis, chemical properties of aldehydes and ketones and mechanisms of nucleophilic addition
CO4: Understand nomenclature, synthesis, chemical properties of carboxylic acids and their derivatives along with reactive mechanisms.

Course Outcome for Semester-IV

Paper-I: Inorganic Chemistry
CO1: A detail study of coordination compounds and its applications.
CO2: Isomerism and redox process in inorganic compounds.
CO3: The concept organometallic and metal carbonyl compounds.
CO4: Applications of inorganic macromolecules in the biological concept, and acid-bases principles.

Paper-II: Physical Chemistry
CO1: Insight into laws of crystallography and Bravais lattices
CO2: Debye-Huckel theory and concepts related to electrochemistry
CO3: Introduction to Rotational and Vibration Spectroscopy.
CO4: Basics of Quantum Chemistry, Operators and Schrodinger wave function

Course Outcome for Semester-V

Paper-I: Organic Chemistry
CO1: The students will understand some fundamental aspects of organic chemistry. They will learn mechanism of some organic reactions, classification of polymers, structure and uses of some commercial and natural polymers.
CO2: To know stereochemistry and various possible conformations of organic compounds and how it affects the reaction outcome.
CO3: To be familiarize with the important photochemical reactions in Organic Chemistry.
CO4: To understand the functions and applications of bioorganic compounds.

Paper-II: Physical Chemistry
CO1: To study the basic postulates of quantum mechanics.
CO2: To enable the students to solve the simple quantum mechanical models such as simple harmonic oscillator, particle in a 1D- box, rigid rotor, H atom etc.
CO2: To understand the quantum mechanical aspect of angular momentum and spin.
CO3: Enable the students to predict the point group of important

molecules and to know how they are classified

CO4: To understand the idea of space groups and to learn the theory of molecular symmetry.

CO5: To gain skill to apply group theory to vibrational and electronic spectroscopy.

Course Outcome for Semester-VI

Paper-I: Inorganic Chemistry

CO1: To know the structure and bonding of important coordination compounds.

CO2: To understand the magnetic properties of complexes and to know how magnetic moments can be employed for the interpretation of their structure

CO3: To get an overview about the stereochemistry of coordination compounds

CO4: To get an idea about the basic coordination chemistry of Lanthanides and Actinides.

CO5: Ability to prepare inorganic complexes. Ability to prepare inorganic complexes.

CO6: To know about VBT, CFT and MOT of co-ordination complexes

Paper-II: Organic Chemistry

CO1: To impart the students a thorough knowledge about the mechanisms of reactions of some selected functional groups in organic compounds

CO2: To give an outline of applied organic chemistry and the applications of organic chemistry in various spheres of chemical sciences.

CO3: To give an elementary idea of chemotherapy, organic spectroscopy and photochemistry.

CO4: To analyze organic compound using UV, IR and NMR spectroscopic techniques, which provides platform for students to work in industries.

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DEPARTMENT OF COMPUTER SCIENCE

Program Outcomes: B.Sc. Computer Science

Department of Computer Science

After successful completion of three year degree program in Computer Science, the students are able to:

Program Outcomes

PO1: To develop problem solving abilities using a computer.
PO2: To build the necessary skill set and analytical abilities for developing Computer based solutions for real life problems.
PO3: To implement quality software development practices.
PO4: To create awareness about process and product standards.
PO5: To train students in professional skills related to Software Industry.
PO6: To prepare necessary knowledge base for research and development in Computer Science
PO7: To help the students to build-up a successful career in Computer Science.

Program Specific Outcomes

PSO1: Demonstrate understanding of the principles and working of the hardware and software aspects of computer systems.
PSO2: Design, implements, test, and evaluate a computer system, Component or algorithm to meet desired needs and to solve a computational problem.
PSO3: To Enhance skills and adapt new computing technologies for attaining professional excellence and carrying research.
PSO4: Apply fundamental principles and methods of Computer Science to a wide range of applications.
PSO5: Impart an understanding of the basics of our discipline.
PSO6: Practice for continued professional development.

Course Outcomes B.Sc. Computer Science

Course Outcome for Semester-I

Paper-I: (Programming in C)

CO1: To illustrate the flowchart and design an algorithm for a given problem. They understand the basic concept of programming structure.
CO2: Students learnt the knowledge of fundamentals of writing C program which include data types, keywords, tokens, variables, and operators. Develop conditional and iterative statements to write C programs
CO3: To solve user defined functions with real time problems.
CO4: Students developed their concepts to write C program that uses Pointers, Arrays, and Strings.
CO5: Understand the knowledge of user defined data types that include

	structure and union to solve problems. CO6: Students can write the programs which includes file concept to show input and output of files in C.
Paper-II: (Fundamentals of IT)	CO1: Bridge the fundamental concepts of computers with the present level of knowledge of the students. CO2: Familiarize operating systems, programming languages, peripheral devices, networking, multimedia and internet CO3: Understand binary, hexadecimal and octal number systems and their arithmetic. CO4: Understand how logic circuits and Boolean algebra forms as the basics of digital computer CO5: Demonstrate the building up of Sequential and combinational logic from basic gate.
	Course Outcome for Semester-II
Paper-I: (Object Oriented Programming Using 'C++')	CO1: To understand the object-oriented methodology which involves elements and features of object-oriented programming. CO2: Students developed the concept of class, object and structure of class which includes definition of class members and also, they learned how to write the programs using class. CO3: Students learnt the basic concept of constructor and destructor. Also, they were able to overload the unary and binary operators using the concept of operator overloading. CO4: Understand how to reuse code by implementing the OOPs Inheritance concept in C++. Also, they got knowledge of dynamic objects. CO5: Students were able to understand how inheritance and virtual functions implement dynamic binding with polymorphism. CO6: Students learnt how to use exceptional handling in C++ programs
Paper-II: (System Analysis and Design)	CO1: Identify various types of information systems concepts and terminologies CO2: Discuss the initial phase of system Development Life Cycle (SDLC) using analytical tools and quantitative technique used to identify problem CO3: Define problem and opportunities that initiate projects CO4: Evaluate information systems projects to identify various aspects of feasibility of these projects CO5: Apply at least one specific methodology or tool for analyzing business situation by modeling using a formal technique.
	Course Outcome for Semester-III
Paper-I: (Data Structures)	CO1: To be able to implement the abstract data type list as a linked list using the node and reference pattern. CO2: Select appropriate data structures as applied to specified problem definition. Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and Quick sort and also calculates the complexity of all sorting and searching methods. CO3: To understand the abstract data type stack and notation like prefix infix and postfix expression formats. Implement

	operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures and design applications based on it.
	CO4: Determine and analyze the complexity of given Algorithms.
	CO5: Ability to have knowledge of tree and graph concepts.
Paper-II: (Operating Systems)	CO1: Describe and explain the fundamental components of a computer operating system
	CO2: Define, restate, discuss, and explain the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.
	CO3: Describe and extrapolate the interactions among the various components of computing systems.
	CO4: Design and construct the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems.
	Course Outcome for Semester-IV
Paper-I: (Java Programming)	CO1: Explain the Use of java programming language Concept and programming technologies in software development.
	CO2: Demonstrate the Concepts of Thread and Applets
	CO3: Identify classes, objects, members of the class and relationships among them needed for a specific problem.
	CO4: Able to understand basic Concepts of java like variables, operators and tokens etc.
	CO5: Design and Develop Applications using AWT controls in Java.
Paper-II: (Linux Operating System)	CO1: To understand the basic commands and directory structures use in Linux OS and explain the use of all these commands to make the effective use of the environment to solve problems.
	CO2: Design and develop applications using Vi Editor in Linux OS.
	CO3: Able to identify the differences between processes and shells use in Linux OS.
	CO4: Able to Understand the basic set of Communication utilities commands and other commands use in Linux OS.
	CO5: To learn Graphical user Interfaces like KDE and GNOME.
	Course Outcome for Semester-V
Paper-I: (Visual Basic Programming)	CO1: Explain the basic Concepts of Program building block control statements and the basic concepts of function and procedure.
	CO2: Discuss about graphics handling related control and properties and Develop a Graphical User Interface (GUI) based on problem description.
	CO3: Discuss about the fundamental functions and properties of Advanced ActiveX Control.
	CO4: Design and Develop the programs which are based on events that retrieve input from a file as opposed to input only provided by user.
	CO5: Explain the procedure of creating menus and how to use these menus while designing applications in VB. (Menu Editor).
	CO6: Describe the concepts of database handling using DAO, ADO

and RDO control with data report concepts.

Paper-II: (Database Management System)

CO1: To learnt the fundamental elements of traditional file processing system, objective of database system.

CO2: Students learnt the basic concept of different data models which includes Hierarchical, Network, and E-R and Relational model.

CO3: Students are able Design E-R model to represent simple database application

CO4: Students developed the concept of how to convert E-R model into relational tables and how to perform relational operation on tables through relational algebra.

CO5: Students developed the concept of functional dependency and improve the database design by the concept of Normalization.

Course Outcome for Semester VI

Paper-I: (Compiler Construction)

CO1: Students learnt the major concept areas of language translation and compiler design

CO2: Students got an awareness of the function and complexity of compilers.

CO3: Students were able to understand the role of Lexical analyzer, its design, and implementation. Students got knowledge of context free grammars, Derivation and parse trees.

CO4: Students are able to identify the similarities and differences among various parsing techniques and grammar transformation techniques

Paper-II: (SQL and PL/SQL)

CO1: Able to Understand the basics of SQL with control structure and sublanguages like DDL, DML and DCL/TCL.

CO2: Able To identify the differences between integrity constraints and value constraints.

CO3: Explain how functions, triggers, cursors and stored procedure work in PL/SQL.

CO4: Compare SQL with PL/SQL and integrate the concept of procedural language with SQL to build advance applications.

CO5: Able to understand the basics of PL/SQL Programming: PL/SQL Data Types, Identifiers, Operators and Expressions, Iterative Statements, Conditional Statements,

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DEPARTMENT OF ELECTRONICS

Program Outcomes: B.Sc. Electronics

Department of Electronics Program Outcomes	After successful completion of three years degree program in the subject Electronics, the students are able to: PO1: Ability to design and conduct electronics experiments, as well as to analyze and interpret data. PO2: Utilize the basic knowledge of science Electronics and Communication. PO3: To provide opportunity to students to learn the latest trends in Electronics. PO4: To satisfy the needs of the core Electronics Industry useful for the society in all walks of life. PO5: To provide opportunities to the students to formulate, analyze and resolve the problems in Electronics Industry.
Program Specific Outcomes	PSO1: After completing the program, interested students can pursue in research field or in development field. PSO2: Students can become entrepreneur and can work on multidisciplinary projects.

Course Outcomes for B.Sc. Electronics

Course Outcome for Semester-I

Paper-I: Basic Circuit Components & Network Analysis	CO1: To enrich the students with the basic requirement of electronic circuits. CO2: To describe the theorems useful for circuit operation. CO3: To explore the use of energy sources for circuit operations. CO4: To familiarize about the use of transducers in instrumentation systems
Paper-II: Fundamentals Of Digital Electronics	CO1: To enrich the students with the basic requirement of digital electronics. CO2: To describe the use of Boolean Algebra for circuit operations. CO3: To elaborate the use of flip flops as memory in data processing system. CO4: To explore the use of binary circuits in digital system. CO5: To familiarize about the basic building blocks required for digital system.

Course Outcome For Semester-II

Paper-I: Semiconductor Devices	CO1: To explain about semiconductors used for the fabrication of semiconductor devices. CO2: To acquire the knowledge of transistor used in many electronic circuits. CO3: To familiarize about the field effect transistor and its operation. CO4: To explore the use of power devices required in electronics circuits. CO5: To familiarize about the applications of diode, transistor and power devices.
Paper-II: Advanced Digital Electronics	CO1: To enrich the students with the digital ICS used in electronics circuits. CO2: To enhance the use of Flip-Flops in the construction of counters. CO3: To familiarize the use of Counters & Registers in data processing system. CO4: To explore the use of binary memory in digital system. CO5: To disseminate about the building blocks required for digital system.

Course Outcome for Semester-III

Paper-I: Analog Circuits	CO1: To illustrate applications of diode as clippers, clamper and rectifier. CO2: To describe the role of transistor in amplification, signal analysis and two port hybrid circuit for testing amplifier parameters. CO3: To elaborate the concept of feedback and construction of feedback amplifier and oscillators. CO4: To explore the use of power amplifier in electronics circuits. CO5: To familiarize about the applications of diode and transistor.
Paper-II: Linear Integrated Circuits	CO1: To study DC & AC characteristics of operational amplifier. CO2: To elucidate and design linear and nonlinear circuits of OP-AMP. To study timer IC and its applications. CO3: To elaborate the role of filters in electronics circuits. CO4: To explore the knowledge of linear integrated circuits and its uses.

Course Outcome for Semester-IV

Paper-I: Basic Communication Electronics	CO1: To understand functioning of basic processes in communication systems. CO2: To understand analogue modulation & demodulation techniques.

	CO3: To Understand transmission and reception systems. CO4: To understand propagation of radio waves in communication systems. CO5: To understand the process of analogue signal communication system.
Paper-II: Analogue and Digital Circuits	CO1: To study DAC and ADC used for data conversions in electronics system. CO2: To elucidate and design regulated DC power supply for operating electronic devices. CO3: To study PLL IC 565 and its applications. CO4: To elaborate the role of transducers in Bioelectronics circuits. CO5: To explore the knowledge of Analogue and Digital circuits and its uses.
	Course Outcome for Semester-V
Paper-I: Modern Communication Systems	CO1: To understand the concept optical communication and its operation CO2: To understand various digital modulation and demodulation techniques. CO3: To analyse the performance of digital communication system in terms of error rate and spectral efficiency. CO4: To understand the telecommunication traffic, channel and cellular capacity CO5: To understand various application of cellular technology.
Paper-II: Introduction to Microprocessor	CO1: To understand importance of Microprocessors as a programmable digital system element in computer system. CO2: To understand architecture and features of 8085 Microprocessor. CO3: To explore some basic concepts of microprocessors through assembly language programming. CO4: To augmented the knowledge of interfacing the peripheral to increase the flexibility of microprocessor. CO5: To grown-up the in-depth understanding of the operation of microprocessors and machine language programming & interfacing techniques.
	Course Outcome for Semester-VI
Paper-I: Programming in "C"	CO1: After completion of course, Students are able to Develop their programming skills CO2: Familiar with elements of C language CO3: Understand operators, Expression and Preprocessors CO4: Understand different decision making and concept of looping in C

	CO5: Understand Array, Structure, Function and Pointers, their declaration and use
Paper-II: Microcontroller 8051 and its Applications	CO1: To understand architecture and features of 8051 Microcontroller.
	CO2: To learn Programming of 8051 microcontroller.
	CO3: To learn interfacing of 8051 Microcontroller with real world input and output devices.
	CO4: To understand the coding and interfacing of 8051 with various IO devices.
	CO5: To understand importance of Microcontrollers in atomization and control system

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DEPARTMENT OF GEOLOGY

Program Outcomes: B.Sc. Geology

Department of Geology After successful completion of three years degree program in the subject Geology, the students are able to:

Program Specific Outcomes

PSO1: This program will provide learning via problem solving and hands on training methodologies.

PSO2: This program will help provide pupils with a fundamental grasp of geology and its applications.

PSO3: This study provides basic knowledge, training, skills and eligibility degree for various higher academic courses.

PSO4: To develop intellectual ability and geological skills through an appropriate blending of theoretical subject education, practical exercises and field training.

PSO5: Students can continue further education and will become successful geologist or obtain positions in the industry, government, public or consulting sectors.

PSO6: This study will encourage students to pursue further education and, eventually research in many sub-disciplines of the topic in India and abroad.

PSO7: This program will develop appropriate skills in the students to make them competent to take up self-employment in innovative geology related fields

PSO8: At the end of three years of B. Sc. Geology course, students would obtain a thorough knowledge of the core ideas of geological sciences

Course Outcomes for B.Sc. Geology

Course Outcome for Semester-I

Paper-I Introduction to Geology

CO1: Students will be able to know branches of geology, earth origin, processes and various hypothesis of origin of the Earth (Solar System).

CO2: Students will be able to understand broad perspective of crust, mantle and core of the Earth and reorganization of the Earth's layers.

CO3: Students will be able to explain volcanoes, their classification, products and distribution.

CO4: Students will be able to compare and contrast properties and mechanics of different types of waves, understand the causes and effects of earthquakes and recognize our limited ability to predict seismic activity, compare magnitude versus intensity.

CO5: Students will be able to acquire an introductory understanding of geologic time and the importance of both relative and radiometric dating techniques.

CO6: Students will be able to develop the concept of isostasy, isostatic anomalies, isostatic models, and evidence.

CO7: Students will be able to continental drift as plate motion and develop the concept and theories of continental drift.

Paper-II

Minerology

CO1: Students will be able to understand how atoms interact to form minerals and how the structure and chemical composition of minerals

CO2: Students will be able to describe chemistry of minerals (Polymorphism, Isomorphism and Pseudomorphism).

CO3: Students will be able to demonstrate the silicate structures with examples.

CO4: Students will be able to identify the common minerals in hand specimen using their physical properties.

Course Outcomes for Semester-II

Paper-I

Physical Geology and General Geology

CO1: Students will be able to know geological works of wind, river, underground water, glaciers, oceans and their landforms of erosion and deposition processes.

CO2: Students will be able to understand evolution of continents and oceans.

CO3: Students will be able to know endogenic processes originating within the earth like diastrophism and how they interact to create landforms

CO4: Students will be able to explain Geosynclines, classification and evolution of Geosynclines, causes of subsidence and uplift.

CO5: Students will be able to demonstrate the mountain building process and types of mountains

CO6: Students will be able to know the role of plate tectonics in the development of all Earth's surface features including mountain ranges, ocean basins, etc.

Paper-II

Optical Mineralogy and Crystallography

CO1: Students will be able to know general characteristics of light - polarization, refraction, and describe the parts of polarized microscope.

CO2: Students will be able to know the refractive index by Becke line method and Abbe refractometer.

CO3: Students will be able to understand The properties of uniaxial and biaxial minerals under parallel and crossed nicols

CO4: Students will be able to understand the diagnostic characteristics of minerals using petrological microscope

CO5: Students will be able to know the symmetry in crystals and classify crystals based on symmetry elements and describe its forms.

CO6: Students will be able to know various laws of crystallography governing the consistency of crystal structures with respect to specific chemical composition.

Course Outcomes for Semester-III

Paper-I

Igneous Petrology

CO1: Students will be able to identify rock type and the steps of the rock cycle related to their formation.

CO2: Students will be able to recognize different forms of igneous rocks

CO3: Students will be able to assign a name to an igneous rock on the basis of its mineralogical and textural characteristics, and appreciate the environment(s) of formation.

CO4: Students will be able to understand the origin of magma and its evolution

CO5: Students will be able to understand phase equilibrium of magma crystallizing systems.

Paper-II

Sedimentary and Metamorphic Petrology

CO1: Students will be able to understand the processes of sedimentation; origin of sediments

CO2: Students will be able to identify sedimentary rocks and describe the mineralogy of sedimentary rocks.

CO3: Students will be able to recognize the textures of clastic and non-clastic sedimentary rocks and their significance

CO4: Students will be able to identify key sedimentary structures and appreciate the significance of such features with regard to geological processes that have operated.

CO5: Students will be able to interpret structures and textures of metamorphic rocks and their importance in understanding metamorphic reaction principle.

CO6: Students will be able to understand the concept of facies, grade and zone of metamorphism

Course Outcomes for Semester-IV

Paper-I

Paleontology

CO1: Students will be able to demonstrate understanding of the nature of fossils and types of fossilization that turn organic remains into fossils

CO2: Students will be able to understand methods of fossil preservation and preparation.

CO3: Students will be able to understand the uses of fossils in solving geological problems: paleoenvironments, relative age, paleo-ecology, economic geology, evolution, stratigraphy, paleogeographic and paleoclimatic reconstructions.

CO4: Students will be able to recognize the major groups of invertebrate fossils on the basis of their morphology, classification, evolution, and geological history of major invertebrate classes like Brachiopoda, Mollusca, Echinoidea and Trilobita and identify key index fossils to the species level.

CO5: Students will be able to understand the classification, morphology, uses and geological history of Foraminifera, Graptoloidea and Anthozoa

CO6: Students will be able to recognize characteristic features and assemblage of the Gondwana flora

Paper-II

Structural Geology

CO1: Students will be able to understand the concept of rock deformation in time and space

CO2: Students will be able to demonstrate a basic understanding of stress, strain and rheology of Earth's lithosphere.

CO3: Students will be able to use stereographic projections in structural analysis.

CO4: Students will be able to comprehend how to describe and classify brittle and ductile structures, including faults, folds, joints, unconformity etc

CO5: Students will be able to identify and explain different erosional structures such as Inlier and Outlier, Klippe and Fenster,

CO6: Students will be able to interpret the outcrops and their relationship with topography

CO7: Students will be able to identify linear and planar structures.

CO8: Students will be able to understand lineation and foliations and their relation to major structures.

CO9: Students will be able to demonstrate brittle and ductile shear zones.

Course Outcomes for Semester-V

Paper-I

Economic Geology

CO1: Students will be able to understand the processes of formation of mineral deposit and various theories of ore genesis explaining how the various types of minerals originate and deposited within the Earth's crust.

CO2: Students will be able to demonstrate knowledge of variety of ore forming processes.

CO3: Students will be able to describe the variety of minerals deposits and how they are found and formed

CO4: Students will be able to explain origin, mode of occurrence, association, uses and Indian occurrences of the ores of important metallic minerals.

CO5: Students will be able to explain origin, mode of occurrence, association, specification and grades for uses in industries and Indian occurrences of important non-metallic minerals.

CO6: Students will be able to understand origin, composition, occurrences, prospecting and preparation of coal.

CO7: Students will be able to understand origin, migration and accumulation of petroleum and natural gas.

CO8: Students will be able to understand and compare the geological setting and mineralization of Kolar gold field, Singhbhum copper belt, Malanjkhand copper deposit, Lead zinc deposit of Zawar, Manganese belt of Maharashtra, Iron ore deposits of Bastar, Bauxite deposits of Maharashtra, Mica deposits of Bihar, and Andhra Pradesh. Gondwanacoal deposits, Neyveli lignite deposit, Gypsum deposit of Rajasthan and beach placers of Kerala.

Paper-II

Indian Stratigraphy

CO1: Students will be able to understand time concept in stratigraphic and major stratigraphic boundaries and their causative factors.

CO2: Students will be able to explain fundamentals of stratigraphic principles and various methods of stratigraphic analysis.

CO3: Students will be able to understand geological time, classification of sequences in terms of Litho-, Bio- and Chrono- stratigraphy.

CO4: Students will be able to know about physiographic subdivision of the Indian subcontinent and their characteristics.

CO5: Students will be able to understand Archaean Supergroup of Peninsular India, Dharwar Supergroup and associated granitic rocks, Sausar Group, Sakoli Group, Dongargarh Supergroup, Aravalli Supergroup and associated gneissic rocks with reference to its classification, geographic distribution, lithological characteristics, fossil content and economic importance.

CO6: Students will be able to acquaint with the important stratigraphic Supergroup and formations such as Cuddapah Supergroup of Cuddapah basin, Kaladgis, Pakhals, Penganga Formation, Delhi Supergroup, Shimla Formation, Vindhyan Supergroup of Vindhyan basin, Kurnool Supergroup, Chhattisgarh Supergroup

CO7: Students will be able to know about the classification, geographic distribution, lithological characteristics, fossil content and economic importance of Paleozoic succession of Spiti valley, Gondwana Supergroup, Triassic of Spiti, Jurassic of Kutch, Rajasthan and Spiti.

CO8: Students will be able to describe Cretaceous deposits of Narmada Valley namely, Bagh Beds and Lameta Beds

CO9: Students will be able to render understanding of Deccan volcanicProvince, type of eruptions and Intertrappeans

CO10: Students will be able to know about Siwalik System and its vertebrate life

Course Outcomes for Semester-VI

Paper-I

Elements of Remote Sensing and Environmental Geology

CO1: Students will be able to give basic idea, scope and aim of remote sensing.

CO2: Students will be able to distinguish remote sensing from aerial heights and space heights

CO3: Students will be able to introduce aerial photographs and their types.

CO4: Students will be able to apply the underlying principles of interpreting image data

CO5: Students will be able to study aerial photos in the form of mosaics and stereopairs.

CO6: Students will be able to apply the understanding of photo-geology and remote sensing in geological studies.

CO7: Students will be able to interpret lithologic, structural and geomorphic features on aerial photos

CO8: Students will be able to understand the concept of environmental geology and render understanding of interdependent nature and processes operative over earth surface

CO9: Students will be able to evaluate the concerned impact of human development on environment systems.

CO10: Students will be able to understand natural hazards and their impact on environmental system.

Paper-II

Elementary Hydrogeology and Geomorphology

CO1: Students will be able to demonstrate understanding of the hydrologic cycle as it pertains to ground water systems

CO2: Students will be able to explain geological factors governing the occurrence and distribution of groundwater

CO3: Students will be able to understand zones of aeration and saturation.

CO4: Students will be able to explain aquifers and their classification

CO5: Students will be able to explain the porosity and permeability.

CO6: Students will be able to state Darcy's law.

CO7: Students will be able to elucidate the hydrological properties of rocks.

CO8: Students will be able to describe the characteristics of Groundwater provinces of India

CO9: Students will be able to understand influent and effluent seepages and springs.

CO10: Students will be able to explain the concepts of geomorphology and give examples of its application.

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DEPARTMENT OF MATHEMATICS

Program Outcomes: B.Sc. Mathematics

Department of Mathematics Program Outcomes

After successful completion of three years degree program in the subject Mathematics, the students are able to:

PO1: Develop creative and critical thinking.

PO2: Develop effective communication.

PO3: Build strong leadership qualities and develop team spirit.

PO4: Learn to become better and effective citizens of the country.

PO5: Develop moral maturity and ethical behavior.

PO6: Learn about the environment and sustainability process.

PO7: Self-direct a life-long learning system.

PO8: Learn knowledge application.

PO9: Learn analytical, scientific reasoning and problem solving.

PO10: Gain Information / Digital Literacy.

Program Specific Outcomes

PSO1: Construct mathematical arguments, proofs and develop mathematical as well as analytical thinking

PSO2: Critically interpret numerical data, graphical data and develop models

PSO3: Apply mathematical knowledge to a career and research related to mathematical sciences

PSO4: Apply critical thinking skills to solve problems which can be modelled mathematically.

Course Outcomes for B.Sc. Mathematics

Course Outcome for Semester-I & II

Semester- I & II
Paper-I: Algebra & trigonometry, Differential and difference equations

CO1: Understand the applications of De Moiver's theorem, properties of groups and subgroups

CO2: Learn basic properties of first order, higher order differential equations and solve them with different methods.

CO3: Understand to find unknown solution by using known solution, the formation of difference equation, solution of homogeneous and non-homogeneous linear equation.

CO4: Understand the concepts of rank, Eigen values of matrices, solution of homogeneous and non-homogeneous system of equations.

Semester- I & II Paper-II: Calculus, Vector calculus & improper integrals	CO1: Understand basic properties of limit, continuity and derivability of functions, expansion of functions in terms of infinite series by using different methods. CO2: Find indeterminate forms and partial differentiation of functions with two or more variables CO3: Understand basics of directional derivatives, gradient, divergence and curl CO4: Evaluation of double and triple integral, improper integrals and their convergence.
Course Outcome for Semester-III & IV	
Semester- III & IV Paper-I: Advanced calculus, Partial Differential equations & calculus of variations	CO1: Understand concept of limit and continuity of functions of two variables, application of Mean value theorems CO2: Study of convergence, divergence of sequences and series using various tests. CO3: Understand ordinary differential equation in more than two variables and methods of finding solution CO4: Study Lagrange's method, Charpit's method, Jacobi's method to solve PDE, homogeneous and non-homogeneous PDE with constant coefficients
Semester- III & IV Paper-II: Differential equations & group homomorphism, Mechanics	CO1: Understand basic properties of Laplace transforms, inverse Laplace transforms and solution of ordinary differential equation using Laplace transform. CO2: Study of group homomorphism, isomorphism in details. CO3: Understand kinematics in two dimensions, mathematical exposition and geometrical representation of simple harmonic motion. CO4: Study mechanics of system of particles and Lagrange's equations.
Course Outcome for Semester-V & VI	
Semester- V & VI Paper-I: Analysis, Abstract algebra	CO1: Study Fourier series and it's convergence, existence of Riemann-Satieties integral, construction of analytic function, harmonic function etc. CO2: Understand conformal mapping, bilinear transformation. CO3: Study Group auto-morphism, inner auto-morphism, vector spaces and it's properties, subspaces, basis, dimensions etc. CO4: Understand algebra of linear transformation and its inverse, matrix associated with linear map and vice versa, properties of inner product space.
Semester- V & VI Paper-II: Metric space, complex integration &	CO1: Understand concepts of countable, uncountable sets, completeness, compactness, connectedness of metric space. CO2: Calculation of zeros and different types of singularities of analytic function, application of Cauchy's residue theorem

Algebra, Special theory of relativity	to evaluate integral. CO3: Study geometrical interpretation, group properties of Lorentz transformations and basics of tensors, metric tensors etc. CO4: Understand equivalence of mass and energy, transformation formulae for mass, momentum and energy, relativistic equations of motion, Maxwell's equations etc.

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DEPARTMENT OF MICROBIOLOGY

Program Outcomes: B.Sc. Microbiology

Department of Microbiology Program Outcomes

After successful completion of three years degree program in the subject Microbiology, the students are able to:

PO1: Demonstrate laboratory skills applicable to Microbiological and Clinical methods including laboratory safety.

PO2: Acquire skills for accurately reporting observations and findings through oral, written and digital formats.

PO3: Apply the knowledge of microbiology from multiple fields to critically analyze and evaluate microbiological, environmental and health related issues and to create awareness and impact of microbiology outside the science community.

PO4: Practice flexible professional skills needed for careers in microbiology & related professional and scientific fields like-Health sector, medical laboratory technology (MLT), Water testing labs, Dairy and food Industry as quality assurance and quality control professional etc, can opt for either post graduate study program, research, or for various competitive exams and professional courses. Exposure provided to the students during the add-on bioinformatics certificate course would help students gain awareness of career options in the software industry too.

PO5: Students will be able to expand their learning horizons through use of multidimensional learning resources to keep themselves at par with the pace of scientific and research development worldwide.

Program Specific Outcomes

PSO1: The subject helps to gain knowledge about all types of microbial world, living as well as non-living, its harmful & useful interactions with human, animals, plants, bacteria and the environment

PSO2: Students will be able to recognize structural & functional relationship of all living beings at molecular & cellular level.

PSO3: They will get acquainted with importance of microorganisms as model systems in Genetics & Molecular

Biology.

PSO4: Students will be able to demonstrate basic microbiological techniques & acquire experimental and quantitative skills encompassing preparation of laboratory reagents, media, conducting experiments, handling different instruments, analyzing samples& interpreting results.

Course Outcomes of B.Sc. Microbiology

Course Outcomes for Semester-I

Paper-I: Fundamentals of Microbiology (New Syllabus)

CO1: Get knowledge about basic branches of microbiology, they will understand the contribution of eminent scientists in the development of microbiology.

CO2: Acquainted with the ultrastructure of bacterial cell, concepts of prokaryotic and eukaryotic cell's, their differences with examples.

CO3: They will acquire the knowledge about nutritional requirements, classification of bacteria on the basis of nutritional habits.

CO4: Learn about the growth of microbes, cell cycle and reproduction processes, various environmental parameters affecting their growth & different techniques used for their detection & quantification.

Paper-II: Basic Techniques in Microbiology (New Syllabus)

CO1: Understand the basic principles and applications of various types of microscopic techniques.

CO2: The students learn different techniques of Cultivation and preservation of bacteria, yeast and fungi. They are acquainted with various culture collection centres in India and abroad.

CO3: Understand different staining techniques, role of reagent and dyes principles involved in these staining techniques.

CO4: Get acquainted with various disinfectants, antiseptic and antimicrobial agents used in microbial control. They come to know about its mode of action and mechanism involved in microbial control.

Course Outcomes for Semester-II

Paper-I: Microbial Diversity

CO1: Know about the Prokaryotic microbial diversity with examples, general characters & their life cycle.

CO2: Get acquainted with Eukaryotic microbial diversity with examples, general characters & their life cycle.

CO3: Understand the general characters, morphology and classification of viruses, mode of replication and methods of cultivation.

CO4: Conceptualize various kind of positive and negative

	microbial interactions.
Paper-II: Food Microbiology & Milk Microbiology	CO1: Get acquainted with various food and milk products, their production techniques, various diseases caused, prevention of spoilage and its preservation. CO2: Gain knowledge about food safety and food standards
	Course Outcomes for Semester-III
Paper-I: Chemistry of Organic Constituents and Enzymology (Old Syllabus)	CO1: Acquire knowledge about classification of organic compounds like Carbohydrates and lipids and get acquainted with their structures and various bonds involved in them. CO2: Understand classification & structures of amino acids& proteins. CO3: Concept building about classification, structures and functions of enzymes, their mode of action and reaction mechanism. Understand steady state kinetics. CO4: Gain knowledge about nucleic acids, structures and their differences. Can describe importance of vitamins to human body and their deficiency syndrome.
Paper-II: Industrial Microbiology	CO1: Know the scope of industrial microbiology and screening methods used for isolation of industrially important microbes. CO2: Gain knowledge about different Fermenter configurations& designs. CO3: Scale up and DSP. CO4: Concept building about industrial production of SCP, Baker's yeast, ethanol, penicillin and semisynthetic penicillin, citric acid, Vit B12, beer and wine.
	Course Outcomes for Semester-IV
Paper-I: Metabolism	CO1: Understand the general strategy of metabolism and conceptualize various metabolic processes operating in living cells. CO2: Gain knowledge about methods of DNA replication, models of replication, enzymes involved and Prokaryotic transcription process and mechanism. CO3: Acquainted with deamination processes, Urea cycle, glucogenic and ketogenic amino acids Genetic code and Prokaryotic translation CO4: Understand the mechanism by which energy is generated.
Paper-II: Applied Microbiology	CO1: Get acquainted with multiple tube dilution technique, IMViC classification and understand the significance of bacteriological analysis of drinking water.

CO2: Gain knowledge about various methods applied for treatment of water and waste water & understand the importance of disposal of industrial wastes and techniques used in its disposal.

CO3: Understand the techniques of air analysis, various samplers used & methods involved. Know the role of soil microbes and methods involved in biofertilizer & biopesticide productions. Conceptualize PSB, mycorrhiza & microbial leaching process.

CO4: Gain knowledge about Food spoilage, pathogens involved and methods of preservations. Food borne diseases and food intoxications.

Course Outcomes for Semester-V

Paper-I: **Medical Microbiology**

CO1: Concept building about various epidemiological concepts and definitions. Various modes by which infections spread in community, portal of entry& exit and their control.

CO2: Microbial mechanism of Pathogenicity and virulence, exaltation and attenuation methods, MID, MLD, ID 50, LD50.

CO3: Acquire knowledge about methods used in isolation and identification of various pathogenic organisms, based on their morphology, cultural characteristics, biochemical characteristics, serology and lab diagnosis.

CO4: Understand the Basic principles of drug designing, the role of these drugs and antimetabolites in disease control.

Paper-II: **Molecular Biology and Bioinstrumentation**

CO1: Acquainted with various concepts – related to gene, different types of mutation and its regulation.

CO2: Concept building about various processes by which gene transfer occurs amongst microbes

CO3: Understand the principles, methodology and application of various bio instruments like spectrophotometer, electrophoresis, chromatography, centrifuge etc

CO4: Get acquainted with Isotopic tracer technique and its applications.

Course Outcomes for Semester-VI

Paper-I: **Immunology**

CO1: Concept building about defensive mechanism of host against diseases, various terminologies used and definitions of epidemic, endemic, pandemic, nosocomial infection, zoonotic infection, vector, types and role of vectors, portal of entry portal of exit of pathogens.

CO2: Knowledge about Haematopoiesis, Cells of immune system, general characters of B and T cells, cellular and humoral

immunity.

CO3: Understand the structures, properties, types and importance of Antigens and Immunoglobulins, Ag-Ab reactions in Diagnostic immunology.

CO4: Gain knowledge about ELISA test, its application and various Hypersensitivity reactions and their types.

Paper-II: **Biotechnology**

CO1: Know the tools and techniques of genetic engineering

CO2: Knowledge about DNA, fingerprinting and its application in forensic science

CO3: Acquainted with the methods of production of insulin, interferon. Vaccines, monoclonal antibody. Understand the applications of biotechnology in agriculture

CO4:Acquire knowledge about the advantages /disadvantages of genetic engineering for humans & comprehend the production and importance of genetically modified foods and animals, know about the ethics to be followed.

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DEPARTMENT OF PHYSICS

Program Outcomes: B.Sc. Physics

Department of Physics

After successful completion of three years degree program in the subject Physics, the students are able to:

Program Outcome:

PO1: Gain a thorough understanding of the subject.
PO2: Lay the groundwork for future learning.
PO3: Learn the fundamentals of research.
PO4: Instill good moral and ethical ideals in yourself.
PO5: Recognize your societal and environmental responsibility.
PO6: Develop communication and professional skills.
PO7: Acquire the ability to accept a wide range of ideas and points of view.
PO8: Empower yourself to meet the demands of a changing universe.

Program Specific Outcomes

PSO1: Understand the principles of physics, matter characteristics, and electrodynamics, as well as the basic notions of scientific process.
PSO2: Understanding the theoretical foundations of quantum mechanics, relativistic physics, nuclear physics, optics, spectroscopy, solid state physics, astrophysics, statistical physics, photonics, and thermodynamics.
PSO3: Understand and apply electrical ideas in the design of various analogue and digital circuits.
PSO4: Understand the fundamentals of computer programming and numerical analysis with PSO4.
PSO5: Use laboratory experiments to test and apply theoretical principles.

Course Outcomes of B.Sc. Physics

Course Outcomes for Semester-1

Paper – I: Properties of Matter and Mechanics: Learning Outcomes:

CO1: The curriculum covers general characteristics of matter, which include solid and liquid. Elasticity is a solid property that offers a notion of material strength in three forms, as well as liquid viscosity and its relevance. Surface tension in a liquid's geometrical form.
CO2: Mechanics covers the fundamentals. Newton's laws of motion and how they're used. Students' imagination is improved by geometrical descriptions of rules, and the study

	of restrictions leads to the area of physics known as classical mechanics. The relationship between M.I. and body movements is given by rotational motion.
Paper-II: Electrostatics, Time varying fields & Electric Currents	CO1: State and express Coulomb's law in vector form and apply it to solve for E due to stationary charges, Electric potential due to point charge, owing to dipole, and field due to dipole at any place after finishing this course. CO2: Able to establish that potential is force per unit charge and to describe V and its link to energy conceptually. CO3: Able to explain the similarities and differences between a conductor and a dielectric, the action of an electric field, dielectric polarisation, polar and non-polar molecules, and the Classius-Mossoti equation. CO4: When given epsilon and the free charge on the dielectrics, be able to determine the E field inside the dielectric. CO5: Able to grasp the fundamental concepts of parallel plate capacitors, including capacity derivation with or without the use of a calculator. When given epsilon and the free charge on the dielectrics, it is possible to determine the E field inside the dielectric. CO6: Able to grasp the fundamental concepts of parallel plate capacitors, including capacity derivation with and without dielectrics, as well as solve numerical issues. CO7: Able to articulate and explain Faraday's laws of electromagnetic induction, self and mutual induction, transformers and their operation, transformer losses and applications, and Kirchhoff's laws. CO8: Able to study series resonance, frequency derivation, power in an ac circuit, and solve mathematical problems.
	Course Outcomes for Semester-1I
Paper-I: Oscillations, Kinetic theory of gases and Thermodynamics:	CO1: Students will be able to grasp linear and angular S.H.M., as well as the S.H.M. differential equation and its solution. Also capable of developing damped oscillation differential equations and energy dissipation via damped oscillations. CO2: The basics and applications of forced vibrations, resonance, and its energy and quality factor will be understood by the students. Also included are gas laws and their applications. CO3: Students will learn about gas transportation phenomena and the thermodynamics that underpin it. Also, the role of thermodynamic laws in engine efficiency.
Paper-II: Gravitation, Astrophysics,	CO1: The students get an understanding of the fundamental rules of classical mechanics, which improves their understanding

Magnetism and Magneto statics:	of planetary motion and interactions. CO2: An introductory course in astrophysics piques students' curiosity in space science. CO3: Studying atomic magnets at a microscopic level improves students' intellectual abilities in material research and provides insight into the relationship between electric and magnetic fields as a future key to power consumption.
	Course Outcomes for Semester-1II
Paper-I: Sound waves, Applied acoustic, Ultrasonic and Power supply Learning	CO1: Students learn about the many types of waves and their properties. They also learn about harmonics, sound quality, and the human ear's reaction and audibility to sound. Students may learn about sound intensity measurement and the influence of temperature on sound. CO2: Students are familiar with various sound measurement instruments such as transducers, sound recording, and sound reproduction. CO3: Students learn about ultrasonic waves, their characteristics, ultrasonic wave generating methods, and research applications. CO4: Students learn about the necessity of voltage, current, and load management, as well as power supply and conversion from alternating current to direct current.
Paper-II: Physical optics and Electromagnetic waves	CO1: Students are able to explain how light behaves as a wave. CO2: Examine how light intensity varies owing to interference and diffraction. • Understand Michelson and Fabry-Parot Interferometer Applications CO3: Examine the concept of polarization and how it is used. CO4: Understand electromagnetic waves, Maxwell's field equations, and their transverse nature. CO5: Explain Poynting's theorem and its significance.
	Course Outcomes for Semester-1V
Paper-I: Solid state physics, X-ray and Laser:	CO1: Students will have a fundamental understanding of crystal systems and spatial symmetry, Miller indices, and how different diffraction methods are used to study crystalline materials. CO2: Be familiar with the notion of a reciprocal space lattice and the meaning of Brillouin zones. CO3: Students will be able to identify the different types, characteristics, and uses of X-rays. CO4: Students explain the fundamentals of lasers, how they are made, and how they are used.
Paper-II:	CO1: Students will learn the fundamentals, manufacturing, and

Solid state electronics, and Molecular physics:	applications of LED, Solar Cell, and BJT in everyday life, as well as the concepts, applications, and special characteristics of FET, JFET, and MOSFET. CO2: Students will be able to explain and quantify vibrational and rotational energy, kinds of molecules, diatomic molecules as harmonic and anharmonic oscillators, rotational-vibrational spectra, and the Born Oppenheimer approximation. CO3: Students who understand the relevance and applicability of Raman spectroscopy in molecular physics are also familiar with the Frank-Condon principle, the fundamentals of NMR and ESR, and their spectroscopic applications.
	Course Outcomes for Semester-V
Paper-I: Atomic physics, free electron theory and Statistical physics:	CO1: Students comprehend the many theories of the atomic model, as well as the various quantum numbers. CO2: Students learn about electron conduction, both electrical and thermal. Fermi temperature band, Fermi energy. Free electron theory: different theorems, models, and experiments Material classification is also important. CO3: The student gains an understanding of - space, Gamma space, probability distribution, and thermodynamic probability, Principle of a priori probability, Boltzmann's entropy relation, different states, Maxwell Boltzmann distribution law, and its application; Boltzmann's entropy relation; Boltzmann's entropy relation; Boltzmann's entropy relation; Boltzmann's entropy relation; Boltzmann' Students will also study Bose-Einstein statistics, as well as the Fermi Dirac distribution and how to use it.
Paper-II: Quantum mechanics, Nano-materials and Nanotechnology:	CO1: Understand the major components of quantum mechanics' historical evolution, as well as wave characteristics of matter, after finishing this course. CO2: Capable of relating classical mechanics to quantum mechanics. CO3: Able to solve Schrodinger equations in one to three dimensions and understand them physically. CO4: Familiarity with the fundamentals of nano-science and nanotechnology, as well as their relevance in everyday life.
	Course Outcomes for Semester-VI
Paper-I: Relativity, Nuclear physics and Bio Physics	CO1: Students comprehend frame of reference, special theory of relativity postulates, and relativistic variation in length, time, mass, velocity addition, and mass energy equivalence. CO2: They can design radiation detectors, charge accelerators, and

	nuclear reactions, as well as the many types of nuclear processes and their significance in modern technology. CO3: Students are able to describe and grasp the essential ideas of decay particles. CO4: Students will be able to understand bio physics and its significance in the medical profession.
Paper-II: Electronics, Fiber optics, Communication and Digital electronics	CO1: Students will understand the construction and operation of amplifiers and oscillators, as well as their applications. CO2: Students will be able to understand the fundamental principles and operations of fiber optics, as well as the importance of optical fibre, light wave propagation in optical fiber, and its role in communication. CO3: They will also be familiar with communication kinds such as AM and FM, as well as their core theory and how television is broadcast using these methods. CO4: The students will be able to understand how large amounts of data are kept in current times utilizing technologies such as Number Systems, as well as the theory behind it.

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DEPARTMENT OF STATISTICS

Program Outcomes: B.Sc. Statistics

Department of Statistics

After successful completion of three years degree program in the subject Statistics, the students are able to:

Program Outcomes

PO1: Demonstrate, solve and an understanding of major concepts in all disciplines of statistics

PO2: Solve the problem and also think methodically, independently and draw a logical conclusion.

PO3: Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of statistical experiments.

PO4: Create an awareness of the impact of statistics on the society, and development outside the scientific community.

PO5: Use modern techniques and different Statistical software

Program Specific Outcomes

PSO1: Make aware and handle the sophisticated data.

PSO2: Gain the knowledge of Statistics through theory and practical.

PSO3: To learn about basic principles of design of experiment.

PSO4: To gain knowledge about official statistics; purpose and functions of CSO, NSSO

PSO5: Understand basic concepts of Statistical Quality Control and Uses of SQC

PSO6: To study applications of statistics in the field of industrial statistics, operation research, survey sampling technique etc.

PSO7: Use modern statistical tools, Models, Charts and Equipment.

PSO8: Develop research-oriented skills.

Course Outcomes for B. Sc. Statistics

Course Outcome for Semester-I

Paper-I: Probability Theory

CO1: Understand the Theory of Probability.

CO2: Able to apply additive and multiplicative laws of probability

CO3: Obtain the various results on theorems in probability

CO4: Distinguish between measures of location and measure of dispersion.

CO4: Identify Conditional Probability, Bayes theorem, and Chebyshev's inequality

	CO5: Concept of Random variable, pmf, pdf, pgf, distribution function, mgf and its uses
Paper-I: Descriptive Statistics-I	CO1: Able to plan, execute and analyze a data CO2: Use and understand basic concepts of Descriptive statistics CO3: Analyze data and understand concept of population census CO4: Analysis of categorical data using various techniques and draw conclusions. CO5: Apply statistics to draw different types of diagrams and graphs
	Course Outcome for Semester-II
Paper-I: Probability Distribution	CO1: Understand various Discrete and Continuous distributions. CO2: Able to have the knowledge of Discrete Distributions such as Bernoulli, Binomial, Poisson, Uniform, Hyper geometric and Geometric, Negative Binomial with their properties and applications CO3: Able to have the knowledge of Continuous Distributions such as Uniform, Beta, Gamma, Normal and their properties CO4: Distinguish between Bernoulli distribution and Binomial distribution CO5: Understand concept of Lack of memory property of Geometric distribution.
Paper-II: Descriptive Statistics-II	CO1: Able to plan, execute and analyze a data. CO2: Use and understand concepts of central tendency and location. CO3: Understand different concepts and measures of dispersion CO4: Analysis the concept of bivariate data and correlation coefficient as well as regression. CO5: Apply different types of partition values and the concepts of skewness and kurtosis The concepts of central tendency and location.
	Course Outcome for Semester-III
Paper-I: Statistical Methods	CO1: Drawing random samples from uniform and normal distribution. CO2: Able to find moments and correlation coefficient of bivariate probability distribution. CO3: Obtain a joint probability distribution of random variable (one or two dimensional) in the given situation. CO4: Distinguish between t- distribution and F- distribution. CO5: Identify the type of Statistical situation in which different Transformation of variable technique can be applied.
Paper-II: Economics Statistics	CO1: Construction of Price and Quantity index number by simple aggregative method CO2: Construction and uses of Wholesale Price Index number. CO3: Able to determine concept of purchasing power of money CO4: Fitting of Pareto curve to income data.

	CO5: Analyze data pertaining to seasonal Indices and to interpret the results. CO6: Summarize and analyze the data using Economic time series. CO7: Apply statistics in the various fields.
	Course Outcome for Semester-IV
Paper-I: Statistical Inference	CO1: To solve problems on chi-square for testing independence of attributes. CO2: To solve problems on t-tests and construction of confidence intervals for single mean and difference of two means, paired t-test. CO3: Identify the characteristics properties of good estimator. CO4: Identify the type of statistical situation to which central limit theorem can be applied. CO5: Understand the construction of confidence interval.
Paper-II: Applied Statistics	CO1: Explain the sources of demographic data. CO2: Calculation of Percentile scores and T-scores for a given frequency distribution of raw scores. CO3: Comparison of raw scores on the basis of (i) Percentile, (ii) Z scaling, (iii) T scaling. CO4: Able to solve numerical problems on construction and use of life tables. CO5: Can do computation of CDR and Standardized death rates by direct and indirect methods. CO6: Be able to compute and interpret Gross Domestic rates.
	Course Outcome for Semester-V
ST-301: Paper-I: Statistical Quality Control and Linear Programming Problem	CO1: Use tools of SQC, draw control charts for mean, standard deviation and range CO2: Able to draw conclusion about whether process is in statistical quality control or not. CO3: Obtain the optimum solution of Linear programming problem. CO4: Distinguish between Process and product control CO5: Identify the General form of LPP and Standard form of an LPP.
ST-302: Paper-II: Survey Sampling Techniques	CO1: Able to plan, execute and analyse a sample survey CO2: Use and understand basic concepts of sample survey, sampling and types of sampling and non-sampling errors CO3: Analyze data and understand concept of stratified sampling, systematic sampling and cluster sampling and compare various sampling techniques. CO4: Analyze data using various sampling techniques and draw conclusions.24 CO5: Apply statistics in the various fields of sampling

techniques

Course Outcome for Semester-VI

ST-311: Paper-I: Operations Research	CO1: To solve and understand different concepts of Network Analysis and Construct Network Diagram CO2: Able to understand concept of Duality in LPP, relationship between primal and dual problem and its economic interpretation CO3: Identify the balanced transportation problem and unbalanced transportation problem, CO4: Identify two-person zero sum game and solution of game. CO5: Understand concept of Duality in LPP, relationship between primal and dual problem and its economic interpretation
ST-312: Paper-II: Experimental Designs	CO1: Able to explain factorial experiments, Yates' method to calculate main effects and interaction effects in 2^2 and 2^3 factorial experiments CO2: Analyse data using various experimental designs CRD, RBD, LSD and draw conclusions. CO3: Comparison of theory of linear estimation, analysis of variance (ANOVA) CO4: Able to analyze data using various ANOVA techniques and draw conclusions. CO5: Understand basic principles of designs of experiments. CO6: Be able to compute and interpret ANOVA for one way and two-way classified data.

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DEPARTMENT OF ZOOLOGY

Program Outcomes: B.Sc. Zoology

Department of Zoology

After successful completion of three years degree program in the subject Zoology, the students are able to:

Program Outcome

PO1: classification and Identification of organisms according to their characteristic features.

PO2: Correlates the Morphology, physiology and biology of invertebrate and vertebrates.

PO3: Gain the knowledge of Micro-technique for preserving tissue and specimens.

PO4: Analyze interactions among the various organisms of different phylas, their distribution and relationship with the environment.

PO5: Gain knowledge about economic importance and application of knowledge agro based small industries like sericulture, apiculture, aquaculture, fish breeding, pear-culture.

PO6: Understand concept of genetics and its importance in human health.

PO7: Understand the use of biotechnology, biostatistics and bioinformatics.

Program Specific Outcome

PSO1: Students are able to understand the basic concept of cell biology, environmental biology, genetics, physiology, taxonomy and applied zoology.

PSO2: Understand the application of biological sciences in aquaculture, sericulture, vermin-culture, pearl-culture and apiculture.

PSO3: Perform procedures as per laboratory standards in the area of physiology, cell biology, environmental biology, genetics, entomology, Biotechnology fisheries.

PSO4: Gain knowledge about research methodology i. e. skills of micro technique which consists of preservation of tissue and specimens, their staining techniques

Course Outcomes of B.Sc. Zoology

Course Outcomes for Semester-I

Paper - I: Life and Diversity of Animals – Non-chordates (Protozoa to Annelida)

CO1: Students get knowledge about unity and diversity of life on the earth.
CO2: Students will be able to identify and classify non- chordates on the basis of their peculiar characteristics.
CO3: students will be able to understand phylum wise structural features, morphology, anatomy, physiology, habit and Habitat.
CO4: Students will be able to explain how organisms' function at different level of grade of Organization like cellular, tissue, organ and organ system.
CO5: Able to give examples of the physiological adaptation, development, behavior of different forms of life.
CO6: Students understand economic importance of non-chordates as well as life cycle of pathogenic organisms.

Paper - II: Environmental Biology

CO1: Students get knowledge and understand about different strata of atmosphere.
CO2: Students able to understand /recognize biological, chemical, physical components of earths system.
CO3: Students will also understand how natural system human designed system work together and conflict with each other.
CO4: Students understood about environmental issues like water pollution, Air pollution, soil pollution and noise pollution.
CO5: Students able to understand and gain knowledge about renewable and non-renewable energy sources.

Course Outcomes for Semester-II

Paper - I: Life and Diversity of Animals – Non-chordates (Arthropoda to Hemichordata)

CO1: Students understood role of insect vectors in spreading diseases, mode of infection and symptoms.
CO2: Students also understood economic importance of molluscans.
CO3: Students understood affinities of hemichordates with different phyla.
CO4: Students get knowledge about indirect development through various larval stages.

Paper - II: Cell Biology

CO1: Students will be able to understand structure and functions of cell and cell organelles.
CO2: Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells and cell organelles
CO3: Students will understand how these cellular components are used to generate and utilize energy in cells
CO4: Students will understand types of cell division that is mitosis and meiosis

	CO5: Students will apply their knowledge of cell biology to study environmental or physiological responses of cell
	Course Outcomes for Semester-III
Paper-I: Life and diversity of Animals - Chordates (Protochordata to Amphibia	CO1: Students are able to understand diversity of earlier chordate from Protochordata to amphibian. CO2: Students are also studied about growth and development, evolution of different system of chordates. CO3: Students also get knowledge about adaptations, parental care and sexual dimorphism in chordates
Paper – II: Genetics	CO1: Students are able to understand Mendel's laws of inheritance, basic concepts of gene, transmission of hereditary characters. CO2: Students also understand about interaction of genes. CO3: Students also understand concept of lethal genes, chromosomal disorder and syndrome caused due to abnormal chromosomal no. CO4: Students also understand about population genetics and application of genetics
	Course Outcomes for Semester-IV
Paper - I: Life and Diversity of Animals – Chordates(Reptilia, Aves and Mammals)	CO1: Students understand about classification of reptiles, Aves and mammals based on structural variation. CO2: Get knowledge about Biting mechanism in snakes, adaptations in Aves and mammals. CO3: Get information about modern evolution theories, genetic basis of evolution CO4: Understand comparative study of development of heart and aortic arches in birds, Aves and mammals. CO5: Study different aspects of chick development
Paper - II: Molecular Biology and Immunology	CO1: Understand detail structure of DNA and RNA as a genetic material, structure of gene. CO2: Students are able to understand different processes like replication, transcription, protein synthesis. CO3: Able to understand concept of immunity, types of antigen antibody and their interaction CO4: Get information about types of immune response and about immune deficiencies.
	Course Outcomes for Semester-V
Paper-I: General Mammalian Physiology I	CO1: It gives knowledge about structural features and functions of different systems like digestive, respiratory and circulatory. CO2: General properties of enzymes, enzyme activity CO3: Digestive glands, respiratory pigments, respiration mechanism and in detail circulatory system.
Paper-II: Aquaculture and Economic Entomology	CO1: This paper gives knowledge about-application of zoology and economic importance of zoology like fresh water aquaculture, prawn culture, pearl culture, apiculture, sericulture, and lac culture. CO2: Gives information about economic entomology and methods

	of pest control.
	Course Outcomes for Semester-VI
Paper-I: General Mammalian Physiology-II	CO1: Get knowledge about nerve and muscle physiology, CO2: Studied in detail structure and function of different endocrine glands. CO3: Understood reproductive system, causes of infertility in male and female.
Paper-II: Applied Zoology-II	CO1: Students are able to understand methods of separation of biomolecules, micro techniques (different staining methods CO2: Understand importance and role of bioinformatics CO3: Understand application of statistics in biology and biotechnology.

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DEPARTMENT OF LANGUAGES

- **COMPULSORY ENGLISH**
- **SUPPLEMENTARY ENGLISH**
- **MARATHI**
- **HINDI**

Program Outcomes: B.Sc. Compulsory English

Department of Languages

After successful completion of three years degree program in the subject English, the students are able to:

Program Outcomes

PO-1: Students will be able to develop Life skills through the different life lessons incorporated in the prose and characterization.

PO-2: Students will be able to make sensible and ethical decisions and inculcate moral values those that are demonstrated in the literature.

PO-3: Comprehensive skills are developed through reading and writing exercises.

PO-4: Students will learn effective use of formal and informal use of English language

PO-5: Students will be able to learn their critical faculties required in personal and professional life.

PO-6: Students will be able to tap the intrinsic and extrinsic motivational theories through the text prescribed.

PO-7: Students should be able to write business communication and other formal writings required in their professional life.

PO-8: Students will be able to understand the concepts and strategies of communication skills with special reference to writing and listening skills.

PO-9: Students will be able to write and appreciate different types of prose such as essay, paragraph writing, dialogue writing etc.

PO-10: Students will be able to understand the different state of minds for example humour, struggle, resilience, success, innovation and the strategies to deal in such situations through motivational and inspiring stories.

Program Specific Outcomes

PSO1: Students will acquire fundamentals of formal writing skills required in a workplace.

PSO2: Students will be able to use correct grammar to improve their writing and speaking skills.

PSO3: Students will review and inculcate moral and ethical values as discussed in the prescribed prose.

PSO4: Students will improve their analytical power through reading and

writing exercises.

PSO5: Students will learn important business communication through accurate use of language and formats.

PSO6: Students will be able to demonstrate concepts of creative skills and innovative presentation skills

Course Outcomes B.Sc. Compulsory English

Course Outcome for Semester-I

UNIT-I: PROSE **My struggle for an Education: Booker T Washington** **Florence Nightingale: Lytton Strachey**	CO1: To motivate student to understand the importance of education in one's life. CO2: To inspire students through the real-life examples of struggle and success. CO3: To inculcate the concept of community service and philanthropy among the youth. CO4: To set examples of benevolence and strength through self- worth, self -image and self -identity.
UNIT-II: PROSE **The Birth of Khadi: Mahatma Gandhi** **Go, Kiss the World: Subroto Bagchi**	CO1: To integrate and revive the idea of swadeshi moment as a contribution to the development of Indian nationalism. CO2: To extend the concept of self-generation and self- reliance and considering clothing as a power changing mechanism in freedom struggle. CO3: To introduce the model of Child -Parent Relationship in shaping the life of an individual. CO4: To help students identify their role models to learn life skills through them.
UNIT-III: POETRY **Ulysses: Alfred Tennyson** **Yussouf: James Russel Lowell** **If: Rudyard Kipling**	CO1: To extend the idea of resilience, vigor and self- determination in the youth. CO2: To help students understand and incorporate life skills such as bravery, fearlessness, heroism in the times of struggle and hardships. CO3: To make students learn the importance of forgiveness and moving ahead in their lives. CO4: To help students to evolve as Samaritans and spread the word of fraternity among individuals. CO5: To help students to have determination in the face of failure. CO6: To provoke students in the direction of sportsmanship in the competitive world.
UNIT-IV: Comprehension of Unseen Passage **Prepositions** **Subject-Verb Agreement**	CO1: To improvise the comprehension skills through reading and writing. CO2: To revise the use of grammar in day-to-day life. CO3: To make students explain the idea briefly in their own words.

Summarizing

Course Outcome for Semester-II

UNIT-I: PROSE **1. Grassroot innovation and Social Enterprise: Changing Lives** **2. The Two Gentlemen of Verona**	CO1: To introduce the students about inventions through innovations. CO2: To inspire students towards innovation through real time success stories. CO3: To teach students the life-skills such as focus and self-control, facing challenges, making connections etc. CO4: To inculcate the habit of hard-work and diligence irrespective of their age.
UNIT –II: PROSE **The Verger** **Synthesis of Science and Spirituality**	CO1: To involve students in understanding the basic principles of value education. CO2: To impart reasoning of conventional and non-conventional education in one's life. CO3: To institute the concept of science and spirituality in the minds of youth. CO4: To foster the young minds with connection between science and spirituality.
UNIT -III: POETRY **Richard Cory** **Allow sanity a little space** **Refugee Blues**	CO1: To share the idea of resilience in face of adversity. CO2: To unveil the learners about the evil and dark forces prevalent in this millennial and how one should deal with it. CO3: To bring forth the stories of refuges focusing on their accommodating and tolerant behaviors.
UNIT-IV: WRITING SKILLS **Paragraph Writing** **Application and C.V. Writing** **3. Phrasal Verbs**	CO1: To inculcate writing skills through idea development strategies. CO2: To teach students the skill of writing applications and C.V. CO3: To make appropriate use of phrasal verbs to improve language skills.

Course Outcomes B. Sc. Supplementary English

Course Outcome for Semester-I

UNIT-I: PROSE Short Stories	CO1: To revise the learners with the concepts of compassion, love and care. CO2: To convey the students the purpose of life through enlightenment and wisdom. CO3: To promote the importance of humour.
UNIT -II: Short Stories	CO1: To revise the concepts of wisdom and knowledge in the constant changing world. CO2: To expand and explore on the idea freedom and responsibility. CO3: To share the views on duality concept of real and fake.
UNIT-III: Vocabulary Expansion	CO1: To introduce the varied words used in English Language. CO2: To maximize the use of different use of vocabulary in reading and writing.
UNIT -IV: Essay writing Email	CO1: To develop the critical thinking and writing among students on various current issues. CO2: To develop email writing skills as a part of formal communication.

Course Outcomes B. Sc. Supplementary English

Course Outcome for Semester-II

UNIT-I: Short Stories	CO1: The stories teach how healthy sense of humour can help one deal with tough times. CO2: The students learn the pros and cons of having and lacking integrity in one's life. CO3: To teach the learners the meaning of 'Luxury' and connotations attached to it.
UNIT- II: Short stories	CO1: To teach the learners how the serious things can also be leant through dark humor. CO2: To impart philosophical lessons through the technique of storytelling. CO3: To impart that reading can also be an experiential learning process.
UNIT-III: Writing Advertisements Letter writing	CO1: To make students aware of strategies of Advertisement writing. CO2: To guide students how to write different types of formal letters.
UNIT-IV: Story writing based on given outline Reporting an event	CO1: To develop the creative writing skills through development of story. CO2: To develop critical thinking and decision making of the students. CO3: To improve report writing skills of the students. CO4: To develop comprehension skills of any situation.

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Program Outcomes: B.Sc. Marathi

Department of Languages

After successful completion of three years degree program in the subject Marathi, the students are able to:

Program Specific Outcomes

PSO	Programme outcomes
PSO-1	साहित्य व भाषाविषयक आकलनक्षमता वाढते.
PSO-2	मराठी साहित्य, भाषा व संस्कृती यांचा जवळून परिचय होतो
PSO-3	मराठी भाषा व साहित्य अवलोकनाची रूची वाढते.
PSO-4	साहित्यकृतीला मुक्त प्रतिसाद देण्याची क्षमता निर्मान होते.
PSO-5	साहित्यभाषा व व्यवहारभाषा यांचे ज्ञान मिळते.
PSO-6	लेखन, वाचन, संभाषन, आकलन, ई. भाषिक कौशल्यांचा विकास होतो.

Course Outcomes B.Sc. Marathi

Course Outcome for Semester-I & II

Course Outcomes

COs	Course outcomes
CO-1	मराठी भाषेतून वैज्ञानिक दृष्टीकोन वृद्धिंगत होतो.
CO-2	मराठीभाषेतून सामाजिक समता रुजवण्याचा प्रयत्न केला जातो.
CO-3	साहित्यातून वाचण्याचे महत्व नवीन पिढीला कळते.
CO-4	मराठी साहित्यातून मराठी तरुंनाना एक प्रेरक दृष्टी प्राप्त होते.
CO-5	मराठी साहित्यातून मानवताधिष्ठीत विचार समृद्ध होण्यास मद्दत होते.
CO-6	भाषेतून मराठी साहित्य, भाषा व संस्कृती यांचा जवळून परिचय होतो.
CO-7	भाषेद्वारे मानवांच्या भावनांचे प्रगटी करण होते.
CO-8	मराठी भाषेतून राष्ट्रीय एकात्मतेचे मूल्य रुजवले जाते.
CO-9	साहित्यातून सामाजिक कार्याचा संदर्भ स्पष्ट केला जातो.
CO-10	साहित्यातून सामाजिक जागृतीचे ध्येय ठरवले जाते.
CO-11	साहित्यातून व भाषेतून नवा आशावाद व्यक्त केला जातो.
CO-12	साहित्यकृतीला मुक्त प्रतिसाद देण्याची क्षमता निर्माण होते.
CO-13	साहित्यातून लेखन वाचन संभाषण आकलन इत्यादी भाषिक कौशल्यांचा विकास होतो.
CO-14	मराठी साहित्यातून उत्कृष्ट व्यक्तीमत्वाचा परीचय होतो

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Program Outcomes: B.Sc. Hindi

Department of Languages

After successful completion of three years degree program in the subject Hindi, the students are able to:

Program Specific Outcomes

PSO	Programme outcomes
PSO-1	साहित्य और भाषा की आकलन क्षमता विकसित होती है।
PSO-2	हिंदी साहित्य, भाषा व संस्कृती इनका नजदीक से परिचय होता है।
PSO-3	हिंदी भाषा व साहित्य के अवलोकन में रुची बढती है।
PSO-4	साहित्यकृती को मुक्त प्रतिसाद देने की क्षमता निर्माण होती है।
PSO-5	साहित्यिक भाषा व व्यवहारभाषा इनका ज्ञान मिलता है।
PSO-6	लेखन, वाचन, संभाषण, आकलन इ. भाषिक कौशल्य का विकास होता है।
PSO-7	उपयोजन कौशल्य विकसित होते है।
PSO-8	भाषिक ज्ञाना में वृद्धी होती है।
PSO-9	साहित्य और संस्कृती का परिचय होता है।

Course Outcomes B.Sc. Hindi

Course Outcome for Semester-I & II

Course Outcomes

COs	Course outcomes
CO-1	साहित्य की विभिन्न विधाओ (जैसे कविता, कहानी, निबंध, एकांकी,संस्मरण आदि) की समझ बनाना और उनका आनंद उठाना ।
CO-2	विभिन्न सामाजिक- सांस्कृतिक मूल्यों के प्रति अपने रुझानों को अभिव्यक्त करना ।
CO-3	पढ़ी सुनी रचनाओं को जानना, समझना, व्याख्यान करना, अभिव्यक्त करना ।
CO-4	अपनी स्तरानुकूल दृश्य, श्रव्य माध्यमों की सामग्री (जैसे पत्र- पत्रिकाए, नाटक, सिनेमा आदि) में अपनी राय व्यक्त करना ।
CO-5	दैनिक जीवन में औपचारिक - अनोपचारिक अवसरों पर उपयोग की जा रही भाषा की समाझ बनाना ।
CO-6	हिंदी भाषा साहित्य को समझते हुए सामाजिक परिवेश के प्रति जागरूक होना ।
CO-7	दैनिक जीवन में तार्किक एवं वैज्ञानिक समझ की ओर बढ़ना ।
CO-8	पढ़ी- लिखी- सुनी- देखी- समझी गई भाषा का सृजनशील प्रयोग ।
CO-9	भाषा की नियमबध्द प्रकृति को पहचानना और विश्लेषण करना ।
CO-10	भाषा के नए संदर्भो परिस्थितियों में प्रयोग करना ।
CO-11	पाठ विशेष को समझना और उससे जुड़े मुद्दों पर अपनी राय देना ।
CO-12	अन्य विषयों, जैसे- विज्ञान, गणित, सामाजिक विज्ञान, आदि में प्रयुक्त भाषा की समुचित बनाना व उसका प्रयोग करना ।
CO-13	किसी भी नई रचना/ किताब को पढने/ समझने की जिज्ञासा व्यक्त करना ।

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DEPARTMENT OF COMPUTER SCIENCE

DEGREE COURSE: BACHELOR OF COMPUTER APPLICATION (BCA)

Program Specific Outcomes: BCA

Department of Computer Science	After successful completion of three years BCA degree program, the students are able to:
Program Specific Outcomes	PSO1: Analyze and compare alternative solutions to computing problems
	PSO2: Design, correctly implement and document solutions to significant computational problems
	PSO3: Apply algorithmic, mathematical and scientific reasoning to a variety of computational problems.
	PSO4: Implement software systems that meet specified design and performance requirements
	PSO5: Work in the IT sector as system engineer, software tester, junior programmer, web developer, system administrator, software developer etc.

Course Outcomes: BCA

BCA Semester-I

Paper-I	CO1: Familiar with Fundamental concepts of computer
Computer Fundamentals	CO2: Get the knowledge about input and output devices and their working
	CO3: Basic knowledge of Memory storage devices use with computer and computer networks.
	CO4: Understand Network terminology
Paper-II	CO1: Students will be able to develop logics which will help them to create programs, applications in C.
'C' PROGRAMMING	CO2: Understand complete knowledge of C language
	CO3: Improve upon a solution to a problem
	CO4: Design, develop and test programs written in 'C'
Paper-III	CO1: Learn about Sampling Methods.

STATISTICAL METHODS	CO2: Know the basic idea of Permutations and Combinations, and Probability Concepts
	CO3: Apply knowledge of mathematics, science, and engineering.
	CO4: Evaluate the probabilities and conditional probabilities.
Paper-IV **DISCRETE MATHEMATICS – I**	CO1: Know the basic idea of Propositional calculus Students completing this course will be able to evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
	CO2: Learn about Disjunctive , connective principal conjunctive normal forms
	CO3: Students completing this course will be able to use tree and graph algorithms to solve problems.
	CO4: Students completing this course will be able to evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
Paper-V **OPERATING SYSTEMS**	CO1: Learn different types of operating systems along with concept of file systems and CPU scheduling algorithms used in operating system.
	CO2: Provide students' knowledge of memory management and deadlock handling algorithms
	CO3: Implement various algorithms required for management, scheduling, allocation and communication used in Operating System
	CO4: Understand the difference between process & thread, issues of scheduling of user level processes / threads and their issues & use of locks
Paper-VI	CO1: Learn about Windows Operating system
Office Automation	CO2: Know the basics of Word, creating documents , formatting, toolbars, creating templates , mail merge
	CO3: Understand the use of MS Power point for presentation
	CO4: Apply knowledge of MS EXCEL, formatting, entering formula, chart creation, functions in EXCEL

Course Outcomes: BCA

BCA Semester-II

Paper-I	CO1: Describe OOPs concepts
PROGRAMMI NG IN 'C++	CO2: Use the functions and pointers in C++ program.
	CO3: Describe and use constructors and destructors.

	CO4:	Explain arrays and strings and create programs using them.
Paper -II	CO1:	Understand the steps in software development.
SYSTEM ANALYSIS AND DESIGN	CO2:	Know the tools for System Analysis and design.
	CO3:	Learn about Data collection
	CO4:	Describe structured tools and techniques of data analysis
Paper- III	CO1:	Solve Algebraic , Polynomial Equations, iterative, bisection, false position methods
NUMERICAL METHODS	CO2:	Understand the concepts of Integration and differentiation
	CO3:	Apply various interpolation methods and finite difference concepts
	CO4:	Work numerically on the partial differential equations using different methods through the theory of finite differences
Paper -IV	CO1:	Know the Graph theory concepts like types of graph, representation etc.
DISCRETE MATHEMATICS–II	CO2:	Understand the concept of Set theory
	CO3:	Describe Functions, its types, counting concept like Permutations, combinations
	CO4:	Demonstrate different traversal methods for trees and graphs
Paper -V	CO1:	Learn about Linux concepts such as Directory structures, file types, data files, Shell , commands
LINUX OPERATING SYSTEM	CO2:	Learn about Vi editor
	CO3;	Learn about Sharing files with other users
	CO4:	Get knowledge of Managing Disk space
Paper -VI	CO1:	Describe the concept of Electronic market, concepts, inter-organizational value chains
E COMMERCE	CO2:	Get knowledge of Business strategy in electronic age, its competitive advantages , technology ecommerce evaluation
	CO3:	Get knowledge of Business to business Electronic commerce
	CO4:	Learn about Business to consumer electronic commerce

Course Outcomes: BCA

BCA Semester-III

Paper -I	CO1:	Design, create, build, and debug Visual Basic applications.

VISUAL BASIC PROGRAMMING	CO2:	Explore Visual Basic's Integrated Development Environment(IDE).
	CO3:	Implement syntax rules in Visual Basic programs
	CO4:	Explain variables and data types used in program development
Paper -II	CO1:	Gain a good understanding of the architecture and functioning of database management systems
DATABASE MANAGEMENT SYSTEM	CO2:	Understand the use of structured query language and its syntax, transactions, database recovery and techniques for query optimization
	CO3:	Acquire a good understanding of database systems concepts and to be in a position to use and design databases for different applications
	CO4:	Draw various data models for Data Base and Write queries mathematically.
Paper -III	CO1:	Get the knowledge of Concept of data structure its applications in different areas.
DATA STRUCTURES	CO2:	To access how the choices of data structure & algorithm methods impact the performance of program.
	CO3:	To Solve problems based upon different data structure & also write programs.
	CO4:	Choose an appropriate data structure for a particular problem.
Paper -IV	CO1:	Formulate a real-world problem as a mathematical programming model
OPERATIONS RESEARCH – I	CO2:	Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand
	CO3:	Understand the relationship between a linear program and its dual, including strong duality and complementary slackness
	CO4:	Solve specialized linear programming problems like the transportation and assignment problems
Paper -V	CO1:	Design and develop web pages
WEB TECHNOLOGY–I	CO2:	Understand, analyze and apply the role of languages like HTML, DHTML,CSS, XML, JavaScript, in the workings of the web and web applications
	CO3:	Understand, analyze and create web pages using HTML, DHTML and Cascading Styles Sheets.

	CO4:	Understand, analyze and build dynamic web pages using JavaScript and VB Script
Paper -VI	CO1:	Understand Number system and their conversions
DIGITAL ELECTRONICS–I	CO2:	Explain the concepts like Binary arithmetic
	CO3:	Get the knowledge of Logic gates
	CO4:	Understand the concept of Boolean algebra.

Course Outcomes: BCA

BCA Semester-IV

Paper -I	CO1:	Select and implement different software development process models.
SOFTWARE ENGINEERING–I	CO2:	Extract and analyze software requirements specifications for different projects.
	CO3:	Develop some basic level of software architecture/design.
	CO4:	Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress
Paper -II	CO1:	Get detail knowledge of SQL queries and its sublanguages.
SQL AND PL/SQL	CO2:	Understand the concept of PL/SQL programming.
	CO3:	Learn about Built-in functions of SQL
	CO4:	Understand about table View, Log & Triggers
Paper -III	CO1:	Learn the concept of Finite automation and regular expression
THEORY OF COMPUTATION	CO2:	Knowledge of concepts like Set, Context free grammar
	CO3:	Understand the Push down automata, context free languages .
	CO4:	To solve various problems of applying normal form techniques, push down automata and Turing Machines
Paper-V	CO1:	Get the practical knowledge of concepts of adding VB Script to HTML
WEB TECHNOLOGY–II	CO2:	Learn Java script
	CO3:	Get knowledge of Web services
	CO4:	To solve various problems of applying normal form techniques, push down automata and Turing Machines
Paper-VI	CO1:	Understand the concept of Combinational circuits

DIGITAL ELECTRONICS–II	CO2:	Understand the concept of Sequential circuits, Flip-Flops, Counters
	CO3:	Understand the concept of Assembly language programming
	CO4:	Get the knowledge of Instruction set

Course Outcomes: BCA

BCA Semester-V

Paper-I **COMPUTER GRAPHICS–I**	CO1:	Provide comprehensive introduction about computer graphics system, design algorithms and two dimensional transformations
	CO2:	Make the students familiar with techniques of clipping, three dimensional graphics and three dimensional transformations
	CO3:	Understand 2D transformation concept like translation, scaling, rotation.
	CO4:	Write programs that demonstrate geometrical transformations
Paper-II	CO1:	Learn about the concepts of Compilers and translators
COMPILER CONSTRUCTION	CO2:	Get knowledge of High level programming languages, Lexical and syntactic structure of a language
	CO3:	Learn the concept of code generation, Parsing
	CO4:	Understand Finite state machine and purpose
Paper-III **VB.NET**	CO1:	Students will understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic.
	CO2:	Students will describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE)
	CO3:	Students will create applications using Microsoft Windows Forms
	CO4:	Students will create applications that use ADO.NET
Paper-IV	CO1:	Understand the concept of Software architecture
SOFTWARE ENGINEERING – II	CO2:	Understand the basic concepts of Software testing, Strategies, approaches of testing
	CO3:	Learn the concept of Risk management in software testing
	CO4:	Use PHP's built in server to server static resources
Paper-V	CO1:	Analyze PHP scripts and determine their behavior
PHP – I	CO2:	Design web pages with ability to retrieve and present data from a MySQL.

	CO3:	Learn how to take a static websites and turn it into a dynamic website run from a database using PHP
	CO4:	Use PHP's built in server to server static resources
Paper-VI	CO1:	Explain how communication works in computer networks and to understand the basic terminology of computer networks
DATA COMMUNICATION AND NETWORK- I	CO2:	Explain the role of protocols in networking and to analyze the services and features of the various layers in the protocol stack.
	CO3:	Understand design issues in network security and to understand security threats, security services and mechanisms to counter
	CO4:	Connect internet to the system and knowledge of trouble

Course Outcomes: BCA

BCA Semester-VI

Paper-I	CO1:	Provide comprehensive introduction about computer graphics system, design algorithms and three dimensional transformations
COMPUTER GRAPHICS–II	CO2:	Get knowledge of 3D transformations, Geometric Transformations
	CO3:	Learn computer animation design, functions, motion specifications
	CO4:	Develop new kinds of graphics and animations
Paper -II	CO1:	Understand the principles and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements.
PROGRMMING IN JAVA	CO2:	Implement, compile, test and run Java programs comprising more than one class, to address a particular software problem
	CO3:	Demonstrate the principles of object oriented programming
	CO4:	Demonstrate simple data structures like arrays in a Java program
Paper-III	CO1:	Understand the ASP.Net framework and Page structure
ASP.NET	CO2:	Design web application with variety of controls
	CO3:	Access the data using inbuilt data access tools
	CO4:	Students will be able to create database driven ASP.NET web applications and web services
Paper-IV	CO1:	Understand the fundamental concept in software testing
SOFTWARE TESTING	CO2:	Distinguish characteristics of structural testing methods
	CO3:	Discuss about the functional and system testing methods

	CO4:	Understand different types of testing levels
Paper-V	CO1:	Learn how to use HTML forms
PHP – II	CO2:	Learn how to use PHP's built in server to serve static resources
	CO3:	Learn How to use cookies to store some data in the browser and pass it to next request
	CO4:	learn how to upload files to the website

Paper-VI DATA COMMUNICATION ANDNETWORK–II	CO1:	Understand network communication using layered concept, OSI and Internet model.
	CO2:	Understand various types of transmission media, network devices
	CO3:	Learn about different Protocols operations
	CO4:	Identify and describe development history of routing protocols

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DEPARTMENT OF COMPUTER SCIENCE

PG COURSE

MASTER IN COMPUTER APPLICATIONS (MCA)

(2 Years)(CBCS)

Program Specific Outcomes: MCA

https://www.nagpuruniversity.ac.in/links/Syllabus/Faculty_of_Science/Notification_Direction_Syllabus_and_Program_Outcome_of_MCA_28122020.pdf

Department of Computer Science

After successful completion of two years MCA PG degree program, the students are able to:

Targeted Graduate Attributes: Disciplinary Knowledge, Critical Thinking, Problem Solving, Analytical Reasoning, Communication Skills, Teamwork, Moral and Ethical Awareness

Program Specific Outcomes

PSOl: Computational Knowledge: The students will be able to apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualisation of computing models from defined problems and requirements

PSO2: Problem Analysis: The students will be able to think critically for Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines

PSO3: Design /Development of Solutions: The students will be able to design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PSO4: Conduct Investigations of Complex Computing Problems: The students will be able to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions, maintenance and its implementation

PSO5: Modern Tool Usage: The students will be able to create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PSO6: Professional Ethics: The students will be able to understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

PSO7: Project management and finance: The students will be able to demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Course Outcomes: Master in Computer Applications

MCA Semester-I

Course Name: Advanced Java Programming	CO1: Facilitates in understanding the concepts of object oriented programming. Skill Enhancing through concepts like multithreading, abstraction , platform independence
	CO2: Effective to implement platform independence, Applet programming
	CO3: JDBC Architecture and RMI programming
	CO4: Design Programs for JAVA Beans and Servlets
Course Name: Data Communication and Network	CO1: To understand and master the fundamentals of data communications through the knowledge of data transmission concepts, media used for data communication
	CO2: To know the different layer of OSI reference model
	CO3: To know the different network security algorithms
	CO4: To know the intrusion detection techniques and Authentication
Course Name: Open source Web Programming using PHP	CO1: To become familiar with client server architecture and able to develop a web application using various technologies.
	CO2: To understand and develop a web-based application using a framework concept
	CO3: To gain the skills and project-based experience needed for entry into web application and development careers
	CO4: Web page development using PHP

Course Name: Advanced DBMS and Administration	CO1:	Can explore efficient method for handling multiple types of data
	CO2:	Have a detailed view of handling paralleland distributed database
	CO3:	Ability to normalize the database & understand the internal data structure
	CO4:	Deep visualization of realistic data into physical structure
Course Name: Software Engineering	CO1:	To Get detailed knowledge of role of software in daily basis
	CO2:	Student will be identifying different models and find out the best
	CO3:	Test the developed software for high performance and maintainability
	CO4:	Study the software measure parameters for software quality
Course Name:1P1 Practical-1	CO1:	Design and program stand-alone Java Applications
	CO2:	Useful in designing web and desktop applications
	CO3:	Analyse And Setup Protocol Designing Issues For Communication Networks
	CO4:	Web development using PHP
Course Name:1P2 Practical-2	CO1:	Facilitates in creation of Data Structures and effective management of Database
	CO2:	Ability to normalize the database & understand the internal data structure
	CO3:	To implement Software prototyping for better software development
	CO4:	To acquire skills to think about problems and solution using appropriate method

Course Outcomes: Master in Computer Applications

MCA Semester-II

Course Name: C# and ASP .NET	CO1:	To study simple C# program structure
	CO2:	To write C# program for classes, arrays, struct, array of objects
	CO3:	To understand ASP.NET structure
	CO4:	Error handling, Component based programming
Course Name: Cloud Computing	CO1:	To become familiar with Cloud Computing and its ecosystem and learn basics of virtualization and its importance.
	CO2:	To evaluate in-depth analysis of Cloud Computing capabilitiesand give technical overview of Cloud Programming and Services.

	CO3:	To understand security issues in cloud computing and exposed to Ubiquitous Cloud and Internet of Things
	CO4:	To understand emerging trends in cloud computing.
Course Name: Computer Graphics	CO1:	Provides user interfaces, data visualization, television commercials, motion pictures
	CO2:	Hardware devices and algorithms which are necessary for improving the effectiveness, realism, and speed of picture generation
	CO3:	Three dimensional graphic algorithm are incorporated in various streams to better simulate complex interactions
	CO4:	3-d transformations, b-spline surfaces, curves, and hidden surfaces can be explored
Course Name: CE1-1 (Elective) Computer Architecture and Organization	CO1:	To explore the fundamentals of Computer Architecture and Organization
	CO2:	To understand the design of control unit
	CO3:	To study the concepts of memory organization and to understand various memory technologies
	CO4:	To understand the concepts of input output processing to interface various I/O devices
Course Name: CE1-2 (Elective) Operation Research	CO1:	Understand LPP
	CO2:	Understand Transportation problem, assignment problem
	CO3:	Study of decision theory, CPM/PERT
	CO4:	Study of queuing Theory
Course Name: CE1-3 (Elective) Cyber Forensics	CO1:	Understand the different types of vulnerability scanning
	CO2:	To know the different network defense tools and web application tools
	CO3:	To understand the different types of cyber crimes and laws
	CO4:	To understand the different tools for cybercrime investigation
Course Name: Android Programming	CO1	Able to develop apps based on different types of menus
	CO2	Make decision to solve a problem using package, library and threads Handling Errors and Exceptions
	CO3	Ability to design and develop database applications
	CO4	Able to design and develop mobile applications works with internet applications

Course Name: 2P1 Practical-1	CO1: To write C# program for classes, arrays, struct, array of objects
	CO2: To write ASP.NET Programs and Component based programming
	CO3: Study the common elements in user interfaces, data visualization, television commercials, motion pictures, and many other applications
	CO4: Explore the algorithms necessary for basic transformation with respect to computer graphics
Course Name: 2P2 Practical-2	CO1: Would gain the knowledge about inside of computer
	CO2: Transportation problem, LPP problem, Inventory problem
	CO3: To develop apps based on different types of menus
	CO4: Design and develop mobile applications works with internet applications
Course Name: Project	CO1: Select the topic for software development
	CO2: Analysis and design of proposed system
	CO3: Apply the known language for project programs
	CO4: Combine the small program to make the integrated software

Course Outcomes: Master in Computer Applications

MCA Semester-III

Course Name: Big Data Analytics	CO1: To know the structuring the big data, technology for handling the big data, Hadoop, MapReduce.
	CO2: To understand the big data technology foundation, Storing data in databases and data warehouses.
	CO3: To get a basic understanding of R and the various ways to create scripts and programs in R and understand some of the key constructs in R for data handling.
	CO4: To understand and appreciate how to summarize large volumes of data effectively by appropriate use of charts of different types.
Course Name: Data Mining	CO1: To introduce the students, the basic concepts and techniques of Data mining and Warehousing and data pre-processing.
	CO2: Understand association mining algorithms for discovery of frequent item patterns in large data sets and their Visualizations
	CO3: Understand classification analysis algorithms for discovery and generation of rules in large data sets and their Visualizations

	CO4:	Understand basic and advanced clustering analysis algorithms and Visualizations in Data Mining.
Course Name: Python Programming	CO1:	Understand the data types and structures in python
	CO2:	Ability to understand object oriented programing concepts and write programs in python. Handling Errors and Exceptions
	CO3:	Ability to design and develop database applications
	CO4:	Web development using Python
Course Name: CE2-1 (Elective) Artificial Intelligence	CO1:	Understand the various underlying concepts in Artificial Intelligence. Acquire the knowledge of search techniques used in Artificial Intelligence
	CO2:	Acquire the concepts of knowledge representation
	CO3:	Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.
	CO4:	To understand NLP and Distributed reasoning system

Course Name: CE2-2 (Elective) Mobile Computing	CO1: Helps to understand the fundamental requirements for initiating an online business CO2: Helps in process of initiating and funding a start-up, e-Business or large projects CO3: Necessary to describe the issue and methods of transforming an organization into an e-business CO4: Provides deeper knowledge of mobile handheld devices, wireless mediums, palm OS, MANNET
Course Name: CE2-3 (Elective) Machine Learning	CO1: To understand the different machine learning methods CO2: To understand the Multilayer Perceptron, Back Propogation algorithm, Support Vector Machine CO3: To understand the machine learning with trees, different classifier CO4: To understand the concept of dimensionality reduction, Graphical Methods
Course Name: Soft Computing	CO1: To know the soft computing methodology, heuristic search techniques CO2: To understand the Neural Network structure, different types of leaning methods CO3: To understand the different methods of unsupervised learning CO4: To understand the concept of Fuzzification and defuzzification
Course Name: 3P1 Practical-1	CO1: Programs in R for data analysis and visualization CO2: Programming on classification, association and clustering algorithm CO3: Programming in python to design and develop database applications CO4: Programming in python for Web development
Course Name: 3P2 Practical-2	CO1: Programming for AI search techniques CO2: Programs on Mobile Computing CO3: Programs on Neural Network CO4: Programs on Fuzzification and defuzzification
Course Outcomes: Master in Computer Applications	
MCA Semester-IV	
Course Name: Project Work	CO1: To use the working knowledge in industry. CO2: To develop software in industry for various clients CO3: To gain awareness about ethical aspects and development work. CO4: Ability to plan and use adequate methods for software development

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PG COURSES

MASTER OF SCIENCE (M.Sc.) (CBCS)

- M.Sc. Chemistry
- M.Sc. Computer Science
- M.Sc. Mathematics
- M.Sc. Microbiology
- M.Sc. Physics

Program Outcomes: Master of Science (Chemistry) (CBCS)

Program Specific Outcomes

PSO1: Chemistry Knowledge: Possess knowledge and comprehension of the core and basic knowledge associated with the profession of chemistry, including specialized areas of inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry, and elective subjects of nuclear chemistry, medicinal chemistry, polymer chemistry and environmental chemistry.

PSO2: Problem analysis and Modern tool usage: Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions. Find, analyze, evaluate and apply information system atically and to make defosbledec is ion s. Learn, select, and apply appropriate methods and procedures resources, and modern chemistry-related to computing tools with an understanding of the limitations.

PSO3: Environment and sustainability: Understand the impact of the professional chemistry solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PSO4: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self- access and use feedback effectively from others to identify learn in needs and to satisfy these needs on an ongoing basis

PSO5: Leadership skills: Understand and consider the human reaction to change, motivation issues, leadership and teambuilding when planning changes required for fulfillment of practice, professional

and societal responsibilities. Assume participatory role as responsible citizens or leadership role appropriate to facilitate improvement in heath and well beings.

PSO6: Professional Identity: Understand, analyze and communicate the value of the in professional roles in society (e.g. environmental professionals, analytical professionals, educators, researchers, employers, employees).

PSO7: Communication: Communicate effectively with the society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

Course Outcomes: Master of Science (Chemistry) (CBCS)

M.Sc. Semester-I

Course name: Inorganic Chemistry (CH-1T1)	CO1:	Be able to predict the geometry of individual molecules or complexes
	CO2:	Be able to understand the complex formation equilibria in solution and to know unusual methods to the study of reaction rates.
	CO3:	Be informed with boron hydrides, or polyboranes which are the original cluster compounds as well as the first known family of electron-deficient compounds.
	CO4:	Be able to study of clustering of metal atoms.
Course name: Organic Chemistry (CII-lT2)	CO1:	Be able to understand the applicability of concepts like delocalized bonding, conjugation, cross conjugation, resonance, in various carbon containing COM and develop the understanding of the reactive intermediates.
	CO2:	Be able to study optical activity in compounds without chirality and analyse stereo-chemical aspects involved in various compounds and the corresponding chemical reactions.
	CO3:	Be able to reactions and understand mechanisms of various substitution nucleo-phillic reaction and get basic knowledge about the anchimcric assistance and isotope effects
	CO4:	Be able to understand mechanisms of various Aromatic nucleophillic and electro-phillic substitution reactions and get acquainted with associated outcomes like resonance, field, steric effects & its quantitative treatment.
Course name: Physical Chemistry (CH-lT3)	CO1:	Get acquainted with various laws of thermionics and its applications.
	CO2:	Be able to understand partial molar quantities, its determination and reduced phase rule in various comenttems

	CO3:	Be able to recapitulation of terms of surface tension and different adsorption isotherms and be able to validate the newly developed analytical method as rvcll as rted methods
	CO4:	Able to propose some new methods or modify existing methods of qualitative and quantitative analysis.
Course name: Analytical Chemistry (CH-lT4)	CO1:	Get acquainted with various terminology and fundamentals of analytical chcrris including classical and instrumental methods.
	CO2:	Recaitulate the tion techniues like chromatoh
	CO3:	Be able to explain analytical techniques in terms of the working principles of volumetry, and gravimetry
	CO4:	Able to propose some new methods or modify existing methods of qualitative and quantitative analysis.
Course name: Practical Inorganic Chemistry (CH-1P1)	CO:	Be able to understand the basic principles involved in separation and estimation of acidic and basic radicals and be able to apply the knowledge in real sample analysis for quantitative estimation as well as qualitative detection and also be able to assign a numerical value to variables by the quantitative analvsts is to reflect reality mathematically.
Course name: Practical Physical Chemistry (CH-1P2)	CO:	Be able to understand the principles of physical chemistry and interpret them through small experimental performances.
Course name: Seminar (1Sl)	CO:	On completion of seminar, the student will be in a position to present the topic in front of subject audience that will enhance confidence level and lead to personality development.

Course Outcomes: Master of Science (Chemistry) (CBCS)

M.Sc. Semester-II

Course name: Inorganic Chemistry (CH-2T1)	CO1:	Will be able to understand the origin of colors in the complexes and their magnetic behavior.
	CO2:	Develop ability to understand various reactions of transition metal complexes.
	CO3:	Will know the concept of bonding in various metal carbonyls.
	CO4:	Will be able know chemistry behind the metal nitrosyl.
Course name: Organic Chemistry (CH-2T2)	CO1:	Be able to acquire the knowledge and understand applicability of carbon carbon multiple bond and carbon hetero atom multiple bond, addition reaction and develop understanding of reaction mechanism in metal hydride reaction.
	CO2:	Be able to analyze various mechanism of molecular rearrangement and concept of elimination reaction.

	CO3:	Be able to understand free radical reaction.
	CO4:	Be able to comprehend various aspects of green chemistry.
Course name: Physical Chemistry (CH-2T3)	CO1:	Be able to understand the Eigen value and Eigen function and application of Schrodinger wave function to various systems.
	CO2:	Be able to determine the activity coefficients and ionic strength.
	CO3:	Able to identify symmetry in crystals.
	CO4:	Get the knowledge about various statistics and understand and working of different counters.
Course name: Analytical Chemistry (CH-2T4)	CO1:	Be able to understand the working, principle and techniques involved in methods of analysis
	CO2:	Be able to explain the advantages of modern methods over the classical ones.
	CO3:	Apply the principles of spectroscopic techniques in the quantitative and qualitative analysis of various samples.
	CO4:	Be able to develop their own methods of quantitative analysis of metalions using instrumental methods.
Course name: Practical Organic Chemistry (CH-2P1)	CO:	Be able to perform the quantitative analysis of organic binary mixture and able to get hands on training for the synthesis of commercially important organic compounds (single and two stage organic reaction).
Course name: Practical Analytical Chemistry (CH-2P2)	CO:	Get expertise in titrimetric analysis based on neutralization, precipitation, redox, and complexometric analysis, gravimetric estimation of barium and calcium, separation technique of paper chromatography and electro analytical techniques as potentiometry, conductometry and optical method like colorimetery.
Course name: Seminar (CH-2S1)	CO:	On completion of seminar, the student will have an improved knowledge about the subject and will be in a position to present the topic more confidently.

Course Outcomes: Master of Science (Chemistry) (CBCS)

M.Sc. Semester-III

Course name: Organic Chemistry Special Paper I (CH-3T1)	CO1:	Be able to explain what happen when organic molecule are excited by irradiation and be capable to discuss the photochemistry in nature and in various photochemical reaction.
	CO2:	Pericyclic reaction is used in very vast way in nature and also by organic chemist. This course gives the students the theoretical basis of this kind of reaction and also helps them to find a way to carry out these types of reaction
	CO3:	Get well versed with the various oxidation and reducing agents and the stereo chemical aspects involved in various chemical reactions.

	CO4:	Acquire knowledge about the chemistry of compounds of phosphorus and sulfur and their application of organo boranes and organo silicon compounds in organic synthesis.
Course name: Organic Chemistry Special Paper II (CH-3T2)	CO1:	Be able to acquire knowledge about terpenoids and porphyrines, the stereochemistry involved along with the structure determination and synthesis of some representative molecules.
	CO2:	Be able to build learning about alkanoids, the stereochemistry involved along with structure determination and acquire brief idea aboutprostaglands.
	CO3:	Be able to develop understanding of steroid chemistry and plant pigments.
	CO4:	Be able to quantify the contribution of carbohydrates in nature and get as well versed with properties of amino acids, and structural features of polypeptides.
Course name: Medicinal Chemistry Elective Paper (CH-3T3)	CO1:	Became acquainted with various terminology and fundamentals of drug designing including classical method for QSAR
	CO2:	Be able to study pharmacokinetics and pharmacodynamic aspects of drug metabolism and would be able to acquire knowledge and applicability of diuretic and the analgesic and antipyretic drugs.
	CO3:	Be able to get well versed either cardiovascular and antineoplastic agents and their applicability.
	CO4:	Able to develop comprehensive knowledge about various psycho activedrugs and anticoagulants.
Course name: Spectroscopy-I (core subject centric) Paper (CH-3T4)	CO1:	Be able to understand symmetry elements and operations to organic and inorganic molecules
	CO2:	Learn the mass spectroscopy technique and will be able to identify the molecule on the basis of the fragmentation pattern in the mass spectrum and learn application of readio active molecules in Mossbauer Spectroscopy
	CO3:	Be able to understand energy changes at very lower level and capable of predicting the satellite pattern of geographical areas. ESR techniques used to determine the presence of unpaired electron especially in complexes
	CO4:	Elucidate the structure determination of organic molecules b IR spectroscopy, problem based on IR spectra
Course name: Practical Organic Chemistry Special I (CH-3P1)	CO:	Be able to isolate natural product using fractional distillation, column chromatography and extraction method, get hands on the technique involved for the qualitative analysis of a mixture of three organic compounds and able to understand application of volumetry analysis in the estimation of organic analyze from given solutions

Course name: Practical Medicinal Chemistry Elective(CH-3P2)	CO:	Be able to estimate the active ingredients of various pharmaceutical; compounds and get acquainted with the strategies involved the preparation of many organic and drug moieties.
Course name: Seminar (CH-3S1)	CO:	On completion of seminar, the student will be able to consolidate idea about the subject and thereby develop knowledge about the subject hich will boost their confidence.

Course Outcomes: Master of Science (Chemistry) (CBCS)

M.Sc. Semester-IV

Course name: Organic Chemistry Special Paper I (CH-4T1)	CO1:	Be able to quantify the applicability of carbanion intermediate in organic synthesis.
	CO2:	Be able to understand organic synthesis using transition metals and organo metallic reagents.
	CO3:	Be able to be well familiar with the advance terminologies rules and concepts involved in stereochemistry and will have a deeper knowledge about the applicability of stereo chemical and the protection deprotection concepts.
	CO4:	The student will able to apply logic behind organic synthesis using retro synthesis approach
Course name: Organic Chemistry Special Paper II (CH-4T2)	CO1:	Get acquainted with basic terminology involved in enzyme chemistry hich is important to understand several life processes
	CO2:	Come to know importance of heterocyclic compounds as a part of many natural product as well as pharmaceutical drugs
	CO3:	Be able to analyze structure of nucleic acid, lipids, peptides and vitamins which are important building blocks in living system
	CO4:	Be able to have brief idea about the terminologies and concepts involved in drugs, dyes and polymer chemistry
Course name: Medicinal Chemistry Elective Paper (CH-4T3)	CO1:	Get acquainted with various terminology and fundamentals of drug rules and drug acts
	CO2:	Be able to study and analyze assorted chromatographic separation technique for drugs: TLC
	CO3:	Be able to know the concept of analytical and statistical sampling
	CO4:	Able to the chemistry of anti viral, anti-malarial, histamines and anti-histamic, antibiotics, anti-helmenthis, anti-amoebic and anti- inflammatory drugs
Course name: Spectroscopy II (core	CO 1:	Be able to understand the theoretical aspects of UV, NMR and electron spectroscopy

subject centric) Paper (CH-4T4)	CO 2:	Be able to identify various molecular excitations and calculation of wavelengths of absorption
	CO 3:	Be able to elucidate the structure of molecule based on NMR spectra and be in a position to carry out the spectral analysis for structure determination.
	CO 4:	Comprehend the XRD data for crystal structure determination
Course name: Practical Organic Chemistry Special (CH-4P1)	CO:	Be able to carry out elemental analysis of organic compounds, get experience in the estimation of biomolecules and some organic drug molecules. The students will get hands on training of multi-step preparation of small organic molecules and will develop ability to identify various known organic molecules using NMR, IR, Mass and U. V. spectra.
Course name: Project (CH-4P2)	CO:	Learn how to carry out literature survey in a specific area of research, work on a small idea to develop their own observations, analyze the results obtained from the experiments carried out, validate the methods developed by him/her and develop an overall research attitude so that he can become a good researcher in future
Course name: Seminar (CH-4S1)	CO:	After successful completion these four seminars assigned to them, they will be in a position to explain the concepts they learned from the dais in front of any number of audiences. This will lead to overall personality development of the student for entering into teaching profession.

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Program Outcomes: Master of Science (Computer Science) (CBCS)

https://www.nagpuruniversity.ac.in/pdf/Naac_Reports/programs_outcomes/MSc_Computer_Science_compressed_150620.pdf

M.Sc. Semester-I

Targeted Graduate Attributes: Disciplinary Knowledge, Critical Thinking, Problem Solving, Analytical Reasoning, Communication Skills, Teamwork, Moral and Ethical Awareness

	Program Outcomes
PSO1	The students will be able to develop aptitude to manifest a wide and extensive knowledge in the field of computer science.
PSO2	Ability to think critically for solving various problems and recent trends in computer softwares.
PSO3	The students will be capable of working effectively in diverse conditions as a team.
PSO4	The students will be able to develop skills in software design and its implementation.
PSO5	The students will be able to apply knowledge of computer science in academic and corporate sectors.
PSO6	The students will be able to develop self sustainability as well as competitiveness and employability.
PSO7	The students will be able to plan and write a research paper or proposal and assignment in computer science.

Course Outcomes: Master of Science (Computer Science) (CBCS)

Program Matrix

Name of Program: M.Sc. (Computer Science)

(Low Correlation = L/1 ; Moderate Correlation = M/2 ; High Correlation = H/3)

Course Outcomes (COs)		Program Outcomes (POs)						
		Domain Specific (PSO)				Domain Independent (PO)		
	Course Name: M.Sc.(Computer Science) - Semester I	1	2	3	4	5	6	7
	DISCRETE MATHEMATICAL STRUCTURE							
CO1	To able to specify and manipulate basic mathematical object	M	M	L	M	M	M	H
CO2	Very important to develop logic for the problem solving in the field of computer science.	H	H	M	H	M	M	H
CO3	Understand the basics of probability and number theory which is very important in problem solving.	M	H	M	H	M	M	H
CO4	Use effectively algebraic techniques to analyse basic discrete structures and algorithms	M	M	L	H	H	M	H
	PROGRAMMING IN JAVA							
CO1	Facilitates in understanding the concepts of object oriented programming	M	H	M	M	M	M	H
CO2	Effective to implement platform independence	H	H	H	H	H	H	H
CO3	Design Programs for RMI and JAVA Beans and Swings	H	M	M	M	H	H	H
CO4	Skill Enhancing through concepts like multithreading, abstraction , platform independence	H	H	H	H	H	H	H
	DIGITAL ELECTRONICS AND MICROPROCESSOR							
CO1	Learning to design various applications based on digital electronics	M	M	H	M	H	M	H
CO2	Developing assembly language programming skills	M	H	H	H	H	H	H
CO3	Learning to design various applications based on digital electronics	M	H	H	H	H	H	H

CO4	Developing assembly language programming skills	M	M	M	H	H	H	H
	ADVANCED DBMS & ADMINISTRATION							
CO1	Can explore efficient method for handling multiple types of data	M	M	H	H	H	H	M
CO2	Have a detailed view of handling parallel and distributed database	M	M	M	H	H	H	H
CO3	Ability to normalize the database & understand the internal data structure	M	H	H	M	H	H	H
CO4	Deep visualization of realistic data into physical structure	M	H	H	H	H	H	H
	PRACTICAL I							
CO1	Solve problems in theoretical computer science as it relies heavily on graphs and logic	M	H	H	H	M	M	H
C02	The students can imbibe the idea of proving programs correct through the use of discrete mathematic structure	M	H	M	M	M	M	H
C03	Useful in designing web and desktop applications	H	H	H	H	M	M	H
CO4	Design and program stand-alone Java Applications	H	H	M	H	M	M	H
	PRACTICAL II							
CO1	Learning to design various applications based on digital electronics	M	H	H	M	H	H	H
CO2	Developing assembly language programming skills	H	H	H	H	H	H	H
CO3	Facilitates in creation of Data Structures and effective management of Database	H	H	H	H	H	H	H
CO4	Ability to normalize the database & understand the internal data structure	H	H	H	H	H	M	H
	Course Name: M.Sc.(Computer Science) - Semester II							
	WINDOWS PROGRAMMING USING VC++							
CO1	Provides many tools for coding and debugging visual codes	M	H	H	M	M	M	H
CO2	Facilitates as a lightweight tool to edit your C++ files	H	M	H	M	M	M	H
CO3	Provides add-on features such as smart pointers, New Container, Polymorphism, Exception Handling etc	H	H	M	M	M	M	H
CO4	Encapsulates multiple applications and hence can make use of the package with installing it once	H	H	H	M	M	M	H
	THEORY OF COMPUTATION AND COMPILER CONSTRUCTION							

CO1	Analyze the behaviour of machines and how they solve a problem	M	H	H	H	M	H	H
CO2	Problems solving in many fields beside computer science such as physics, economy, biology etc	M	H	H	H	M	H	H
CO3	Would know program execution using lexical and syntactical analysis	M	H	H	H	H	H	H
CO4	Can correlate the working of compiler in program execution	M	H	H	H	H	H	H
	COMPUTER ARCHITECTURE AND ORGANIZATION							
CO1	To explore the fundamentals of Computer Architecture and Organization	H	H	M	H	H	H	H
CO2	To understand the design of control unit	M	H	M	H	H	M	H
CO3	To study the concepts of memory organization and to understand various memory technologies	H	M	M	H	H	M	H
CO4	To understand the concepts of input output processing to interface various I/O devices	H	M	M	H	H	H	H
	COMPUTER GRAPHICS							
CO1	Provides user interfaces, data visualization, television commercials, motion pictures	H	M	H	H	H	H	H
CO2	Hardware devices and algorithms which are necessary for improving the effectiveness, realism, and speed of picture generation	H	M	H	H	H	H	H
CO3	Three dimensional graphic algorithm are incorporated in various streams to better simulate complex interactions	H	H	H	H	M	H	H
CO4	3-d transformations, b-spline surfaces, curves, and hidden surfaces can be explored	H	H	H	H	H	M	H
	Practical I							
CO1	Helps to understand the nature of efficient computation	H	H	H	H	M	H	H
CO2	Facilitates in efficient problem solving	H	H	H	H	M	H	H
CO3	To understand the nature of efficient computation	H	M	M	H	H	M	H
CO4	Apply and redistribute runtime packages mostly installed for standard libraries that many applications use	M	M	M	H	H	H	M
	Practical II							
CO1	Would gain the knowledge about inside of computer	H	M	M	M	M	H	H
CO2	Develop the design concepts of latest processors	M	M	M	M	M	M	M

CO3	Study the common elements in user interfaces, data visualization, television commercials, motion pictures, and many other applications	H	H	H	H	H	H	H
CO4	Explore the algorithms necessary for basic transformation with respect to computer graphics	H	M	M	M	M	H	H
	COURSE NAME: M.SC.(COMPUTER SCIENCE) - SEMESTER III							
	DATA COMMUNICATION AND NETWORK							
CO1	To understand and master the fundamentals of data communications through the knowledge of data transmission concepts, media used for data communication	H	M	M	M	H	H	H
CO2	To compress the data, different compression algorithms used to optimize data transfer even if the network is congested	H	M	M	H	H	H	H
CO3	Various network routing algorithms, data link layer protocols are necessary to be understood while working on networking concepts	H	H	H	H	H	H	H
CO4	Exploring frequency and time division multiplexing techniques to share network bandwidth among multiple users are very necessary to be learnt	M	M	H	H	H	H	H
	SOFTWARE ENGINEERING							
CO1	To Get detailed knowledge of role of software in daily basis	H	H	H	H	H	H	H
CO2	Student will be identifying different models and find out the best	H	H	H	H	H	H	H
CO3	Test the developed software for high performance and maintainability	M	H	H	H	H	H	H
CO4	Study the software measure parameters for software quality	M	H	H	H	H	H	H
	CE1-1(ELECTIVE 1) NEURAL NETWORK							
CO1	Provides an understanding of underlying geometry of foundation Neural Network models	H	H	H	H	H	H	H
CO2	Helps in Neural Network algorithm along with an approach to neuro-science findings	H	H	H	H	H	H	H
CO3	Necessary for the research community around the world to realize the biological fidelity	H	H	H	H	H	H	H
CO4	Develop powerful computational models that has applications to vast number of disciplines	H	M	L	H	H	H	H
	CE1-2(ELECTIVE -2)MOBILE COMPUTING							
CO1	Helps to understand the fundamental requirements for initiating an online business	M	M	M	M	M	H	H

CO2	Helps in process of initiating and funding a start-up, e-Business or large e-projects	H	H	H	M	H	H	H
CO3	Necessary to describe the issue and methods of transforming an organization into an e-business	H	H	H	H	H	H	H
CO4	Provides deeper knowledge of mobile handheld devices, wireless mediums, palm OS, MANNET	H	M	M	H	H	H	H
	CE1-3 MULTIMEDIA TECHNOLOGIES							
CO1	Define multimedia to potential clients	M	M	M	M	M	H	H
CO2	Identify the basic components of a multimedia project	M	H	H	H	H	H	H
CO3	Identify the basic hardware and software requirements for multimedia development and playback	H	H	M	H	H	H	H
CO4	Identify and describe the function of the general skill sets in the multimedia industry	M	M	M	M	M	M	H
	CE1-4 ASP.NET							
CO1	Helps to create web form with server control	H	M	M	M	M	M	H
CO2	Separate page code from content by using code-behind pages, page controls, and Components	M	H	H	H	H	H	H
CO3	Display dynamic data from a data source by using Microsoft ADO.NET	M	M	M	M	M	H	H
CO4	Debug ASP.NET Pages by using trace	M	M	H	H	H	H	H
	CE1-5 DIGITAL AND CYBER FORENSICS							
CO1	Cite and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy	M	M	H	M	H	H	H
CO2	Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy	M	M	H	M	H	H	H
CO3	Work collaboratively with law enforcement to advance digital investigations or protect the security of digital resources	M	M	H	M	H	H	H
CO4	Access and critically evaluate relevant technical and legal information and emerging industry trends	H	M	H	M	H	H	H
	PRACTICAL V							
CO1	Analyse And Setup Protocol Designing Issues For Communication Networks	H	M	M	H	H	H	H

CO2	Estimate The congestion Control Mechanism to improve Quality Of Service of Networks	M	M	H	H	H	H	H
CO3	To implement Software prototyping for better software development	H	M	M	H	H	H	H
CO4	To acquire skills to think about problems and solution using appropriate method	H	H	H	H	H	H	H
	Practical VI							
CO1	To design neuro-biologically oriented models	H	M	M	H	H	H	H
CO2	To implement deep learning for solving real world problems	M	M	H	H	H	H	H
CO3	To train through hands-on on m-computing for ease of use	H	M	M	H	H	H	H
CO4	To secure digital documents through data hiding, water marks etc	H	H	H	H	H	H	H
	Course Name: M.Sc.(Computer Science) - Semester IV							
	DATA MINING							
CO1	Necessary to deal with explosive growth of the stored and transient data	H	M	H	M	H	H	H
CO2	Introduces new techniques and automated tools useful in transforming data into knowledge	H	M	H	H	H	H	H
CO3	Provides basic Techniques for OLAP & Data generalization	H	M	H	H	H	H	H
CO4	Helps to identify different cluster analysis techniques and advanced data mining techniques	H	M	H	H	H	H	H
	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM							
CO1	Explore AI problem solving techniques	H	M	H	M	H	H	H
CO2	Explore techniques knowledge representation in Machine	H	M	H	H	H	H	H
CO3	Helps in a deeper knowledge towards natural language processing, robotics	H	M	H	H	H	H	H
CO4	Necessary in decision making, problem solving, perception and understanding human communication	H	M	H	H	H	H	H
	CE2-1 DESIGN & ANALYSIS OF ALGORITHM							
CO1	Ability to analyze performance of algorithms	M	H	H	M	H	H	H
CO2	Choose appropriate algorithm for problem solving	M	H	H	M	H	H	H
CO3	Analyze worst-case running times of algorithms using asymptotic analysis	M	H	H	M	H	H	H
CO4	Analyze greedy algorithm and its applications, divide and conquer strategy	M	H	H	M	H	H	H
	CE2-2 EMBEDDED SYSTEM							
CO1	Helps to addresses the issue of the response time constrain of various tasks	M	H	H	H	H	H	H

CO2	Necessary for designing high performance response time constrained sophisticated systems	H	H	H	H	H	H	H
CO3	Helps to develop the systems that make optimum use of the available system resources: processor, memory	H	H	H	H	H	H	H
CO4	Employ the key concepts of embedded systems like sensors and actuators	M	H	H	H	H	H	H
	CE2-3 PATTERN RECOGNITION							
CO1	Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature	H	M	H	M	H	H	H
CO2	Apply pattern recognition techniques to real-world problems such as document analysis and recognition	H	M	H	H	H	H	H
CO3	Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers	H	M	M	M	H	H	H
CO4	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing	M	L	M	M	M	M	H
	CE2-4 PARALLEL COMPUTING							
CO1	Introduces to various models of parallelism such as shared and distributed memory	H	H	H	M	M	H	H
CO2	Develop parallel computing solutions with respect to different mapping techniques	M	M	H	M	H	H	H
CO3	Helps in developing and implementing various routing mechanism necessary for parallel computing	M	M	H	M	H	H	H
CO4	Contribute as driving force in development of faster computers	H	M	H	M	H	H	H
	CE2-5 MOBILE & CYBER FORENSICS							
CO1	Introduces to Computer Forensics Fundamentals	H	H	H	H	H	H	H
CO2	Helps to analyze and explore different forensic technologies	H	M	H	H	M	H	H
CO3	Helps to identify methods of digital evidence preservation	H	M	H	H	M	H	H
CO4	Helps in exploring data recovery in mobile forensics	H	M	H	H	M	H	H
	PRACTICAL VII							
CO1	To implement standard data mining techniques and methods such as association rules, clustering techniques	H	H	H	H	H	H	H
CO2	To apply data mining techniques on datasets for realistic sizes using	H	H	H	H	H	M	h

	modern data analysis frameworks							
CO3	Implement microcontroller interfacing	H	H	M	M	M	H	H
CO4	To implement real time operating system using embedded	H	M	M	M	M	H	H
	PROJECT							
CO1	To display the working knowledge and skills to the industry	H	H	H	H	H	H	H
CO2	Deeper knowledge of methods in major field of study	H	H	H	H	H	H	H
CO3	To gain a consciousness of ethical aspects of research and development work	H	H	H	H	H	H	H
CO4	Capability to plan and use adequate methods to conduct qualified tasks in given frameworks and evaluate the work	H	H	H	H	H	H	H

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Program Outcomes: Master of Science (Mathematics) (CBCS)

https://www.nagpuruniversity.ac.in/pdf/Naac_Reports/programs_outcomes/MATHEMATICS_compressed_150620.pdf

On successful completion of the M.Sc. MATHEMATICS programme a student will be able to

PSO1	Disciplinary Knowledge	Undestand the basic and advanced knowledge in the field of Mathematics
PSO2	Communication Skills	Effectively communicate and explore ideas of mathematics for propagation of knowledge and popularization of mathematics in society
PSO3	Critical Thinking	Identify, analyse, formulate various problems with scientific approach
PSO4	Problem Solving	Identify and apply the most effective method to solve and evaluate the appropriate solution within a stipulated time
PSO5	Professional Skills	Explain/ demonstrate accurate and efficient use of advanced Mathematical techniques
PSO6	Team Work	Participate constructively in classroom discussion
PSO7	Digitally literacy	Have sound knowledge of mathematical modeling, programming and computational techniques as required for research or employment in industry
PSO8	Ethical and Social awareness	Capable of demonstrating the ethical issues related with the Intellectual Property Rights, copyright etc. and demonstrate highest standards of ethical issues in mathematics
PSO9	Lifelong learning	Continue to acquire mathematical knowledge and skills appropriate to professional activities
PSO10	Research related skills	Pursue research in challenging areas of pure/applied Mathematics.
PSO11	Self-Directed Learning	Work independently to explore new ideas and solutions to mathematical problems
PSO12	Analytical Reasoning	Think logically and analytically over the information to evaluate solution for the mathematical theorems or problems
PSO13	Leadership Quality	Listen and understand the ideas and suggestions of others to imrove quality of learning
PSO14	Scientific Reasoning	Solve mathematical problems systimatically with scientific approach
PSO15	Reflective Thinking	Identify the importance of information provided in theorems, axioms and problems for further justification and application

Program Matrix

Name of Program : M.Sc. Mathematics

(Low Correlation = L/1 ; Moderate Correlation = M/2 ; High Correlation = H/3)

Course Outcomes (Cos)		Program Specific Outcomes(PSO)														
	Course Name: Algebra-I	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	students apply the knowledge of different types of Groups to prove the therom and solve examples.	H	M	M	M					M		L	M			
CO2	students recognize various types of Groups. students solve some examples of different types of Groups	H	M	H	L		L			M			M			
CO3	students apply the knowledge to prove the theorm and solve some examples.	H	M	H	L	L				M		L	M		H	M
CO4	Students interprete Ideals in ring and modules to prove various theorems .	H	L	M	L					M		L	M		H	M
	Course Name: Real Analysis-I															
CO5	Students apply the concept of Uniform convergence to Stone-Weierstrass theorem	H	L	L	L					M		L	M			
CO6	Students apply the knowledge of convergence and continuity of a function to prove some theorems in real analysis	H	M	L	L					M		L	M			
CO7	Students observe the various manifolds and apply their knowledge to differentiable functions and mappings	H	M		L	L				M		L	M			
CO8	Students solve some examples of Lie groups	H	M	L	L					M		L	M			
	Course Name: Topology-I															
CO9	Students recognised countable and uncountable sets and solve some examples in Topological spaces	H	M		L					M		L	M			
CO10	Students recognised the terminologies in Topological spaces and can define bases of topology	H	M		L					M			M			
CO11	Students understood the connectedness and compactness and apply it to continuous functions and homomorphism	H	M		L					M		L	M			
CO12	Students apply the axioms of countability and separbility to understand regular and normal spaces	H			L		L			M		L	M			M
	Course Name: Linear Algebra & Differential Equations															
CO13	Students solve some examples to find transformation matrix, its eigen values and evaluate solution of system of differential equations	H	M		M					M		L	H			
CO14	Students evaluate the system of differential equations with complex eigen values and also with multiplicity eigen values	H	M	M	M					M		L	H			
CO15	Students decomposed the linear operators in diagonalised and nilpotent operators and solve nonhomogeneous linear systems of differential equations	H	M		M					M		L	M			M
CO16	students deal with sinks and sources and identify significance of genericity	H	M		M		L			M		L	M			
	Course Name: Integral Equations															
CO17	Students solve problems to convert ordinary differential equations into integral equations	H	M		H					M		L	H			
CO18	Students identifies various kernals like Green's function type and solve the integral equations	H	M	M	H					M		L	H			

CO19	Students recognised types of Voltera equations and solve nonlinear Voltera equations, problems on real integral equations and Laplace integral equations	H	M	M	H					M	L	L	H		H	
CO20	Students apply the various types of kernals to study the applications of Hilbert transform and finite Hilbert transform	H	M		H					M		L	H		H	M
	Course Name: Algebra-II															
CO21	Students apply the knowledge of unique factoriation and eqclidean domain.	H	M		L		L			M		L	M			
CO22	Students develop the knowledge of exension fileds and apply it to prove relevent theorems.	H	M		L					M		L	M			M
CO23	Students analysed fundamental theorem of Galois theory to solve various examples	H	M	M	L					M		L	M			M
CO24	Students apply the Galois theory to solve the classical problems	H	M		L		L			M			M			M
	Course Name: Real Analysis-II															
CO25	Students analyse whether given sets /functions are measureble or non mesurable by illustrating their properties	H	M							M			M			
CO26	Students recognizes the importance of Riemann and Lebesgue integral of a bounded function	H	M	M						M			M		H	
CO27	Students analyse and apply Holder and Minkowski inequalities to Lp-spaces and bounded linear functionals on Lp-spaces	H	M							M		L	M			
CO28	Students illustrate their knowledge of compact metric spaces and their types	H	M			L				M		L	M		H	
	Course Name: Topology-II															

CO29	Students apply Urysohn's lemma, Tietze extension theorem to study other results of normal spaces, study the properties of completely regular spaces and with the help of compactness for metric spaces they can study countably compactness and sequentially compactness	H	M		L					M		L	M			M
CO30	Students use the defination of quotient topology to analyse many related results. Net is the generalization of sequence, in that point of view, student can study many results of nets by generalizing the results of sequences. Student can also develop many examples of filters from its defination	H	M		L					M			M			M
CO31	Students can distinguish this product topology into two parts, finite product topology and topology on the product of any number of topological spaces and they justify the nature of these two topologies	H	M		L		M			M		L	M			M
CO32	Students can recognisze that paracompactness is the generalization of compactness and therefore students can generalized the results of compactness into the results of paracompactness with the help of locally finite and discrete families of subsets	H	M		L					M		L	M			M
	Course Name: Differential Geometry															
CO33	Students recognizes concepts of families of curves, their properties and equations	H	M		L					M			M			
C034	Students will be comfortably familiar with orientation, Gauss map, geodesic and parallel transport on oriented surfaces.	H	M		L					M			M			
CO35	Students recognize concepts of surfaces, their properties and equations	H	M		√					M			M			

CO36	Students discuss and understand the importance of concepts of compact surfaces, Hilbert's lemma, two dimensional Riemannian manifolds and solve problems of metrization and continuation	H	M		L					M			M			M
	Course Name: Classical Mechanics															
CO37	Students summaries the fundamental concepts of analytical mechanics	H	M		M					M			H			
CO38	Students illustrate various terminologies in classical mechanics	H	M			L	M			M		L	H			
CO39	Students apply knowledge of the action principle to formulate the problem	H	M		M					M		L	H			
CO40	Students formulate & evaluate solutions of transformation equations	H	M	M	M					M		L	H		H	
	Course Name: Complex Analysis															
C041	students apply knowledge of complex function and illustrate the problems .	H	M		L					M		L	H			
C042	Students interprete the concepts of analyticity, Cauchy-Riemann relations by solving problems and also discuss about zeos of a complex function and represent complex function in Mobius transformation and power series	H	M	M	L					M		L	M			
CO43	Students apply the concept of Cauchy integral theorem and Residue theorem to solve complex integration and recognizes singularity and residue of complex function	H	M		L		L			M		L	H			
CO44	students recognised the theory of maximum principle, convex function and hadamards three circle theorem and pharagmen-lindelof theorem.	H	M		L					M			M			M
	Course Name: Functional Analysis															

CO45	Students illustrate examples of Normed spaces and Banach spaces and also develop the examples of their subspaces	H	M		L	L				M		L	M			M
C046	Students discussed the idea of linear functionals and eloborate theory behind various spaces like dual, Inner product, Hilbert spaces.	H	V		L					M		L	M			M
CO47	Students illustrate concepts and theory of Hilbert spaces, complex vector space, normed space and reflexive space.	H	M		L	L				M		L	M			M
CO48	Students recognised the theory of Category theorem, Uniform boundedness theorem, Open mapping theorem and closed graph theorem	H	M		L					M			M			M
	Course Name: Mathematical Methods															
CO49	Students implement concepts and formulae of Fourier Integrals, fourier Transform to obtain solution of problems and also able to obtain solution of Partial differential equation by Fourier Transform	H	M		M					M		L	H			
CO50	Students apply knowledge of Laplace transform, its properties and inverse Lapalce transform to find solution of ordinary differential equations	H	M	M	M					M		L	H			
CO51	Students evaluate solution of some problems by finite Fourier transform, finite Sturm-Liouville transform	H	M	M	M					M		L	H			
CO52	Students implement knowledge of Finite Hankel transform, finite Legendre transform and finite Mellin transform to solve typical problems	H	M	M	M					M		L	H			M
	Course Name: Fluid Dynamics-I															

CO53	Students demonstrate the physical properties of a fluid and solve problems on steady motion	H	M		M	L				M		L	H			
CO54	Students implement their knowledge in two dimentional image systems and develop the proofs of circle theorems	H	M		M					M		L	H			
CO55	Students formulate one, two and three dimentional Wave equation and introduced to spherical, progressive and stationary waves	H	M		M		L			M		L	H		H	
CO56	Students formulate equations of shock waves and analyse it	H	M	M	M					M	L	L	H		H	
	Course Name: General Relativity															
CO57	Students evaluate and justify the differential forms of tensors	H	M		L					M		L	M			
CO58	Students recognizes the application of the fundamental principles of the general theory of relativity	H	M		L					M			M			
CO59	Students construct important field equations	H	M		L					M		L	M			
CO60	Students evaluate & summaries the solutions of field equations	H	M	M	L					M	L	L	M		H	M
	Course Name: Algebraic Topology-I															
CO61	Students describe the detailed study of Homotopy theory and its mappings, homotopically equivalent spaces and higher homotopy theory	H	M		L	L				M		L	M			
CO62	Students apply the knowledge to formulate and solve problems which are of a geometrical and topological in nature	H	M	M	L					M		L	M			
CO63	Students demonstrate describe the basic topological results in graph theory and basic results of embedding graphs in surfaces	H	M		L	L				M		L	M			

CO64	Students define and compute homology groups for simple mathematical objects in terms of simplicial complexes	H	M		L					M			M			M
	Course Name: Non-linear Programming-I															
CO65	Students demonstrate the concepts and techniques of non-linear programming for determining optimal solutions to many problems	H	M		L	L				M		L	M			
CO66	Students describe the convex and concave functions, their basic properties, fundamental theorems and evaluate minimization and local minimization problems	H	M		L	L				M		L	√		H	
CO67	Students explains Differentiability of convex and concave functions and their properties	H	√		L	L				M		L	M			
CO68	Students summarises various optimality theorem	H	√		L					M		L	M			M
	Course Name: Operator Theory															
CO69	Students describes spectrum, properties of resolvent and spectrum, also analyse the spectral theorem for bounded linear operators	H	M		L	L				M		L	M			
CO70	Students demonstrate the properties of bounded linear operators on normed, Banach and Hilbert spaces and apply these properties to solve simple problems.	H	M		L	L				M		L	M			
CO71	Students analyse the spectral properties of compact linear operator, solve the operator equations involving compact linear operator and describe theorems of Fredholmtype and its alternative	H	M		L					M		L	M			M
CO72	Students demonstrate spectral properties of various operators and describe spectral familty and spectral representation	H	M		L	L				M		L	M			
	Course Name: Elementary Mathematics															

CO73	Students apply concepts of differentiation to solve different types of problems	H	M		M					M		L	M			
CO74	Students implement concepts of Integration to solve different types of examples	H	M		M					M		L	M			
CO75	Students apply concepts behind determinants and matrices, their types, properties and operations to solve various examples	H	M		M					M		L	M			
CO76	Students implement the knowledge of complex numbers, their geometrical representation, operations and properties to solve relevent examples	H	M		M					M		L	M			
	Course Name: Operation Research-I															
CO77	Students construct a Primal linear programming problem into standard form and evaluate the solution using Simplex method or dual Simplex method	H	M		M					M		L	H		H	
CO78	Students formulate a number of classical assignment problem and transportation problem to evaluate the solutions	H	M		M					M		L	H		H	
CO79	Students understand the best strategy using decision making methods under uncertainty and game theory and determine the best choice using decision tree to evaluate solution of the zero-sum two- person games	H	M		M					M		L	H		H	
C080	Students illustrate fundamentals of dynamic programming and evaluate the solution of multi-level decision problems using dynamic programming method	H	M		M	L				M		L	H		H	
	Course Name: Dynamical Systems															
C081	Students develop the knowledge of different theorem on dynamical system.	H	M		L					M		L	M			

CO82	Students recognise the theory and concepts of field of stability of an equilibrium points of dynamical system.	H	M		L					M		L	M			
CO83	students analysed poincare theorem and its application.	H	M		L					M		L	M			
CO84	Students apply the knowledge of asymptotic stability of closed orbits, discrete dynamical system and structural stability.	H	M		L					M		L	M			
	Course Name: Partial Differential Equations															
CO85	Students evaluate solutions of first order PDE by relevent methods	H	M		M					M		L	H			
CO86	Students obtain solution of particular types of second order PDE	H	M		M					M		L	H			
CO87	Students implement the concepts of Diffusion and parabolic differential equation to obtain their solution	H	M	H	M					M		L	H			
CO88	Students implement the concept of Wave equation to obtain the solutions under given conditions	H	M	H	M					M		L	H			
	Course Name: Advance Numerical Methods															
CO89	Students analyze the error present in any numerical approximation and apply different approaches to the numerical solution of non-linear equations	H	M		H					M		L	H			
CO90	Students apply specific formulae to obtain the numerical solution of various interpolation problems	H	M	H	H					M		L	H			
CO91	Students apply the concepts of Weierstrass and Taylor's theorem to evaluate solution of approximtion problems	H	M	H	H					M		L	H			
CO92	Students apply different numerical integration methods to obtain solution of integration problems	H	M	H	H					M		L	H			
	Course Name: Fluid Dynamics-II															
CO93	Students demonstrate stress and strain in viscous flow, its analysis, relation between stress and strain, derive the Navier-Stokes equation of motion and solve some exactly solvable problem	H	M	H	H	L				M		L	H			
CO94	Students evalaute the solutions of the problems having the concepts of hydrodynamic process, electromagnetic phenomena in term of Maxwell electromagnetic field equation	H	M		H					M		L	H			
CO95	Students illustrate concepts, properties, conditions and equations in two dimensional boundary layer problem and solve examples on it	H	M	H	H	L				M		L	H		H	
CO96	Students demonstrate detailed information about turbulence flow and solve problems on different conditions	H	M		H	L				M	L	L	H		H	M
	Course Name: Cosmology															
CO97	Students apply the knowledge of physics and geometry of the universe to study structure of the universe	H	M		M					M		L	H			
CO98	Students apply various laws and principles of the universe which are basis of standard cosmology.	H	M		M					M		L	H			
CO99	Students are able to differentiate between present and early stage of the universe.	H	M		M					M		L	H			
CO100	Students formulate and evaluate basic cosmological models of the universe.	H	M	H	M					M	L	L	H		H	M
	Course Name: Algebraic Topology-II															
CO101	Students has knowledge of the advance concepts and methods in algebriac topology	H	M		L					M			M			

CO102	Students demonstrate No retraction theorem, Brouwer point theorem and discuss about homology theory, relative homotopy theory and cohomology groups	H	M		L					M		L	M			
CO103	Students demonstrate and discuss the importance of excision theorem, Mayer-Vietoris sequence, Eilenberg-Steenrod axioms for homology theory, relative homotopyn theory, relation between chain and cochain groups	H	M		L	L				M		L	M			M
CO104	Students analyse the important examples of simplicial mapping, chain mappings, cohomology product, cap product, exact sequences in cohology theory and relations between homology and cohomology groups	H	M		L					M		L	M			
	Course Name: Non-linear Programming-II															
CO105	Students implement concept of Duality in non-linear programming for solving many real life problems	H	M		L					M		L	M			
CO106	Students apply various concepts of quasi convex, strictly quasi concave and pseudo convex function to solve science and technology related problems	H	M	M	L					M		L	M			
CO107	Students Develop familiarity with first and second-order optimisation algorithms and gain practical knowledge by implementing the algorithms introduced in the course	H	M		L					M		L	M			
CO108	Students implement advance knowledge to solve many practical problems	H	M	M	L					M		L	M		H	
	Course Name: Advanced Algebra															
CO109	Students illustrate and justify the fundamental concepts of advance algebra and their role in modern mathematics	H	M		L	L				M		L	M			

CO110	Students demonstrate accurate and efficient use of advanced algebraic techniques	H	M		L	L				M		L	M			
CO111	Students demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advance algebra	H	M		L	L				M		L	M			
CO112	Students apply theory using advanced algebraic techniques to diverse situations in engineering and other mathematical problems	H	M	L	L					M		L	M			
	Course Name: Elementary Discrete Mathematics															
CO113	Students are able to formulate the statements from common language to formal logic truth tables and the rules of proposition to predicate calculus.	H	M		M					M		L	H			
CO114	Students illustrate the concepts, properties, types of Lattices to construct various types of Lattices	H	M		M	L				M		L	H			
CO115	Students implement kowledge of Boolean algebra in boolean expression and switching circuits	H	M		M					M		L	H			
CO116	Students apply the knowledge of graph theory to obtain solution of real life problems	H	M	H	M					M		L	H			
	Course Name: Operation Research-II															
CO117	Students distinguish and formulate integer programming problems and evaluate the solution by cutting plane methods	H	M	H	H					M		L	H		H	
CO118	Students apply the concepts of of queuing theory to evalaute solution of real life problems	H	M	H	H					M		L	H		H	
CO119	Students solve the nonlinear optimization problems using the Kuhn-Tucker optimality conditions	H	M	H	H					M		L	H		H	

CO120	Students recognized the importance of generalized linear programming in optimization technique and evaluate the solutions of problems with multiplicity of objectives, which are generally incommensurable and they often conflict each other in a decision making horizon	H	M		H					M		L	H		H	M
	% Attainment	100	100	27.5	95.8	20	0.83	0	0	100	4.17	86.7	100	0	19.2	22.5
	Correlation															

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Program Outcomes: M.Sc. Microbiology (CBCS)

https://www.nagpuruniversity.ac.in/pdf/Naac_Reports/programs_outcomes/MICROBOLOGY_compressed_150620.pdf

Department of Microbiology

After successful completion of two years PG degree program in the subject Microbiology, the students are able to:

Targeted Graduate Attributes: Disciplinary Knowledge, Critical Thinking, Problem Solving, Analytical Reasoning, Communication Skills, Teamwork, Moral and Ethical Awareness

	Program Outcomes
PO1	Students will be able to gain, communicative, recall and apply specialized language and **knowledge** relevant to microbiology.
PO2	Students will acquire and demonstrate ability in laboratory safety in routine and specialized microbiological laboratory skills applicable to microbiological research methods, including observations and analysis.
PO3	Students will **develop** ability for hypothesis generation and testing, development of theoretical and practical skills in the designing and execution of experiments results and analytical judgment clearly and quickly.
PO4	Students will be able to work effectively in diverse condition as team to communicate with social community to make life easier and better for society by **explain**ing awareness about hygienic condition, Environmental changes, recycling of waste by using microorganisms.
PO5	Students will able to **develop** professional and technical skill in lectureship, quality control, scientist in industries as well as in research laboratories.

Program Matrix

Name of Program :M.Sc. Microbiology

(Low Correlation = L/1 ; Moderate Correlation = M/2 ; High Correlation = H/3)

Course Outcomes (COs)		Program Outcomes (POs) Domain Specific (PSO)				
		1	2	3	4	5
	SEMESTER - I					
PAPER-I	**Course Name : Microbial Metabolism**					H
CO1	The students will be able **to explain** the metabolic pathways - the energy-yielding and energy-requiring reactions in life.	H				
CO2	The students will be able **to explain** the diversity of metabolic regulation, and how this is specifically achieved in different cells.	H				
CO3	The students will be able to **describe** biochemical processes with specific control sites and key junctions.	H				
CO4	The students will be able **to explain** structure, function and biosynthesis of biomolecules like lipids, carbohydrates, proteins and nucleic acid.	H				
CO5	The students will be able **to explain** and **analyse** photosynthetic bacteria from the environment.	H	M			
CO6	The students will be able to **compare** anoxygenic and oxygenic photosynthesis.	H				
CO7	The students will be able to **discuss** role of Nitrogen and Sulphur metabolism and methanogenesis for useful crop production to the farmers.	H				H

PAPER-II	**Course Name : Enzymology and Techniques**					H
CO1	The students will be able to **discuss** structure, functions and the mechanisms of action of enzymes.	H				
CO2	The students will **explain** kinetics of enzyme catalyzed reactions and enzyme inhibitory and regulatory process.	H				
CO3	Students have **comprehension** in the action of enzymes as biocatalysts and in factors that influence enzyme activity	H				
CO4	Students will able **to explain** and **calculate** the kinetics of enzyme of by using **unknown** substrate.	H		M		
CO5	Students **develop** an ability for purification, handling and characterization of proteins	H				
CO6	The students will be able to **perform** immobilization of enzymes for higher production of products.	H				
CO7	Students able to **perform** glucose biosensor and their application and **discuss** about Protein engineering.	H				
CO8	The students will get **knowledge** of wide applications of enzymes and their future potential.	H				
PAPER-III	**Course Name : Advance Techniques in Microbiology**					H
CO1	Students will easily **explain** the basic principles of advance techniques for identification and characterization of microorganisms.	M	H	H		
CO2	Students **develop** an ability to find microbial cell structure and their internal components by using SEM, TEM, Staining procedures and microscopy. Fluorescent Microscopy	M	H	H		
CO3	Students **describe** how to **identify** DNA, RNA on basis of blotting techniques and electrophoresis techniques.	M	H	H		
CO4	Students will able **develop** practical skill for identification of proteins, DNA, RNA by using agarose electrophoresis.	M	H	H		
CO5	Students gain experience in microbiological laboratory practices and skills in the design and implementation of microbiology related research.	M	H	H		
PAPER-IV	**Course Name : Membrane Structure and Signal Transduction**					H
CO1	The students will be able **to explain** the biochemical and biophysical properties of membranes constituents contribute to the structure and organisation of membranes	H				
CO2	The students will be able to **describe** Cell compartmentalisation and how proteins are transported between organelles.	H				
CO3	The students will be able **to explain** the principles and organisation of signal transduction pathway	H				
CO4	The students will be able to **discuss** ions and solutes are transported across membranes	H				
CO5	The students **explain** how sporulation and mating occurs in yeast by signal transduction pathways.	H				
CO6	Students able **to isolate, characterize** and **identify** membrane structure by using differential scanning colorimetry, flouroscencephotobleaching recovery, flow cytometry	M	H	H		
	Course Name : PRACTICAL-I (1P1)					H
CO1	Students will able to **handle** instruments, **calculate** the amount and interpret the result of **unknown** biological samples such lipids, carbohydrates, proteins, DNA and RNA and also draw conclusions from data.	M	H	H		
CO2	Students will able to **calculate** kinetics of enzyme **analyse** and interpret the results.	M	H	H		
	Course Name : PRACTICAL-II (1P2)					H
CO1	Students will able to **separate** and **identify** biomolecules amino acids, DNA and proteins by using separation techniques such as electrophoresis and paper chromatography **analyse** and interpret the results.	M	H	H		
CO2	Students will able to **calculate**, **analyse** the results of DNA and RNA also draw conclusions from data.	M	H	H		
						H
	Course Name : SEMINAR (1S1)					H
CO1	Students will able to **express** thoughts and ideas effectively by using appropriate media alsodevelop Skill & personality development for	H				

	communication and teaching ability.					
	SEMESTER - II					
PAPER-I	**Course Name : Microbial Methods For Environment Management**					H
CO1	Students will **discuss** about how microbial changes induced by organic and inorganic pollutants.	H				
CO2	The students will **explain** Biodeterioration, Biomagnification, biotransformation of pesticides, Bioleaching, Biodegradation of plastics	H			H	
CO3	Students will easily **discuss** how to manage pollution from the environment with the help of microorganisms in waste water management using activated sludge, aerated lagoons, trickling filter	H	M	M	H	
CO4	Students will get **share** thoughts about global Environmental Problems such Ozone depletion, UV-B, greenhouse effect, acid rain, their impact and biotechnological approaches for management. Global warming and climate change and can give information to communities how to prevent from these climatic changes.	H			H	
PAPER-II	**Course Name : Microbial Metabolites**					H
CO1	Students **recognise** and use fundamental concepts in the field of plant secondary metabolites, mycotoxins, bioactive compounds and structure and mode of action of secondary metabolites.	H				
CO2	Students **collect** the information about Biopolymers such as Polypeptides, polynucleotides and polysaccharides also have **knowledge** about outline and functions of polyamines	H				
CO3	Students **develop** critical and analytical attitude on the use of plant bioactive compounds for formulation of medicines.	H	H	H		
CO4	Students able **to explain** the major action and effects of antimicrobial drugs used to treat various infectious diseases.	H			H	
CO5	Students become **autonomous** in searching scientific literature on secondary metabolism and bioactive compounds.	H				
CO6	Students able to **identify** Pigments as secondary metabolites and their important in plants and microorganisms.	H				
CO7	Students able **to know** Structure, function and chemistry of vitamins and their deficiency diseases.	H				
PAPER-III	**Course Name : Medical Microbiology and Parasitology**					H
CO1	Students able **to explain**about pathogenic microorganisms and the mechanisms by which they cause disease in the human body.	H				
CO2	Students able to **develop** skill about diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases and use of microbiology laboratories in medical field.	M	H	H		
CO3	Students able **to explain** the importance of pathogenic bacteria in human disease with respect to infections of the urinary tract, respiratory tract, gastrointestinal tract and **explain** the methods of how microorganisms to be control.	H	H	M		
CO4	Students will be able **to distinguish** aspects of the morphology, physiology and genetics of the diverse microbial groups	H	H	H		
CO5	Students will be able to apply experimental methods for the detection and identification of pathogenic agents such as bacteria, fungi, parasites.	H	H	H		
CO6	Students will be able to **describe** and apply specific methods for the study of human parasites and its parasitosis.	H				
CO7	Students will be able to **develop** an ability to **identify** microorganisms by using different laboratory techniques and **analyse** the results.	H	H	H		
PAPER-IV	**Course Name : Immunology and Immunodiagnostics**					H
CO1	Students have **to explain** concepts in immunology along with overall organization of the immune system and their mechanism.	H				

CO2	Students will **discuss** the significance of maintaining a state of immune tolerance sufficient to prevent the emergence of autoimmunity.	H				
CO3	Studentsable **to explain** about Tumour Immunology and its immune prophylaxis and immune therapy.	H				
CO4	Students will able **to explain** the Immunodeficiency disorders and hypersensitivity and their types and control.	H				
CO5	Students will able to **discuss** features of antigen antibody reaction & its uses in diagnostics and various other studies.	H	H	H		
	Course Name : PRACTICAL-III (2P1)					H
CO1	Students will able to **handle** instruments, **calculate** the amount and interpret the result of **unknown** biological samples such lipids, carbohydrates, proteins, DNA and RNA and also draw conclusions from data.	M	H	H		
CO2	Students will able to **calculate** kinetics of enzyme **analyse** and interpret the results.	M	H	H		
	Course Name : PRACTICAL-IV (2P2)					H
CO1	Students will able **to isolate**, **identify**, and differentiate between different microorganisms by using microbiological techniques and methods.	M	H	H		
CO2	Students will able to aseptically **handle** body fluids as well as **identify** disease by using serological tests and draw conclusions.	M	H	H		
	Course Name : SEMINAR (2S1)					H
CO1	Students will able to **express** thoughts and ideas effectively by using appropriate media also **develop** Skill & personality development for communication and teaching ability.	H				
	SEMESTER - III					
PAPER-I	**Course Name : Molecular Biology and Genetics**					H
CO1	Studentswill able **to explain** the structure, properties and function of genes	H				

	in living organisms at the molecular level and **knowledge** about DNA as a genetic material, and replication **discuss** the molecular mechanisms underlying mutations, detection of mutations , DNA damage and repair mechanisms					
CO2	Studentsable **to know** the importance strategies of molecular mechanisms involved in transcription and translation.	H				
CO3	Students also **explain** the concept of recombination, linkage mapping and elucidate the gene transfer mechanisms in prokaryotes and eukaryotes	H				
CO4	Students easily **explain** the concept of Gene Regulation and its **Express** ion	H				
CO5	Students have **knowledge** about genetics of Bacteria and Bacteriophages such as mapping bacteriophage gene by recombination analysis, deletion mapping and complementation and also about Transposons	H				
CO6	Students will able to **handle** and independently work on lab protocols involving molecular techniques	H	H	H		
PAPER-II	**Course Name : Recombinant DNA Technology and Nanobiotechnology**					H
CO1	Students will **become familiar** with the tools and techniques of genetic engineering- DNA manipulation enzymes, genome and analysis and manipulation tools, gene **express** ion regulation.	H				
CO2	Students have an ability **to explain** the steps of PCR and **discuss** the components and optimization of the process	H	H	H		
CO3	Students able **to explain** about Restriction mapping: DNA sequencing dideoxy and pyrosequencing, DNA fingerprinting.S1 Mapping, primer **express** ions, Dnasefootprinting, DMS footprinting.	H	H	H		
CO4	Students will have **practical knowledge** about Tissue Culture and stem cell technology to improve food products and their applications.	H	H	H	H	
CO5	Students will **discuss** about Stem cell technology-embryonal stem cell and multipotent stem cells	H	H	H		
CO6	Students able **to know** the concept of Transgenic plants and plant products	H				
CO7	Students **expertise** handling the instruments and techniques in genetic engineering in biological research.	H	H	H	H	

PAPER-III	**Course Name : Microbial Diversity, Evolution and Ecology - I**					H
CO1	Students will able **to explain** about Evolution of Earth and early life forms.	H				
CO2	Students able to **discuss** Primitive life forms such asRNA world, molecular coding, energy and carbon metabolism, origin of Eukaryotes, endosymbiosis.	H				
CO3	Students will able **to explains** about Methods for determining evolutionary relationships like Evolutionary chronometers, Ribosomal RNA sequencing, signature sequences, phyllogenetic probes, microbial community analysis	H				
CO4	Students able **to explain** General Metabolism and Autotrophy in archea	H				
CO5	Students able **to explain** Microbial Diversity: Bacteria **explaining** Free living N2 fixing bacteria, purple phototrophic bacteria nitrifying bacteria, sulphur and iron oxidizing bacteria, sulphate and sulphur reducing bacteria.	H			H	
PAPER-IV	**Course Name : Drug and Disease Management**					H
CO1	Students able to **share knowledge** about Drug latentiation and Prodrug, carrier-linked prodrugs, bioprecursors prodrugs.	H				
CO2	Students **explain** about Drug-microbe-Host relationship, mechanism of drug action and drug resistance including MDR.	H	M	M		
CO3	Students will ability **to know** Antiinfective agents Antifungal agents and Antitubercular agents and their mechanisms of action.	H				
CO4	Students will able to **discuss** about structure activity relationships in relation to drug-target interactions	H	M	M		
CO5	Students will able **to explain** Antiprotozoal agent Antimalarials Histamines and Antihistaminic agents Analgesic agents and their mechanisms of action.	H				
	Course Name : Bioinformatics - I					H
CO1	Students will able **to explain** basic Concept of Computer Organization, Internet, File Transfer Protocol, Browser, Home Page, Hypertext, transfer protocol, Uniform Resource Locator, Hyperlink and Web Applications	H	H	H		
CO2	Students able to **discuss** Database types, levels of omics, Data researches and pairwise alignments	H	H	H		
CO3	Students able to **analyse** the results from BLAST, FASTA software and help in genome projects by using phyllogenetic methods.	H	H	H		
CO4	Students able **to explain** Prokaryotes genomes, prokaryotic gene structure GC content prokaryotic gene density, eukaryotic genomes, Tranposition, Repetitive elements, gene density.	H	H	H		
CO5	Student will able to **calculate** and **analyse** the results of by using software for identification of microorganisms.	H	H	H		
	Course Name : PRACTICAL-V (3P1)					H
CO1	Students will able **to learn** all advance molecular biology techniques for isolation, identification and characterization of DNA also learn the methods of how to prepare recombinant DNA by using Genetic engineering tools	M	H	H		
CO2	Students will able to **handle** instruments, prepare chemicals, **calculate** the amount and interpret the result of DNA, plasmid DNA and RNA and also draw conclusions from data.	M	H	H		
						H
	Course Name : PRACTICAL-VI (3P2)					
CO1	Students will able **to isolate, identify**, and differentiate between different microorganisms by using microbiological techniques and methods.	M	H	H		
CO2	Students will able to aseptically **handle** body fluids as well as **identify** disease by using serological tests and draw conclusions.	M	H	H		
						H
	Course Name : SEMINAR (3S1)					
CO1	Students will able to **express** thoughts and ideas effectively by using appropriate media also **develop** Skill & personality development for communication and teaching ability.	H				

	SEMESTER - IV					
PAPER-I	**Course Name : Virology**					H
CO1	Students will able **to explain** the architecture of viruses, their Nomenclature and classification of viruses (Regenmortel et.al.2005, 8th Report of ICTV). Genetic classification and the methods used in their study.	H				
CO2	Student will **discuss** about morphology and structure of viruses (size and shape/symmetry). Chemical composition of viruses (viral capsid, spikes, envelopes and types of viral nucleic acids) and Assay of Viruses.	H	M			
CO3	Students will able **to explain** about Structural organization; life cycle of viruses	H	M			
CO4	Student able to **discuss** about Life cycle, pathogenesis and laboratory diagnosis of plants and animal viruses	H				
CO5	Students will able to **handle** and **expertise** in general techniques of Diagnosis of viruses and **share knowledge** about antiviral drugs	H	H	H		
PAPER- II	**Course Name : Microbial Fermentation Technology**					H
CO1	Student will able to **discuss** how microbiology is applied in manufacture of industrial products, learn methods in discovery of new useful microorganisms and acquire **knowledge** of the design of Fermenters and process controls .	H	M			
CO2	Students will able **to explain** how to **develop** an understanding of fermentation &inoculum media, their formulation and principles & techniques of sterilization.	H	M			
CO3	Students will able **to explain** about the different types of fermentation processes & understand the biochemistry of various fermentations and product recovery methods.	H	H			
CO4	Students have ability to gain **knowledge** about latest techniques applicable for Improvement of microorganisms based on **known** biochemical pathways and regulatory mechanisms and learn the methods of immobilization of enzymes and cells.	H	H	M		

PAPER-III	**Course Name : Microbial Diversity, Evolution and Ecology - II**					H
CO1	Students **explains** the microbial ecosystem includesTerrestrial environment, deep surface microbiology, Fresh water environment, lake and river Microbiology, Marine Microbiology and Hydrothermal vents.	H				
CO2	Students will able to **discuss** about Diversity, stability and succession	H				
CO3	Students able to **discuss** the source of genetic variation such as Hardy-Weinberg; genetic drift.	H				
CO4	Studentswill able **to explain** the concept of microbial Interactions and Ecosystem Management	H	H	H		
PAPER-IV	**Course Name : Vaccines and Delivery System**					H
CO1	Students **explain** the importance of vaccination and their types Active and passive prophylactive measures.	H				
CO2	Students **describe** the basic principles of vaccination.	H				
CO3	Students **explain** how the public are less tolerant of the risk	H				
CO4	Students **explain** subunit vaccines, DNA vaccines and Vaccines additives and adjuvants.	H				
CO5	Students also **know** about conventional vaccines and advanced vaccines production and their effect on microbial model.	H				
CO6	Students also have **knowledge** about Designing & delivery system Drug designing, Non-automated in vitro drug susceptibility testing, Rapid tests for susceptibility testing, and antibiotic assay in body fluid, Drugs & vaccines delivery system.	H	H	H		
	Course Name : Bioinformatics - 2					H
CO1	Students will able to **calculate** and **analyse** data mining problems, cluster analysis, data mining techniques and tools.	H	M	M		
CO2	Students able to **discuss** primary, secondary, tertiary, quaternary of Protein and their motifs and folding, protein folding modeling.	H	M	M		
CO3	Students able **to explain** Structure of RNA, secondary structure of RNA and its types	H	M	M		

Program Outcomes: M.Sc. Physics (CBCS)	
Department of Physics	After successful completion of two years PG degree program in the subject Physics, the students are able to:
Program Outcomes	PO1: Understand the core fundamentals and theories of basic sciences with more focus and maturity. PO2: Analyse problems, formulate a hypothesis, evaluate the results and draw reasonable conclusions PO3: Develop written and oral communication skills by as these students give frequent presentationsand seminars on various scientific theories and activities. PO4: To inculcate the scientific temperament in the students and outside the scientific community. PO5: Handle the sophisticated instruments/equipment. PO6: Enable students acquire jobs in R & D in scientific laboratories, industries, teaching at bothschool or college level (with NET), management, marketing and sales, in public sector organizations and to pursue research. PO7: Go to serve in industries or may opt for establishing their own industrial unit.
M. Sc. PHYSICS Semester I (Core 1) Paper 1: Mathematical Physics	CO1. Understand the application of Vector analysis and curvilinear coordinates and Generalized Coordinates CO2. Demonstrate the theory and application of Tensor analysis, and Tensor algebra. Know Fourier series, Laplace Transforms and its applications. CO3. Analyze the application of Matrices and complex variables. CO4. Use of Partial differential equations and Boundary value problems –solutions. Understand the use of Bessel Functions Legendre Polynomials and Hermite Polynomials.
(Core 2) Paper 2: Complex Analysis and Numerical Methods	CO1. To get equipped with the understanding of the fundamental concepts of functions of a complex variable along with the concepts of analyticity, Cauchy-Riemann relations and harmonic functions. CO2. Evaluate complex contour integrals applying the Cauchy's integral theorem and Cauchy's integral formula. CO3. Be aware of the use of numerical methods in modern scientific computing, numerical interpolation and approximation of functions CO4. Apply numerical differentiation and integration whenever and wherever routine methods are not applicable.
(Core 3) Paper 3: Electronics	CO1. To study the basics of transistor and its working and implementation, various circuits like UJT, SCR and TRIAC, to know the principle of operation of photoelectronic. devices like photodiode, and LED

	CO2. To study applications of semiconductor devices in linear and digital circuits different biasing techniques. CO3. To outline summing amplifier, inverting and non-inverting configuration. To summaries various amplifier like summing amplifier and Schmitt trigger and understand the basic logic gates. CO4. Remember and understand the Basic principle of amplitude frequency and phase modulation
(Core 4) Paper 4: Electrodynamics I	CO1. Describe the mathematical description of electromagnetic phenomena based on basic physical quantities. CO2. Illustrate vector potential and electric field of a localized current distribution using multipole expansion problems. CO3. Understanding of magnetic field, their law and boundary value problem. CO4. Apply Maxwell equations in analyzing the nature of electromagnetic fields due to time varying charge and current distribution.
LAB I Practical 1 (Core 1 and 2)	CO1. Understand the basic concepts of Experimental and Computational Physics CO2. Solve the Computational problems and Write Programs.
LAB II Practical 2 (core 3 and 4)	CO1. Demonstrate proper use of circuit connections of desired experiment. CO2. Review the observations taken during the experimentation and tabulate the results.
M. Sc. PHYSICS Semester II **(Core 5) Paper 5: Quantum Mechanics-I**	CO1. Understand General formulation of quantum mechanics. Know Stationary states and Eigen value problems. CO2. Remember and understand Fundamental postulates of Quantum mechanics. CO3. Demonstrate and interpret solutions of Schrodinger equation for simple problems. CO4. Remember and understand theory of angular momentum, spin matrices and compute Clebsch-Gordan Coefficient.
(Core 6) Paper 6: Statistical Physics	CO1. Remember and understand the concepts, basic idea of probability, phase space, macro and micro states. CO2. Understand to apply and formulate the Fermi-Dirac distribution to calculate thermal properties of electrons in metals and Bose-Einstein distribution to calculate properties of black body radiation. CO3. Demonstrate Fermi Dirac condensation on the basis of BCS theory and its application for free electron gas in metal CO4. Describe phase transition phenomenon using lsing model and Landau theory.
(Core 7) Paper 7: Classical Mechanics	CO1. To understand the fundamental concepts of the Lagrangian and the Hamiltonian methods and will be able to apply them to various problems;

	CO2. Understand the physics of small oscillations and the concepts of canonical transformations and Poisson brackets. Learn Hamilton-Jacobi theory and its importance. CO3. To understand the basic ideas of central forces and rigid body dynamics. CO4. Understand Euler angles, lnertia tensor. Compute equations of motion for simple coupled systems
(Core 8) Paper 8: Electrodynamics II	CO1. Use of Maxwell equations in analyzing the electromagnetic field due to time varying charge and current distribution. Describe the nature of electromagnetic wave and its propagation through different media and interfaces CO2. Explain charged particle dynamics and radiation from localized time varying electromagnetic sources CO3. Formulate and solve electrodynamic problems in relativistically covariant form in four-dimensional space-time CO4. Be familiar with some elementary phenomena and concepts in quantum electrodynamics.
LAB I Practical 3 (core 5 and 6)	CO1. Tabulate the appropriate experimental data accurately and keep systematic record of general laboratory experiments. CO2. Interpret professional quality of textual and graphical presentations of laboratory data and computational results.
LAB II Practical 4 (core 7 and 8)	CO1. Evaluate possible causes of discrepancy in practical experimental observations and results in comparison to theoretical results. CO2. Analyze various experimental results by developing analytical abilities to address real applications.
M. Sc. PHYSICS Semester III **(Core 9) Paper 9: Quantum Mechanics-II**	CO1. Solve simple problems using perturbation theory and be able to apply them to various quantum systems CO2. To understand the basics of time dependent perturbation theory and its application to semi-classical theory of atom radiation interaction. Solve barrier problem using WKB method CO3. To understand the theory of identical particles and its application to helium. To understand the idea of Born approximation and the method of partial waves. CO4. To aware the basic concepts of relativistic quantum mechanics. Know about Klein- Gordon equations, Dirac equations. Solve for Hydrogen atom using Dirac's theory.
(Core 10) Paper 10: Solid State Physics and Spectroscopy	CO1. Clear basic concept of crystal classes, lattices, symmetries and to understand the relationship between real and reciprocal lattice. CO2. Explore with the knowledge of different crystal defect and its influence on basic physical behavior of crystals and basic knowledge of dielectric properties of materials CO3. Understand the spectra of single and multiple electrons atoms including fine and hyperfine structure of alkaline, Helium

	like atoms, spin and relativity correction, different type of coupling such as L-S and J-J couplings. CO4. Understand and analyze the spectra of diatomic molecules such as electronic, rotational, vibrational spectra and a basic introductory idea about the Raman Spectroscopy.
Paper – 11 (Core Elective 1) Atomic and Molecular Physics I	CO1. Understand the atomic structure and spectra of typical one-electron and two-electron systems. CO2. Learn about the physical interpretation of the Laser spectroscopy and its application. CO3. Analyses consequences to explain electronic, rotational, and vibrational spectra of diatomic molecules, explain IR spectroscopy. Know the basics of Raman spectroscopy and the nonlinear Raman effects CO4. Skill of empirical model developing is created by studying the Born-Oppenheimer approximation. Critical thinking ability is developed by studying the Franck Condon principle.
Paper – 12 (Foundation Paper I) S1.2 Nanoscience and Nanotechnology	CO1. Clear basic concept of quantum approach for density of states for quantum well, wires and dots. CO2. Understanding the different methods of preparing nanostructure using chemical and physical process. CO3. Structural and chemical characterization of nano structure. Explore with the knowledge of different instrumentation useful to analyses materials at nanoscale. CO4. Understanding the properties nanomaterials for technology application.
LAB I Practical 5 (core 9 and 10)	CO1. Understand how to apply and verify the theoretical concepts and facts through laboratory experiments. CO2. Basics of different components of spectroscopy in experimental setup.
LAB II Practical 6 (elective)	CO1. Students will learn the sample preparation methods and sample handling. CO2. Students will acquire the ability to analyze the data obtained from the techniques.
M. Sc. PHYSICS Semester IV **(Core 11) Paper 13: Nuclear and Particle Physics**	CO1. Clear basic concept of nuclear properties; its size, radii, shape charge distribution, spin, parity, mass, nuclear stability and also to understand binding energy, semi empirical mass formula, liquid drop model, laws of radioactive decay. CO2. Gains the knowledge of elementary particles, decay of nuclei, their classification, characteristics, selection rule and their theories. CO3. Understand the concepts of the interaction of charged particles and electromagnetic radiation with matter along with principles of radiation detectors including G-M Counter, proportional counter, Na(Tl) Scintillation detectors, semiconductor detectors.

	CO4. Understand the interaction between elementary particles and the conservation laws in particle physics.
(Core 12) Paper 14: Solid State Physics	CO1. Understand the band theory of solid and introduction to quantum theory of magnetism. CO2. Understanding the lattice vibrations of a three-dimensional polyatomic vibrating crystal. CO3. Understand the free electron theory of metals and know the fundamental principles of semiconductors and be able to estimate the charge carrier mobility and density. CO4. Rigorous study of various theoretical treatments of superconductivity, including BCS theory and understanding the Josephson junction effects and their applications
Paper – 15 **(Core Elective 1) Atomic and Molecular Physics II**	CO1. Remember and understand the time-dependent and independent perturbation theory and Fourier transform. CO2. Understand the saturation and absorption spectroscopy and its application. CO3. Understand the theory of stimulated Raman scattering and fluorescence spectroscopy CO4. Understand the Matrix isolation spectroscopy, Fourier transforms spectroscopy and Application of group theory
Paper – 16 **(Foundation Paper II) S2.2: Experimental Techniques in Physics**	CO1. Remember and explain different types of radiation, their sources and detectors which are commonly used in experimental techniques. Clear the conceptual understanding of functionality of different types of sensors CO2. Demonstrate different X-ray and thermal analysis based experimental techniques used for materials characterization in Physics CO3. Understand the different microscopy study Morphological Characterization and instrumentation for Magnetic Characterization CO4. Understanding principle, instrumentation and working of Spectroscopic characterization for spectroscopy analysis

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S.S.E.S.A's
Science College, Nagpur

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Principal
S. S. E. S. Amravati's
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Science College, Congress Nagar, Nagpur

PG COURSES

MASTER OF SCIENCE (M.Sc.) (NEP) (Effective from 2023-24)

- M.Sc. Botany
- M.Sc. Chemistry
- M.Sc. Computer Science
- M.Sc. Mathematics
- M.Sc. Microbiology
- M.Sc. Physics
- M.Sc. Zoology

Programs Outcomes, Course Objectives & Outcomes: M.Sc. Botany
(NEP) (Effective from 2023-24)

https://nagpuruniversity.ac.in/writereaddata/fckimagefile/DOC-20230821-WA0028_compressed.pdf

Department of Botany	After successful completion of two years PG degree program in the subject Botany, the students are able to:

Programme outcomes
M. Sc. (Botany), Affiliated Colleges of University
Number of courses: 29

Targeted graduate attributes: Disciplinary knowledge, Critical thinking, Problem solving, Analytical reasoning, Communication skills, Teamwork,Moral and ethical awareness

	Programme outcomes
PSO1	The student is capable to demonstrate comprehensive knowledge and understanding of one or more branches of Botany, and ofcritical and clear thought about the plant world.
PSO2	The student develops the ability to analyse and contemplate on the various aspects of plants.
PSO3	The student is capable to undertake supervised research, identifying the problem, survey the literature, design & execute theexperiments, generate the data and draw conclusions.
PSO4	The student gets the hands-on experience in the routinely used laboratory techniques and equipment.
PSO5	The student develops the professional skills like identification of plants/algae/fungi, laboratory technician, scientific writing, dataanalysis, techniques in plant tissue culture, environmental impact assessment etc.
PSO6	The student is capable to write report and present the scientific data in form of figures, images and tables.
PSO7	The student is capable to undertake field tours for floristic, environmental and other exploratory surveys.
PSO8	A life-long inquisitiveness about plants and ways to put them at work for enhancing the quality of life is instilled in the student.
PSO9	The student is capable to derive benefits from the traditional knowledge of India.
PSO10	The student develops the qualities of a responsible global citizen and is able to work in a team.

M. Sc. Botany Syllabus (Affiliated colleges of the University) as per NEP- 2020

Semester I

Mandatory Paper 1 (MBO1T01): Microbiology, Algae and Fungi

Objectives

- To explore the microbial diversity.
- To study the morphological and reproductive variations in viruses, prokaryotes, algae and fungi.
- To study the systems of classification and evolutionary trends in algae and fungi.
- To study the common plant diseases caused by bacteria, virus and fungi.

Outcomes

- The diversity among the microbes is revealed to the student in the class, laboratory and field.
- The student appreciates the variability among the algae and fungi and also acknowledges their economic importance.
- The student is able to trace the phylogenetic relationship among the algae and fungi.
- The student is conversed with the common diseases of plants and their control measures.

Semester I

Mandatory Paper 2 (MBO1T02): Bryophytes and Pteridophytes

Objectives

- To explore the diversity of lower plants.
- To study the morphological, anatomical and reproductive variations within and among the groups of Bryophytes and Pteridophytes.
- To traverse the probable evolutionary paths in the lower plants.

Outcomes

- The student acknowledges the diversity among lower plants in the class.
- The student develops an insight to correlate the structural variations with the phylogenetic relationship among plants.
- The student understands the importance of lower plants in the ecosystem and the daily life.

Semester I

Elective Paper 3 (MBO1T03): Palaeobotany and Gymnosperms

Objectives

- To explore the diversity of extinct flora and living Gymnosperms in the class.
- To study the morphological, anatomical and reproductive variations within and among the important groups of extinct plants and living Gymnosperms in the class.
- To understand the evolution of Gymnosperms from the lower plants and their subsequent diversification.

Outcomes

- The student is sensitised about the paleoclimate, fossil flora and the process of fossilisation.
- The student acknowledges the diversity among the Gymnosperms in the class.
- The student develops an insight to correlate the structural variations in the extinct and extant plants with the phylogenetic relationships.

Semester I

Research Methodology Paper 4 (MBO1T04)

Objectives

- To sensitize the student about research methodologies & their application.
- To update the student about the concepts of Foundations of Research, Problem Identification & Formulation, Research Design, Qualitative and Quantitative Research, Measurement, Sampling & data collection.

Outcomes

- The students are acquainted with the process of selection of a research problem and techniques and tools to be employed in completing a research project.
- The students are capable of Analysis and Interpretation of Data and Paper Writing.
- The students are acquainted with the skills of qualitative and quantitative data analysis and presentation.
- The students will be abreast with the employability skills required for various academic research & industrial units.

Semester I

Mandatory Lab 1 (MBO1L1): Microbiology, Algae, Fungi, Plant pathology,Bryophytes, Pteridophytes

Objectives

- To explore the diversity of microbes and lower plants in laboratory and field.
- To study the morphological and reproductive variations in Cyanobacteria, algae, fungi, bryophytes and pteridophytes.
- To study the common plant diseases caused by bacteria, virus and fungi.

Outcomes

- The diversity among the microbes and lower plants is revealed to the student in the laboratory and field.
- The student appreciates the variability among the microbes and lower plants and also acknowledges their economic importance.
- The student is conversed with the common diseases of plants and their control measures.

Semester I

Mandatory Lab 2 (MBO1L2): Palaeobotany, Gymnosperms, Cytology, Genetics, Cell biology and Research Methodology

Objectives

- To study the fossil specimens in laboratory and field.
- To study the morphological, anatomical and reproductive variations within and among the living Gymnosperms in laboratory and field.
- To gain hands-on experience in the fundamental techniques of cytology and genetics.
- To gain hands-on experience in basic techniques used in cell biology.
- To study the effect of stress in plants.

Outcomes

- The student is sensitised about the fossil flora.
- The student acknowledges the diversity among the Gymnosperms the laboratory and field.
- The student is equipped with techniques to prepare stains and study chromosomes and to analyse the data to decipher underlying genetical phenomenon.
- The student is equipped with the techniques to isolate and quantify DNA.
- The student is conversant with the technique to evaluate the effect of stress on plants.

Semester II

Mandatory Paper 5 (MBO2T01): Cytology and Genetics

Objectives

- To study the phenomenon of inheritance and principles of population genetics.
- To study the structure and organization of a typical and special chromosome.
- To study the chromosomal variations and their effect on the organisms.
- To study the nature, effect and applications of mutations in plants.

Outcomes

- The student interprets the observations in nature in the light of laws of genetics and/orunderlying cytological aspects.
- The student employs the knowledge of Genetics and induced mutations for crop improvement.

Semester II

Mandatory Paper 6 (MBO2T02): Plant Physiology and Biochemistry

Objectives

- To get an in-depth view of the biological processes occurring in the plants and the factorsaffecting the plant life.
- To understand the nature and mechanism of enzyme action.
- To understand the structure and role of the major molecules in plant cells.

Outcomes

- The student realises the role and mechanism of physical and chemical factors affecting theplant life.
- The student learns about the diversity of the biological molecules.
- The student develops strategies to mitigate the adverse effect of environmental stresses onplants.

Semester II

Elective Paper 7 (MBO2T3): Cell biology

Objectives

- To study the ultrastructure and function of the cell envelope, organelles and cytoskeleton.
- To study the structure, replication and repair of DNA.
- To study the cellular responses of plants towards the stresses.

Outcomes

- The student is acquainted with the details of the structure and role of the cell organelles.
- The student is acquainted with the structure of DNA and the mechanisms involved in its replication and protecting its structure.
- The student is equipped with the effect of stress on plants.
- The student is able to devise the strategies to mitigate the adverse effect of the stress on the plants.

Semester II

Mandatory Lab 3 (MBO2L2): Plant physiology, Molecular biology, Plantbiotechnology, Plant breeding

Objectives

- To impart student the skills to prepare solutions, buffers etc. to carry out a scientific investigation.
- To instil the skills in the student to set-up the experiment and collect the data.
- To give hands-on experience to the student in molecular techniques and to handle basic equipment and apparatuses in the laboratory.
- To equip the student to evaluate the data and interpret the results.

Outcomes

- The student learns to prepare buffers, solutions and carries-out the experiment.
- The student is trained in routinely used molecular techniques.
- The student learns to handle the equipment in the laboratory.
- The student is able to present the data and interpret the results.

Semester II

Mandatory Lab 4 (MBO2L3): Plant development & reproduction, Taxonomy, Ecology

Objectives

- To study the variation in structure of plant and its reproductive characters.
- To study the local flora by undertaking field tours.
- To learn the technique to describe and identify the plant.
- To undertake ecological investigations.

Outcomes

- The student studies the morphology, anatomy and embryology of the local plants.
- The student learns the biostatistical computations.
- The student is acquainted with the techniques and equipment to study the ecosystem andto describe & identify the plant.
- The student becomes familiar with the local flora and prepares the field report.

Course Outcomes: M.Sc. Chemistry
(NEP) (Effective from 2023-24)

https://nagpuruniversity.ac.in/writereaddata/fckimagefile/CHEMISTRY%20SYLLABUS_compressed.pdf

Department of Chemistry	After successful completion of two years PG degree program in the subject Chemistry, the students are able to:

SEMESTER I

Paper 1

MCH1T01: Inorganic Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students would be able to

1. *predict the nature of bond and its properties through various electronic structural methods; bonding models*
2. *design new coordination compounds based on a fundamental understanding of their electronic properties*
3. *develop the possible catalytic pathways leading to desired products*
4. *apply the principles of transition metal coordination complexes to derive reaction mechanisms.*

SEMESTER I

Paper 2

MCH1T02: Physical Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to

1. Understand, analyze and exercise the principles of classical thermodynamics in various applications
2. Understand and execute the quantum mechanical problems and their applications
3. Understand the concept of adsorption and its application in surface chemistry
4. Analyze and understand the characterization techniques for polymer
5. Understand the principles of chemical kinetics and their applications in chemical dynamics

SEMESTER I

Paper 3 (Elective)

MCH1T03: (a) Bioinorganic Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student would be able to

1. *apply the principles of transition metal coordination complexes in understanding functions of biological systems*
2. *identify the medicinal applications of inorganic compounds*
3. *understand mechanism of energy transfer processes in biological systems*
4. *develop the possible enzymatic pathways in biosystems*
5. *explain oxygen transport mechanisms in biosystems*

SEMESTER I

Paper 3 (Elective)

MCH1T03: (b) Biomolecules

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students would be able to

1. Draw the structures of essential biomolecules
2. Understand the role of biomolecules in various life processes
3. Understand the way how drug can be administrated, absorbed, distributed and metabolized
4. Understand the relation of drug with different types of receptors, chemical messengers, binding site and DNA.

SEMESTER I

Paper 3 (Elective)

MCH1T03: (c) Foundations of Thermodynamics and Electrochemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to

1. Understand, the mathematical concepts used in chemistry
2. Understand the principle involved in fundamental physical chemistry
3. Understand the concept of ideal and non-ideal solutions
4. Understand the theories of electrolytes

SEMESTER I

Paper 3 (Elective)

MCH1T03: (d) Analytical Separation Techniques

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to

1. *Understand various separation technique based on sample and target analyte*
2. *Elaborate the working principles of various separation techniques.*
3. *Apply logic behind working and applicability of each technique.*
4. *Identify most suitable separation tool resolution of mixtures.*
5. *Develop separation methods for multicomponent analysis.*

SEMESTER I

Paper 4

MCH1T04: Research Methodology

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student will be able to

- understand what research is and what is not.
- raise awareness of crucial aspect of the nature of Knowledge and the value of scientific method.
- Introduce the concept at the heart of every research project – the research problem - and to discuss what a researchable problem is.
- evaluate literature, form a variety of sources, pertinent to the research objectives.
- identify and justify the basic components of the research framework, relevant to the tackled research problem.
- explain and justify how researchers will collect research data.
- discuss how to cite sources, and justify this choice.
- put forward a credible research proposal, and
- warn the common mistakes in the field of research methodology.

Practical 2

MCH1P02: Physical Chemistry including RM

6 h per week *100 Marks*

Course Outcomes: At the end of the course students would be able to

1) Understand the basic principle involved in physical chemistry.
2) Evaluate various physical parameters
3) Interprete the experimental results.
4) Calculation involved in inpreting results

Understand the concept of Qualitative analysis

SEMESTER II

Paper 5

MCH2T05: Organic Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to

1. Implement rules of aromaticity to organic molecules
2. Sketch organic molecules in different projection formula and assign its configuration.
3. Apply their understanding about the organic reactions of industrial significance with respect to the chemo- selectivity, regioselectivity and enantioselectivity.
4. Analyze the product distribution and the stereochemistry of various organic products.
5. Evaluate the relationship between structure and reactivity

SEMESTER II

Paper 6

MCH2T06: Analytical Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to-

1. *Select a specific analytical technique based on sample and target analyte*
2. *Develop analytical ability and critical thinking in selection of statistics and their use in making interpretation meaningful and productive.*
3. *Explain the logic behind working of indicator used in each type of titration*
4. *Elaborate interaction of radiation with matter and its application in chemical analysis.*
5. *Develop spectral methods of analysis for desired analytes.*
6. *Apply electroanalytical techniques based on conductance and emf measurements.*

SEMESTER II

Paper 7 (Elective)

MCH2T07: (a) Solid state and organometallic chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student would be able to

1. *Understand the structures of various types of solids.*
2. *Establish structure-property correlation in solids.*
3. *unravel and interpret the structural aspects of metal clusters.*
4. *Explain structures and applications of organotransition compounds,*
5. *predict the mechanism of complex reactions.*
6. *establish the thermodynamic and kinetic stability of reactants and products in complex reactions.*

SEMESTER II

Paper 7 (Elective)

MCH2T07: (b) Organic Reaction Mechanism

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to

1. Predict the orientation and stereochemistry of the product of addition and elimination reaction
2. Apply enolate chemistry to achieve molecular complexity
3. Design organic reactions in order to achieve the required product(s)
4. Formulate green chemistry synthesis to increase atom economy
5. Application of free radicals in functional group transformation

SEMESTER II

Paper 7 (Elective)

MCH2T07: (c) Quantum, Statistical and Nuclear Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to

1. Understand, the concept of statistical thermodynamics and their uses.
2. Understand the quantum mechanical applications in actual practice and in spectroscopy
3. Understand the thermodynamics of real processes
4. Understand the distribution laws and their applications
5. Understand the fundamentals of Nuclear sciences

SEMESTER II

Paper 7 (Elective)

MCH2T07: (d) Instrumental Methods of Analysis

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to -

1. *Understand the importance of sampling and sample treatment.*
2. *Select appropriate sampling technique based on sample and target analyte.*
3. *Explain principle and instrumentation involved in AAS.*
4. *Deduce the necessity to remove interferences in AAS and methods involved .*
5. *Select proper technique among the available techniques.*
6. *Formulate experiments based on optical and electroanalytical techniques.*

SEMESTER II

Practical 4

MCH2P04: Organic Chemistry

6 h per week *100 Marks*

Course Outcomes: At the end of the course students would be able to

5) Handling of the hazardous chemicals by safely
6) Predict and analysis of the major and minor products of a variety of organic reactions
7) Monitoring of the chemical reactions
8) Calculation of yield, percentage yield of the chemical reactions
9) Understand the concept of Qualitative analysis

SEMESTER II

Practical 5

MCH2P05: Analytical Chemistry

6 h per week *100 Marks*

Course Outcomes: At the end of the course, student will be able to

1. *Carry out calibration of glassware available in the laboratory.*
2. *Analyze the data obtained through experiments using statistical analysis parameters.*
3. *Estimate quantitatively analyte present in different samples using classical and instrumental methods of analysis.*
4. *Design experiments based on classical and instrumental techniques.*
5. *Understand the principles involved in visual and instrumental volumetric techniques.*
6. *Formulate experiments based on optical and electroanalytical techniques.*

Program Outcomes, Course Objectives & Outcomes:
M.Sc. Computer Science
(NEP) (Effective from 2023-24)

https://nagpuruniversity.ac.in/writereaddata/fckimagefile/MSC_Computer_Science_Syllabus_NEP_2020.pdf

Department of Computer Science	After successful completion of two year degree PG program in Computer Science, the students are able to:

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. The ability to apply theoretical foundations of Computer Science and problem-solving skills through programming techniques for complex real time problems using appropriate data structures and algorithms.
2. The ability to design/develop hardware and software interfaces along with database management to meet the needs of industry.
3. The ability to demonstrate personal, organizational and entrepreneurship skills through critical thinking, engage themselves in life-long learning by following innovations in business, science & technology
4. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

M. Sc. (Computer Science)
Semester I

MCS1T01
Paper I : ARTIFICIAL INTELLIGENCE

Hours/Week : 4
Credits : 4

Course Objectives:
1. To impart artificial intelligence principles, techniques and its history.
2. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems.
3. To develop intelligent systems by assembling solutions to concrete computational problems

Course Outcomes:
1. Evaluate Artificial Intelligence (AI) methods and describe their foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
3. Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.
4. Analyze and illustrate how search algorithms and planning play vital role in problem solving.

M. Sc. (Computer Science)
Semester I

MCS1T02
Paper II : COMPILER CONSTRUCTION

Hours/Week : 4
Credits : 4

Course Objectives :
1. To gain knowledge on Language Processor.
2. Distinguish different computing models and classify their respective types
3. Show a competent understanding of the basic concepts of Syntax Analysis.

Course Outcomes :
1. Demonstrate the knowledge of Lexical Analysis
2. Derive an appropriate model of code generation.

M. Sc. (Computer Science)
Semester I

Elective 1 : MCS1T03
Paper III : COMPUTER ARCHITECTURE AND ORGANIZATION

Hours/Week : 4
Credits : 4

Course Objectives:
1. To provide knowledge on overview of IAS computer function and addressing modes.
2. Hardware and software implementation of arithmetic unit to solve addition, subtraction, multiplication and division.
3. To provide knowledge of memory technologies, interfacing techniques and sub system devices.

Course Outcomes:
1. Provide fundamentals on machine instructions and addressing modes.
2. Comprehend the various algorithms for computer arithmetic.
3. Analyse the performance of various memory modules in memory hierarchy.
4. Compare and contrast the features of I/O devices and parallel processors.
5. Outline the evaluation of memory organization.
6. Analyse the performance of Arithmetic logic unit, memory and CPU.

M. Sc. (Computer Science)
Semester I

Elective 1 : MCS1T03

Paper III : DISCRETE MATHEMATICAL STRUCTURE

Hours/Week : 4
Credits : 4

Course Objectives:

1 To cover certain sets, functions, relations and groups concepts for analyzing problems that arise in engineering and physical sciences.
2 To imparting to analyze the problems connected with combinatorics and Boolean algebra.
3 To solve calculus and integral calculus problems.

Course Outcomes:

1. Observe the various types of sets, functions and relations.
2. Understand the concepts of group theory.
3. Understand the concepts of combinatorics.
4. Understand the concepts of graph theory and its applications.
5. Learning logic and Boolean algebra. Using these concepts to solve the problems

M. Sc. (Computer Science)
Semester I

MCS1T04

Paper IV : RESEARCH METHODOLOGY

Hours/Week : 4
Credits : 4

Course Objectives:

1. To study and understand the research issues & challenges, research goals, scientific methods
2. To study processing and analysis of data, Quantitative and Qualitative data analysis.
3. Reviewing Literature and research papers, writing research papers, Thesis reports.

Course Outcomes:

1. The basic concept of research and its methodologies, Identify appropriate research topics, select and define appropriate research problem and parameters.
2. Prepare a project (to undertake a project)
3. Organize and conduct research in a more appropriate manner, writing research report and thesis.

M. Sc. (Computer Science)
Semester II

MCS2T05
Paper I : CLOUD COMPUTING

Hours/Week : 4
Credits : 4

Course Objectives:
1. To Understand fundamentals of cloud computing
2. To acquire good working knowledge of the essentials of Cloud Micro Services
3. To implement business specific cloud applications

Course Outcomes:
1. Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
2. Compare the advantages and disadvantages of various cloud computing platforms.
3. Program data intensive parallel applications in the cloud.
4. Analyze the performance, scalability, and availability of the underlying cloud technologies and software.
5. Identify security and privacy issues in cloud computing.

M. Sc. (Computer Science)
Semester II

MCS2T06
Paper II : MACHINE LEARNING

Hours/Week : 4
Credits : 4

Course Objectives:
1. Ability to comprehend the concept of supervised and unsupervised learning techniques
2. Differentiate regression, classification and clustering techniques and to implement their algorithms.
3. To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.

Course Outcomes:
1. Understand the concepts of various machine learning strategies.
2. Handle computational data and learn ANN learning models.
3. Solve real world applications by selecting suitable learning model.
4. Boost the performance of the model by combining results from different approaches.

M. Sc. (Computer Science)
Semester II

Elective 2 : MCS2T07
Paper III : R PROGRAMMING

Hours/Week : 4
Credits : 4

Course Objectives:
1. This course introduces R, which is a popular statistical programming language.
2. The course covers data reading and its manipulation using R, which is widely used for data analysis. It also covers different control structures and design of user-defined functions. Loading, installing and building packages .

Course Outcomes :
1. Develop an R script and execute it
2. Install, load and deploy the required packages, and build new packages for sharing and reusability
3. Extract data from different sources using API and use it for data analysis
4. Visualize and summarize the data
5. Design application with database connectivity for data analysis

M. Sc. (Computer Science)
Semester II

Elective 2 : MCS2T07
Paper III : NEURAL NETWORK

Hours/Week : 4
Credits : 4

Course Objectives:
1. To introduce the foundations of Artificial Neural Networks
2. To learn various types of Artificial Neural Networks

Course Outcomes:
1. Ability to understand the concepts of Neural Networks.
2. Ability to select the Learning Networks in modeling real world systems

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Program Outcomes, Program Specific Outcomes & Course Outcomes:
M.Sc. Mathematics
(NEP) (Effective from 2023-24)

https://nagpuruniversity.ac.in/writereaddata/fckimagefile/Mathematics%20NEP-signed.pdf

Department of Mathematics	After successful completion of two years PG degree program in the subject Mathematics, the students are able to:

PROGRAM: M. Sc. Mathematics

Program Outcome:

PO1. Critical Thinking: *Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.*

PO2. Problem Solving: *Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from mathematics/ sciences/social sciences/humanities.*

PO3. Individual and Team Work: *Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.*

PO4. Ethics: *Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.*

PO5. Self-directed and life-long learning: *Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.*

PO6. Design/Development of Solutions: *Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.*

PO7. Computational Thinking: *Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.*

PO8. Aesthetic Engagement: *Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.*

Program Specific Outcome:

PSO1: ***Rational Thinking****: Students be able to formulate and develop Mathematical arguments in a logical manner to unravel the gist hidden in the problem at hand.*

PSO2: ***Problem solving ability****: Student should be able to think in a critical manner to process the data, and develop Mathematical problem-solving ability.*

PSO3: ***Revisiting the question****: Students should be able to recall basic facts, important milestones, discoveries in Mathematics and inculcate habit of rational thinking by which the problem at hand can be revisited, time and again, that helps in solving it.*

PSO4: ***Analytical ability****: In the growing field of research, it is necessary for students to learn to use some packages like Matlab, Scilab, Mathematica, Maxima, etc, so that analytical tools be available to investigate the functions, problems through graphs, programming, etc.*

PSO5: ***Numerical Ability****: Using packages, students can make programs to solve some problems of which exact solutions are not available, using tools of Numerical analysis.*

PSO6: ***Simulation Ability****: The problems that cannot be solved directly, can at times be solved through techniques of simulation by students.*

PSO7: ***Research****: Students thus motivated would prepare themselves for research studies in Mathematics and related fields.*

PSO8: ***Application****: Student will be able to apply their skills and knowledge in Mathematics to various fields of studies including, science, engineering, commerce and management etc.*

M.Sc. Semester I (MATHEMATICS)

M1: ALGEBRA

Sem I Paper - I DSC (Core) Code: MMT1T01	*Course Outcomes:* *CO1:* ***Foundational Knowledge****: Students will be able to update their basics of Group Theory, Discuss on various topic of group in algebra.* *CO2:* ***Elementary Skills****: Students will be able to understand the importance of Solvable and Nilpotent, Alternating groups.* *CO3:* ***Basic Analytic skills****: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving on Sylow theorems.* *CO4:* ***Application****: By applying the principles of basic theorems of Algebra through the course curriculum, students can solve a variety of logical problems in science and engineering.*	Credit: 4 No. of hours 60

M.Sc. Semester I (MATHEMATICS) **M2: TOPOLOGY**		
Sem I Paper - II DSC (Core) Code: MMT1T02	*Course Outcomes:* *CO1: **Foundational Knowledge:** Students will learn the basic concepts of topological space, metric spaces, product topology, closed sets, limit points and continuous function. Students will also get to know about interrelating these concepts with one another.* *CO2: **Elementary Skills**: Students will study about the connectedness of topological spaces. They will get to know about connectedness on real line with standard examples* *CO3: **Basic Analytic skills**: Students will study about covering spaces and relate it with compactness of the spaces. Students will gain analytical skill to relate compactness on real line, limit point compactness and local compactness.* *CO4: **Application**: Students will be able to think critically and apply the knowledge of topological spaces in the study of analysis and will be able to prove the standard results regarding countability and separation axioms.*	Credit: 4 No. of hours 60

M.Sc. Semester I (MATHEMATICS) **M3: ORDINARY DIFFERENTIAL EQUATION**		
Sem I Paper - III DSC (Core) Code: MMT1T03	*Course Outcomes:* *CO1: **Foundational Knowledge**: Students will be able to study basic notions in Differential Equations and use the results in developing advanced mathematics.* *CO2: **Elementary Skills**: Students will able to solve problems modeled using linear differential equations having ordinary points and regular singular points and solve them by method of power series.* *CO3: **Basic Analytic skills**: The main outcome of the course is to equip students to develop techniques to solve differential equations that would help students sharpen their understanding of the Mathematical solutions with their characteristics.* *CO4: **Application**: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems involving ordinary differential equations in science and engineering.*	Credit: 4 No. of hours 60

M.Sc. Semester I (MATHEMATICS) PRACTICAL - I **COMPUTATION WITH C /C++**		
Sem I Practical – 1 Code: MMT1P01	*Course Outcomes:* *Upon successful completion, students will have the knowledge and skills to:* *CO1. Execute C /C++ programs involving logical statements.* *CO2. Operate Mathematical operations and Logical operators in determining the general output of the problem.* *CO3. Determine roots of a cubic equation in general perspective.* *CO4. Understand in depth nuances of programming that would help them gain confidence and avail them job opportunities.*	Credit: 2 No. of hours 60

M.Sc. Semester I (MATHEMATICS) (ELECTIVE – I) **M4: INTEGRAL EQUATIONS** (Option – A)		
Sem I **Paper - IV** **DSE (Elective 1)** **Code:** **MMT1T04**	*Course Outcomes:* *CO1: **Foundational Knowledge**: The new concept of 'Integral Equations' will be introduced to students in which they will study different types of integral equations and various methods to solve them. Also, they will be taught integral transforms such as Hilbert transform.* *CO2: **Elementary Skills**: Students will be able to understand integral equations with different types of kernel and will be able to recognize their solving methods.* *CO3: **Basic Analytic skills**: The main outcome of the course is to teach student about integral equations and solving them using various transforms such as Laplace transform, Fourier transform, Hilbert transform, etc.* *CO4: **Application**: By applying the solving techniques, students can solve Fredholm Integral equations, Volterra Integral equations, Non-linear Integral equations and Integro-differential equations.*	**Credit 4** **No. of hours** 60

M.Sc. Semester I (MATHEMATICS) (ELECTIVE – I) **M4: FUZZY MATHEMATICS** (Option -B)		
Sem I Paper - IV DSE (Elective 1) Code: MMT1T04	*Course Outcomes:* *Upon successful completion, students will have the knowledge and skills to:* *CO4. Interpret problems involving uncertainty and its quantification.* *CO5. Understand fuzzy numbers and fuzzy arithmetic.* *CO6. Implement fuzzy logic in various problems involving uncertainty.* *CO4. Understand fuzzy systems and fuzzy control.*	Credit 4 No. of hours 60

. Semester I (MATHEMATICS) **M5: RESEARCH METHODOLOGY IN MATHEMATICS**		
Sem I **Paper - V** **Research** **Code:** **MMT1T05** (Mandatory)	Course Learning Outcomes: *Upon successful completion, students will have the knowledge and skills to:* *CO1. Recall and describe the fundamental concepts and principles of mathematics. Understand the research approaches and their significance in various fields and the different types of research designs and their characteristics.* *CO2. Apply research methods and approaches to investigate mathematical phenomena.* *CO3. Analyze the effectiveness and clarity of scientific communication and presentations.* *CO4. Describe the roles and dynamics within a group process, including teamwork and collaboration.* *CO5. Explain the concept of sponsored research and its implications for research ethics.*	**Credit** **3** **No. of hours** 45

M.Sc. Semester I: **PRACTICAL ON RESEARCH METHODOLOGY**		
Sem I **Practical** **Code:** **MMT1T05** **P** (Mandatory)	**Course Outcomes:** *Upon successful completion, students will have the knowledge and skills to:* *CO1: Demonstrate installation and compilation of free Miktex software and Tex studio.* *CO2: Implement their knowledge of Latex in preparing Tex documents which can be converted into .pdf or .dvi files* *CO3: Prepare question papers of the examination* *CO4: Develop research article as per the learnings from research methodology.*	**Credit** **1** **No. of hours** 15

MSc Sem – II (Mathematics) Syllabus follows:

M.Sc. Semester II (MATHEMATICS) **M6: REAL ANALYSIS**		
Sem II Paper - I DSC (Core) Code: MMT2T06	*Course Outcomes:* *CO1:* ***Foundational Knowledge****: Students will be able to update their basics knowledge in sequence, series, limit, continuity and differentiability.* *CO2:* ***Elementary Skills****: Students will be able to understand the importance of uniform convergence and topological manifold.* *CO3:* ***Basic Analytic skills****: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving with functions of several variables.* *CO4:* ***Application****: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems involving Manifold, sub-manifold and differentiable manifold.*	Credit 4 No. of hours 60

M.Sc. Semester II (MATHEMATICS) **M7: DIFFERENTIAL GEOMETRY**		
Sem II Paper - II DSC (Core) Code: MMT2T07	*Course Outcomes:* *CO1:* ***Foundational Knowledge****: Students will be introduced to the fundamentals of Differential Geometry primarily by focusing on the theory of curves and surfaces in three-dimensional space.* *CO2:* ***Elementary Skills****: Students will be study about the curves and their global properties. Students will get to know about Geodesic curve and its existence conditions.* *CO3:* ***Basic Analytic skills****: Students will get the knowledge of fundamental quadratic forms of a surface, intrinsic and extrinsic geometry of surface, problem of Metrization and Triangulation.* *CO4:* ***Application****: By applying various definitions, theorems and formulas, students can solve different problems based on curved surfaces and their curvatures. It can be further used to analyse shapes and data on non-flat surfaces.*	Credit 4 No. of hours 60

M.Sc. Semester II (MATHEMATICS) **M8: ADVANCE NUMERICAL METHODS**		
Sem II Paper - III DSC (Core) Code: MMT2T08	*Course Outcomes:* *CO1:* ***Foundational Knowledge:*** *Students will learn the basic methods and tools of numerical methods in root finding for linear and non-linear equations. They will learn about Newton's method, Muller's method and System of non-linear equations.* *CO2:* ***Elementary Skills****: Students will develop skills in analysing the methods of interpolation for a given data using polynomial interpolation, Newton's divided difference, forward differences and Hermite interpolation.* *CO3:* ***Basic Analytic skills****: Students will develop skills to approximate a function using appropriate theorems and numerical methods as a solution to the problems.* *CO4:* ***Application****: Students will be able to think critically to use Trapezoidal rule, Simpson's rule and Newton cotes integration formula for solving Mathematics modelling problems. They will be able to compare results of the problems by different methods.*	Credit 4 No. of hours 60

MSc Semester- II: PRACTICAL: 2 **NUMERICAL SOLUTIONS WITH COMPUTER PROGRAMMING** (MATLAB / R PROGRAMMING / PYTHON, etc.)		
Sem II Practical - III Code: MMT2P02	**Course Outcomes:** *Students will able to:* *CO1: Learn about the application of numerical method.* *CO2: Understand Newton's method, Muller's method and solve System of linear and non-linear equations.* *CO3: Find the errors in the solution so obtained by various methods.* *CO4: Derive Numerical integration using Trapezoidal rule, Simpson's rule, Newton-Cotes formulae.* *CO5: Apply approximate numerical methods to solve the problems with more accuracy.* *CO6: Learn how to obtain solution of ordinary and partial differential equations numerically.* *CO7: Compare different methods in numerical analysis efficiently.*	Credit 2 No. of hours 60

M.Sc. Semester II (MATHEMATICS) (Elective-II) **M9: CLASSICAL MECHANICS (Option A)**		
Sem II Paper - IV DSE (Elective-2 MMT2T09	*Course Outcomes:* *CO1:* ***Foundational Knowledge****: Students will be able to update their basics of variational principle.* *CO2:* ***Elementary Skills****: Students will be able to understand the importance of Lagrange's equation of motion.* *CO3:* ***Basic Analytic skills****: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving using Lagrange's and Hamilton's equations of motion.* *CO4:* ***Application****: By applying the course curriculum, students can solve a variety of practical problems in research.*	Credit 4 No. of hours 60

M.Sc. Semester II (MATHEMATICS) (Elective-II) **M9: OPERATION RESEARCH**		
Sem II Paper - IV DSE (Elective-2) Code: MMT2T09	*Course Outcomes:* *CO1:* ***Foundational Knowledge****: Students will be able to update their basics of computational procedures of Linear Programming Problem.* *CO2:* ***Elementary Skills****: Students will be able to understand the importance of efficient computational procedures. Revised simplex method is a modification of the simplex method and students would know that it is economical on computer as it computes only relevant information.* *CO3:* ***Basic Analytic skills****: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving using a modified computational procedure.* *CO4:* ***Application****: By applying the Revised simplex method and Network techniques through the course curriculum, students can solve a variety of practical problems in business, research and development, production & investment Marketing and engineering.*	Credit 4 No. of hours 60

M.Sc. Semester II (MATHEMATICS) PRACTICAL - 3 **ON JOB TRAINING / FIELD PROJECT**		
Sem II Practical -IV Code: MMT2P03	*Course Outcomes:* *On completion of course, Students will be able to:* *CO1: Acquire hands on training* *CO2: Know different aspects of the Institute/Industry involved in it* *CO3: Learn how to work in Team set up* *CO4: Develop aspiration to work up the ladder in the Institute/ Industry*	Credit 4 No. of hours 120

Program Outcomes & Course Outcomes: M.Sc. Microbiology
(NEP) (Effective from 2023-24)

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Department of Microbiology	After successful completion of two years degree program in the subject Microbiology, the students are able to:

M. Sc. Semester-I
Discipline Specific Core Course (DSC-1)-MICROBIOLOGY –Paper I (MMI1T01) (MICROBIAL METABOLISM)

Course Outcomes: At the end of the course the students will be able to

1. Understand the biochemical basis of life forms
2. Learn the energy transformations in biological processes
3. Understand the synthesis of biomolecules
4. Understand synthesis and breakdown mechanisms in bacteria

M. Sc. Semester-I
Discipline Specific Core Course (DSC-2)-MICROBIOLOGY –Paper 2 (MMI1T02) (ENZYMOLOGY AND TECHNIQUES)

Course Outcomes:

1. Students will be able to understand general characteristics of enzymes
2. Students will learn the different mechanisms of enzyme catalysis.
3. Students will be able to Gain an understanding of enzyme kinetics and regulation.
4. Students will be able to understanding the various biochemical techniques based on enzymes like biosensors

M. Sc. Semester-I
Discipline Specific Elective Course (DSE-1)-MICROBIOLOGY- Paper 3 (MMI1T03) (ADVANCE TECHNIQUES IN MICROBIOLOGY)

Course outcome: At the end of the course the students will be able to

1. Learn the basic biophysical techniques
2. Understand the design and working principle of various microscopes
3. Understand the bimolecular separation and identification techniques
4. Learn the advanced molecular techniques

M. Sc. Semester-I
Discipline Specific Elective Course (DSE-1)-MICROBIOLOGY- Paper 3 (MMI1T03) (MEMBRANE STRUCTURE AND SIGNAL TRANSDUCTION)

Course Outcome:

1. Students will understand the structures and components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will understand how the transport of molecules through cell membrane.
3. Students will understand different advance technique used for cell membrane study.
4. At the end of the course, the student has a strong foundation on the functions of the cell.

M. Sc. Semester-I
MICROBIOLOGY - Paper-4 (MMI1T04) (RESEARCH METHODOLOGY)

Course Outcomes:

After learning research methodology course, students will be able to

1. Identify and describe the characteristics of different types of research, including basic, applied, and patent-oriented research.
2. Apply scientific thinking and problem identification techniques in the research process.
3. Apply descriptive and inferential statistical analysis techniques to analyze and interpret research data and understand the concept of hypothesis and its importance in research, and apply appropriate research methods.
4. Develop skills in technical writing, research reporting, and the proper structure and organization of research documents and gain awareness of research ethics, academic integrity, and the importance of avoiding plagiarism and academic malpractice.

M. Sc. Semester-I
MICROBIOLOGY – PRACTICAL-1 (MMI1P01)

Course outcomes:

1. This course explains the enzyme activity determination of important hydrolytic enzymes.
2. Students will earn about the effect of different physical factors.
3. Students will able to isolate and purify the enzyme.
4. Students will able to isolate and identify Nitrogen fixing bacteria.
5. Students will be able to isolate Siderophore producing bacteria.

M. Sc. Semester-I
MICROBIOLOGY – PRACTICAL-2 (MMI1P02)

Course outcomes: After successful completion of this course, students will be able :

1. This course explains the techniques of protein biology
2. Students will learn about Subcellular organelles and isolation of Marker enzymes.
3. The performance of various molecular techniques will be understood
4. Students will learn various techniques of protein isolation and analysis techniques
5. Students will learn about techniques for Isolation and screening of industrially important microorganisms
6. Students will learn about statistical analysis of research data

M. Sc. Semester-II
Discipline Specific Core Course (DSC-3)-MICROBIOLOGY –Paper 5 (MMI2T05) (ENVIRONMENTAL MICROBIAL TECHNOLOGY)

Course Outcomes:

1. Be able to acquaint with microbial communities and their interaction.
2. Be able to know about role of microorganisms in treatment of waste materials.
3. Be able to know about the factors responsible for global warming.
4. Be able to know about restoration of degraded ecosystem.

M. Sc. Semester-II
Discipline Specific Core Course (DSC-4)-MICROBIOLOGY –Paper 6 (MMI2T06) (IMMUNOLOGY AND IMMUNODIAGNOSTICS)

Course outcome:

1. This course gives an overview on the immune system including organs, cells and receptors
2. The students learn about molecular basis of antigen recognition, hypersensitivity reaction, antigen-antibody reactions.
3. The course develops in the student an appreciation for principles of immunology andits applications in treating human diseases.

M. Sc. Semester-II
Discipline Specific Elective Course (DSE-2)-MICROBIOLOGY- Paper 7 (MMI1T03) (MICROBIAL METABOLITES)

Course Outcomes

1. Acquaint with basics of microbial metabolites, newer bioactive molecules and Immunomodulators.
2. Understand structure and mode of action of secondary metabolites.
3. Knows the concept of Quorum sensing.

M. Sc. Semester-II
Discipline Specific Elective Course (DSE-2)-MICROBIOLOGY- Paper 7 (MMI2T07) (PHARMACEUTICAL MICROBIOLOGY)

Course Outcomes:

1) Students will gain the knowledge regarding Drug discovery and drug development
2) Students will get knowledge about production of various types of enzymes antibiotic resistance and development of new therapeutic drugs to the students.
3) Students will have a deep insight into the antimicrobial agents and their mode of action.
4) Students get knowledge about Regulatory practices, biosensors applications in Pharmaceuticals and Quality Assurance

M. Sc. Semester-II
MICROBIOLOGY – PRACTICAL-3 (MMI2P03)

Course Outcomes:

1. Be able to perform techniques in environmental microbiology
2. Be able to understand different parameters in environment microbiology

M. Sc. Semester-II
MICROBIOLOGY – PRACTICAL-4 (MMI2P04)

Course Outcomes:

1. Be able perform various diagnostic technique in immunology.
2. Be able to gain knowledge of different bacterial diseases and their diagnosis

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Program Outcomes, Program Specific Outcomes & Course Outcomes: M.Sc. Physics

(NEP) (Effective from 2023-24)

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Department of Physics, RTMNU

Name of Programme: M.Sc Physics

Programme specific outcome

After completion of course, the student will be to:

PSO1: Understanding basic principles of Physics which are underlying a wide selection of physical phenomenon.

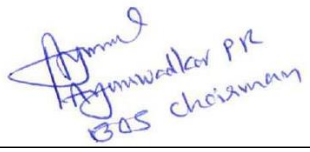
PSO2: Explore with current state-of-art in the selected area of Physics.

PSO3: Inculcate the habit to plan, design and execute new experiment. Analyze, interpret experimental result and write report on it.

PSO4: Assess the errors involved in an experiment work; searching out and adopting new methodology to reduce errors. Presents the experimental outcome in effective manner.

PSO5: After completing PG degree from this programme, they will be eligible to continue research at the higher degree (Ph.D) level. They will be trained by experimental, computer programming and data interpretation programming skill and exposed to improve their employability in research and development, in scientific and engineering industries.

PSO6: Additionally, they will have necessary numerical and transferable skills to select general career choice such as accounting or computing.



Programme matrix
Name of Programme: M.Sc Physics
(Low Correlation = L/1; Moderate Correlation = M/2 and High Correlation = H/3)

CO	Program Outcomes	Program Specific Outcomes (PSOs)					
	Course Name: 1T1 Mathematical Physics	Domain Specific					
		POS1	POS2	POS3	POS4	POS5	POS6
CO1	Curvilinear co-ordinate Systems, Physical ideas about gradient, Applications to the solution of differential equations.	H	M	H	M	H	M
CO2	Elementary ideas about tensors, Cartesian tensors, differential of Cartesian tensors, gradient, divergence and curl , Laplacian of Cartesian tensors, Laplace transform of elementary functions.	H	M	H	M	H	M
CO3	Linear vector spaces - linear independent bases, Dimensionality, inner product, matrices, linear transformation, Orthogonal and Unitary matrices, Cayley Hamilton theorem.	H	H	H	H	L	M
CO4	Linear differential equations, Special Function- Laguerre, Hermite, Legendre polynomials, Special Bessel's function.	H	M	H	H	M	M
	Course Name: 1T2:Complex Analysis and Numerical Methods	Domain Specific					
CO1	Solve simple problems involving complex algebra such as rationalization.	H	M	L	L	M	L
CO2	Given a function, determine if it is analytic. Integrate various functions using calculus of residues.	1	H	H	L	L	H
CO3	Compute pole expansion and product	M	L	H	M	L	M

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	expansion of certain functions.						
CO4	Find the roots of a given nonlinear function.	L	L	L	H	M	M
CO5	For a given data, fit a function, interpolate or extrapolate as necessary.	L	L	M	M	H	M
CO6	Solve ordinary differential equations. Compute integrals numerically .	M	M	M	L	L	H
	Course Name: 1T3:Electronic	Domain Specific					
CO1	Clear the conceptual knowledge of Semiconductor discrete devices, Bipolar junction transistor (JFET, MOSFET, SCR, UJT), Opto-electronic devices like Photo-diode, solar cell, LED, LCD and photo transistor.	H	L	L	L	H	L
CO2	Gains the knowledge of applications of semiconductor devices in linear and digital circuits, transistor as amplifier, coupling of amplifier, feedback in amplifiers and types of oscillators clipping and clamping circuits also gets the knowledge of transistor as a switch OR, AND and NOT and Gates.	M	H	L	L	M	L
CO3	Explores the field of Digital integrated circuits- NAND and NOR gates building block, simple combinational Circuits, Multivibrators, sweep generator, shift registers, counters, coverters, semiconductor memories (ROM, RAM, and EPROM) along with architecture of 8 bit microprocessor (INTEL 8085).	H		M			M
CO4	Gain understanding of Linear integrated circuits- Operational amplifier and its applications-Inverting and noninverting		H		M		M

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	amplifier, adder, integrator, differentiator, waveform generator, comparator and Schmittrigger, Butterwoth active filter, phase shifter.						
CO5	Understand the Communication Electronics in terms of Basic principle of amplitude frequency and phase modulation also Simple circuits for amplitude modulation and demodulation, digital (PCM) modulation and demodulation.	H	H				H
	Course Name: 1T4:Electrodynamics-1	**Domain Specific**					
CO1	Familiar with the static properties of electric and magnetic fields.	H	M	H	H	H	L
CO2	Understand the concept of electric field and they should be able to solve problems.	M	L	H	H	H	L
CO3	Familiar with the definition of electric current and electric current density. They should understand the important information contained in the equation of continuity and they should be able to solve simple problems involving this equation.	M	H	M	H	H	L
CO4	Understanding the concept of the magnetic field and be able to calculate this from given current distributions.	H	H	H	H	M	H
CO5	Understand how the Maxwell equations arise as a synthesis of the various individual electromagnetic phenomena and know how Maxwell's equations lead to electromagnetic waves.	H	H	H	H	M	H

Agarwalkar P R
BOS Chairman

	Course Name: 1=2T1: Quantum Mechanics I	Domain Specific					
CO1	construct operators in coordinate and momentum representation.	H	H	M	M	L	L
CO2	familiar with Dirac notation, notions of inner and outer product and basic mathematical structure.	H	H	L	M	M	L
CO3	write matrix representation for a given operator, understand various transformations and diagonalization.	M	L	H	L	L	M
CO4	Understand tunnelling, parity of eigenfunctions,	L	L	L	H	M	M
CO5	frame a radial equation for a given central force problem and solve it.	L	L	M	H	H	L
CO6	findClebsch-Gordon coefficients for addition of angular momenta.	L	L	M	M	L	H
	Course Name: Statistical Physics	**Domain Specific**					
CO1	Understand basics of theory of probability and statistical approach for thermodynamical properties.	H	H	H	H	M	M
CO2	Gain the knowledge of theory of indistinguishable particles for fifth state of matter i.e Bose Einstein condensate.	H	H	H	L	M	L
CO3	Demonstrate Fermi Dirac condensation on the basis of BCS theory and its application for free electron gas in metal.	H	H	H	L	M	L
CO4	Describe phase transition phenomenon using Ising model and Landau theory.	H	H	H	L	L	L
	Course Name: 2T3:Classical Mechanics	**Domain Specific**					

Arjunwadkar P K
BOS chairman

CO1	Solve simple systems by writing Lagrangian.	H	L	H	L	L	L
CO2	Understand cyclic coordinates, canonical transformations.	M	H	H	L	L	L
CO3	Compute Poisson brackets, interpret them.	L	L	L	H	H	M
CO4	Understand central force motion and interpret scattering cross-section.	L	L	L	M	H	M
CO5	Understand Euler angles, Inertia tensor. Compute equations of motion for simple coupled systems.	L	L	L	H	H	L
CO6	Learn Hamilton-Jacobi theory and its importance.	L	L	L	M	M	H
	Course Name: 2T4:Electrodynamics-II	**Domain Specific**					
CO1	Use of Maxwell equations in analysingthe electromagnetic field due to time varying charge and current distribution	H	H	M	M	H	L
CO2	describethe nature of electromagnetic wave and its propagation through different media and interfaces.	H	H	H	M	M	H
CO3	explaincharged particle dynamics and radiation from localized time varying electromagnetic sources	H	H	M	H	M	M
CO4	Formulate and solve electrodynamic problems in relativistically covariant form in four-dimensional space-time	H	M	H	M	H	H

Ajaymeshkar PR
BOS chairman

CO5	be familiar with some elementary phenomena and concepts in quantum electrodynamics.	H	H	H	M	H	M
	Course Name: 1=2T1 Quantum Mechanics I	**Domain Specific**					
CO1	Solve simple problems using perturbation theory.	H	H	M	M	L	L
CO2	Solve simple problems of perturbation theory, understand symmetries of wavefunction.	M	H	H	M	L	L
CO3	Solve simple problems involving time dependent perturbation.	L	H	H	M	M	L
CO4	Solve barrier problem using WKB method.	L	H	H	H	L	L
CO5	Understand the physical meaning of scattering coefficients. Difference between bosons and fermions.	L	L	L	M	H	M
CO6	know about Klein-Gordon equations, Dirac equations. Solve for Hydrogen atom using Dirac's theory.	L	L	L	L	M	H
	Course Name: 3T2 Solid state Physics and Spectroscopy	**Domain Specific**					
CO1	Clear basic concept of crystal classes, lattices, symmetries and to understand the relationship between real and reciprocal lattice.	H	H	M	M	L	M
CO2	Understanding the correlation of crystallography with experimental crystal study by Braggs conditions for X-ray diffraction.	H	M	H	H	L	L
CO3	Explore with the knowledge of different crystal defect and its influence on basic physical behaviour of crystals.	H	H	H	M	M	M

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CO4	Gain basic knowledge of dielectric properties of materials and learn the basic of the dielectric behaviour of various materials.	H	M	M	M	H	L
CO5	Describe the spectra of single and multiple electrons atoms including fine and hyperfine structure of alkaline, Helium like atoms, spin and relativity correction, different type of coupling such as L-S and J-J couplings.	H	M	M	M	L	L
CO6	Analyse the spectra of diatomic molecules such as electronic, rotational, vibrational spectra and a basic introductory idea about the Raman Spectroscopy.	H	H	H	M	M	H
CO7	Explain effect of electric and magnetic field on the atomic spectrum.	M	H	H	H	L	L
	Course Name: E1.2:X-rays-I	**Domain Specific**					
CO1	Basic concepts of production of X-rays, Designing concepts conventional of X-ray generators, Basics of Advanced radiation source Synchrotron and its advantages over conventional sources.	H	H	M	L	H	L
CO2	Understanding of interaction of X-rays with the matter, Applications of X-rays based on different physical processes involved after interaction of x-rays with matter.	H	H	H	M	H	L
CO3	Understanding the method of X-ray radiography and its applications in medical and industrial fields. Details of materials characterization techniques based on X-ray photoelectron/Auger electron spectroscopies and X- ray fluorescence spectroscopy.	H	H	H	M	H	L
CO4	Designing concepts of different x-ray spectrographs, Understanding the concepts and methods of x-ray detection. Gaining the knowledge to select proper spectrograph and detectors for particular application.	H	H	H	H	H	L
CO5	Different theoretical concepts regarding x-ray spectra and their interpretation. Knowledge about calculating relative intensities of spectral lines.	H	M	M	L	M	M
CO6	Interpretation of X-ray absorption spectra. Experimental techniques for obtaining X-ray absorption spectra and its important applications.	H	H	H	H	H	M
CO7	Understanding the concept of dispersion of X-rays and its significance.	H	L	L	L	H	L
	Course Name: E1.3:Nanoscience and Nanotechnology	**Domain Specific**					
CO1	Clear basic concept of quantum approach for density of states for quantum well, wires and dots.	H	M	H	H	H	
CO2	Understanding the different methods of synthesis of nanomaterials.	H	H	H	H	H	
CO3	Explore with the knowledge of different instrumentation useful to analyse	H	H	H	H	H	

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BOS chairman

Agnihotri PK
BOS chairman

	materials at nanoscale.						
CO4	Understanding the properties nanomaterials for technology application	H	M	H	H	H	
	Course Name: 4T1: Nuclear and Particle Physics	**Domain Specific**					
CO1	Clear basic concept of nuclear properties; its size, radii, shape charge distribution, spin, parity, mass, nuclear stability and also to understand binding energy, semi empirical mass formula, liquid drop model, laws of radioactive decay.	H	M	M	L	M	L
CO2	Understands elements of deuteron problem, n-n scattering, charge independence, and symmetry of nuclear forces along with electric and magnetic moments of nuclei.	H	M	H	M	L	L
CO3	Gains the knowledge of elementary particles, decay of nuclei, their classification, characteristics, selection rule and their theories.	H	H	H	L	M	L
CO4	Explores the field of nuclear reactions, conservation laws, mechanism, cross section, compound nucleus along with fission and fusion reactions, nuclear energy and elements of nuclear power.	H	M	L	L	L	L
CO5	Explains the interaction of char5ged particles and electromagnetic radiation with matter along with principles of radiation detectors including G-M Counter, proportional counter, Na(Tl) Scintillation detectors, semiconductor detectors.	H	H	M	M	L	L
CO6	Describe classification of elementary particles, strong, weak and electromagnetic interactions also will be able to understand Gellamann – Nishijima formula along with properties of elementary particles and their symmetry and conservation laws.	M	M	L	L	M	H

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CO1	Clear basic concept of nuclear properties; its size, radii, shape charge distribution, spin, parity, mass, nuclear stability and also to understand binding energy, semi empirical mass formula, liquid drop model, laws of radioactive decay.	H	M	L	L	L	L
	Course Name: 4T2 Solid State Physics	**Domain Specific**					
CO1	Band theory, Bloch theorem, the Kronig-Penney model, construction of Brillouin zones, extended and reduced zone schemes, Quantum theory of paramagnetism, exchange interactions. Pauli paramagnetic susceptibility.	M	H	H	M	H	H
CO2	Lattice dynamics, energy of atomic motions, adiabatic principle, harmonic approximation, Theories of lattice specific heat, Dulong and Petit'slaw, Einstein and Debye models.	H	M	M	H	H	H
CO3	Free electron theory, electrons moving in one and three dimensional potential wells, quantum state and degeneracy, density of states, electrical and thermal conductivity of metals, semiconductors, free carrier concentration in semiconductors, Fermi level and carrier concentration in semiconductors.	H	M	H	M	H	H
CO4	Superconductivity, Type I and II super conductors, Meissner effect, isotope	M	H	H	H	M	H

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	effect, London equation, coherence length, Josephson junction, high temperature superconductor.						
	Course Name: E2.2:4T3: X-ray-II	**Domain Specific**					
CO1	Concepts of crystal classes, lattices, symmetries, methods of Crystallographic Projections, Point groups, space groups and to understand the relationship between real and reciprocal lattice.	H	L	L	L	H	L
CO2	Conceptual understanding of different X-ray Scattering processes involved in X-ray diffraction.	H	M	L	L	M	L
CO3	Physical Basis of X-ray Crystallography, Different theoretical concepts to interpret and analyse x-ray diffraction pattern.	H	M	M	H	H	M
CO4	Demonstration of different X-ray diffraction based experimental techniques used for materials characterization.	H	H	H	H	H	M
CO5	Interpretation of different phase formation phenomenon in materials using x-ray diffraction technique.	H	H	M	L	H	L
CO6	Comparison of different diffraction techniques with that of x- diffraction. Advantages, disadvantages and applicability	H	H	M	M	H	L
	Course Name: E2.3: 4T3:Nanoscience and Nanotechnology II	**Domain Specific**					
CO1	Understanding the behaviour of materials at nanoscale and their use in different industrial application accordance with properties.	H	H	M	H	H	L

Ayumwedkar P K
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CO2	Familiar with concept of Nanophotonics and tuning the optical properties nanomaterials and their use in different applications.	H	H	H	H	M	L
CO3	Understand the concept of Nanomagnetics and magnetic properties of nanomaterials.	H	L	M	H	H	L
CO4	Understanding the electronic properties of nanomaterials and how to use these properties in making the electronic devices of current trends.	H	M	H	H	H	M
CO5	be familiar with different nanocomposite materials and their synthesis techniques and the need of nanocomposite for current and future applications.	H	L	H	M	H	M
	Course Name: S2.2-4T4:Experimental Techniques in Physics	**Domain Specific**					
CO1	Explain different types of radiation, their sources and detectors which are commonly used in experimental techniques.	H	H	M	H	H	H
CO2	Clear the conceptual understanding of functionality of different types of sensors.	I	H	M	L	M	L
CO3	Demonstrate different X-ray and thermal analysis based experimental techniques used for materials characterization in Physics	H	H	M	L	M	M

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CO4	Describe different electron microscopic techniques for morphological studies of materials.	M	M	H	L	H	M
CO5	Gain understanding of magnetic behaviour of materials and different tools for magnetic characterization of materials.	H	L	L	L	M	H
CO6	Explore with different spectroscopic analysis techniques	M	M	H	H	H	M

Ajmwadkar P R
BOS chairman

Dr. A. A. Halder
IQAC Coordinator
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Science College, Nagpur

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Dr. O. S. Deshmukh
Principal
S. S. E. S. Amravati's
Science College, Nagpur.

Program Outcomes, Program Specific Outcomes & Course Outcomes: M.Sc. Zoology

(NEP) (Effective from 2023-24)

https://nagpuruniversity.ac.in/writereaddata/fckimagefile/ZOOLOGY%20SYLLABUS-08142023163842_compressed%20(1).pdf

Department of Zoology	After successful completion of two years PG degree program in the subject Zoology, the students are able to:

Program Outcomes (POs)

PO 1- M.Sc. program produces post-graduates who have great readiness in playing active role either in government or non-government organization by designing processes/strategies that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 2-Students developed analytical and creative thinking from the conducive research environments and interacting with scholars/ faculties that will help in identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 3- To use research-based knowledge and research methods including review research literature, accession of primary literature,identify relevant works for a particular topic, design of experiments, analysis, evaluation and interpretation of scientific data, and synthesis of the information to provide valid conclusions in real situations.

PO 4- To empower students to create, select, and apply appropriate techniques, resources, and ICT tools for understanding of the science.

PO 5- Apply ethical principles and commit to professional ethics and responsibilities and norms of the work/research practice. Also, to promote learning and research aptitude and attitude to serve the society.

PO 6- Students are encouraged to develop an analytical mind as they ask questions, take part in topic-based quiz and debates, and are made aware of recent study and research on relevant topics.

PO 7- To enhance the ability of writing research project activities, problem-solving, to design and carry research project.

PO 8- M.Sc. program produces post-graduates who have great confidence which allows them to have a positive and realistic perception of themselves and their abilities in the scientific and social environment.

PO 9- Students acquiring skill-based education will make them self-employable and can generate employment.

PO 10- Students are encouraged to develop analytical and critical thinking minds which will help to develop scientific temperament in the community.

Program Specific Outcomes (PSOs)

PSO 1-Students will acquire techniques and skills to implement the knowledge in the design and execution of research in different branches of Zoology. This will help in careers related to teaching, research in Zoology; as well as in having innovative ideas and necessary training to initiate unique start-ups and entrepreneurship in the realm of life sciences.

PSO 2- To learn and apply the ethics in animal handling, during laboratory practices and experimentation.

PSO 3- In addition to the curriculum, the students will also gain skill-based learning, practical knowledge to facilitate experiments in the subject Zoology.

PSO 4- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. Demonstrate knowledge and understanding of Zoology and management principles and apply these to one's own work, as a member and leader in a team.

PSO 5- To acquired knowledge across a broad range of Zoology including recent trends which will help to solve the scientific problem logically in the context of biological process. Thus, leading to self-directed learning and evaluation.

PSO 6- Perform laboratory procedures as per standard protocols in various areas of Zoology including Animal Diversity, Cell Biology, Genetics, Molecular Biology, Physiology, Developmental Biology, Comparative Endocrinology, Immunology, Mammalian Reproductive Physiology, Fish and Fisheries and Entomology.

PSO 7- Understand the applications of zoological science in Apiculture, Sericulture, Lac culture, Fish and Fisheries, Mammalian Reproductive Physiology and Animal Physiology.

PSO 8- Develop knowledge and understanding of living organisms at several levels of Zoological and Biological organization from molecular level, through cells and ultimately the whole organisms and its impact on ecosystems.

PSO 9- To develop interest and elective modules by selecting specialization in various aspects and understanding the methods of zoological research.

PSO 10- The M. Sc. Program will lead the students to impart a scientific temperament which will help them to add new scientific knowledge/information in the field of Zoology research.

M.Sc. Zoology Semester-I

MZO1T01 Paper- Biology of Non- Chordata

Course Outcomes (COs)

Students will be able to identify, classify, describe, discuss and explain invertebrate specimen in the field as well as maintain and organize museum specimen. Develop a skill to demonstrate and explain different anatomical systems, physiological body processes and diversity of invertebrates, animal architecture and functions. Create the awareness of the economic importance, significance and explain structural and functional relationship between invertebrate phyla. Assess and evaluate a taxonomic status of primitive members of arthropods and molluscs. Describe and analyze the sea star's body plan, elucidate the origins and evolutionary significance of echinoderm larval forms, comprehend the mechanism of movements based on fluid filled cavities in invertebrates and identify and classify minor invertebrate specimen. Perform the whole mount preparations of given invertebrate material.

MZO1T02- Cell Biology and Genetics

Course Outcomes (COs)

Students will be able to describe and explain the structure and function of plasma membrane through fluid mosaic model, types of membrane proteins, transport and organization of cytoskeleton, cell organelles and endomembrane system. Differentiate and illustrate the mechanism of Cell division, cell cycle regulation, types of cell signalling, signal transduction pathways and various receptors involved in cell signalling. Describe and differentiate the types and functions of cellular communication, cell adherence molecule and extracellular matrix interaction. Differentiate Mendelian, non-Mendelian inheritance and solve the problems of inheritance based on probability. Explain, differentiate and compare codominance, incomplete dominance, gene interactions, linkage, crossing over, sex limited and sex influenced characters. Illustrate and differentiate the mode of inheritance of polygenic and monogenic traits, role of genetic and environmental factors of inheritance, inbreeding and its consequences and deduce coefficient of inbreeding and consanguinity. Explain, distinguish and describe the mutation and its types, structural and numerical alterations of chromosomes as well as the extra chromosomal inheritance, maternal inheritance, microbial genetics, genetic mapping and human genetics by

Semester I

MZO1T03- Electives

1. Mammalian Reproductive Physiology - Male

Course Outcomes (COs)

Students will be able to describe and demonstrate the development processes and functions of different units of testis. Deduce the structure, functions, regulation, anomalies and disease of male reproductive and accessory reproductive organs and understand the mechanism of sperm capacitation. Explain and discuss the role of hormones in the regulation of reproductive behaviour and types of breeding systems. Recognize and identify structural and functional aspect of different types of pheromones. Illustrate and counsel about the factors responsible for infertility. Assess and describe reproductive health dysfunction affected by aging in males. They could able to demonstrate fructose, acid and alkaline phosphatase, sialic acid and sperm count analysis.

MZO1T03

3. General Fish Biology

Course Outcomes (COs)

Students will be able to explain and describe the evolutionary significance of fishes through the concepts of origin, classification and general characters of Ostracoderms, Placoderms and Chondrichthyes. Explain, describe and compare general characters and classify different ranks of Superorder Pisces. Identify different marine and freshwater fishes. Explain and describe peculiarities and affinities of Dipnoi, comparative account of accessory respiratory organs and different systems in fishes. They could estimate CO_2, dissolved O_2 and chloride of water and protein, sodium and potassium content of blood sample in fish.

MZO1T03

4. General Entomology

Course Outcomes (COs)

Students will able to identify, classify and differentiate the various insects belonging to different ranks. Describe, explain, and analyse insect social organization and its peculiarities. They could describe and explain structure of reproductive system, specialized reproductive mechanism, embryogenesis and metamorphosis in insects.

MZO1T04 - Research Methodology

Course Outcomes (COs)

Students will be able to learn, describe and imbibe animal ethics in research, as well as various guidelines provided by IAEC and CCSEA. Students will be able to compare the model organisms used in biological science. They will able to discuss and determine the animal facilities to laboratories, transportation, hygiene, environment, maintenance, ethical, legal and policy issues. Encourage students to pursue their interests in research and to investigate selecting appropriate methodology of scientific research. Students could design the experiments properly. They will be able to write scientific reports, research proposals, patents, review articles, and will be aware of major funding agencies. Improve the knowledge of computer skills. They will be able to use basic computer programmes such as MS-Office, Coral Draw, and Photoshop. Students will analyse and use statistics to analyse data in biological research. They will able acquainted with AI and its use in Life Science as well as to apply various statistical tools like central tendency, dispersion, skewness, and kurtosis measures to analyze results in the research work. They also learn measures of relationship tests of hypothesis testing of significance and know about statistical software. Students will also able to learn and acquainted with IPR and Patent registration.

M.Sc. Zoology Semester II

MZO2T05 - Biology of Chordata

Course Outcomes (COs)

Students will be able to describe and recognize unique characters, life functions, connecting link between non-chordates and chordates and the diversity of urochordates, cephalochordates, cyclostomes and fish. Describe the structural, physiological and evolutionary correlation of different vertebrates; elaborate how kidneys represented successful evolutionary responses to the surrounding environmental pressures. List some migratory bird species, conduct bird tracking and watching activity. Facilitate students to explore the world of cetaceans and the marine environment. Gain a better understanding of the forces that drive evolution, speciation and the diversity of life on our planet. Identify, describe and differentiate the basic structure and functions of the central and peripheral nervous systems and define learning and memory. Compare and contrast the organization and evolution of the vertebrate circulatory system and heart. Describe specialized sensory organs of vertebrates and relate their role to their habitat. Comprehend the gradual development and evolutionary history of man. Identify, classify, describe and explain vertebrate specimen in the field as well as maintain and organize museum specimen. Develop a skill to demonstrate and explain different anatomical systems of vertebrate, and perform whole mount preparations of given vertebrate materials, different steps of microtomy and staining procedure. They could use, handle and maintain the instruments like microtome and oven. Students will able to identify, demonstrate, explain and compare the histological structure and functions of internal organs of vertebrates.

MZO2T06 - Advanced Developmental Biology

Course Outcomes (COs)

Students will be able to differentiate and explain the basic developmental concept of insects, cast differentiation in insects, amphibian metamorphosis and aves with its hormonal control and regeneration process in vertebrates. Illustrate and classify the type, structure, function and hormones of the placenta, analyse the cell differentiation, organ formation, cell death, and multiple physiological levels of aging. They will be able to analyse the process of advanced cattle breeding with the help of MOET, cloning techniques, acquire knowledge about embryonic sexing to diagnose the genetic disorder, the economic and clinical significance of embryonic stem cells. Comprehend birth control method that uses the body's immune response and classical contraceptive techniques to prevent pregnancy. Explain different anti-androgen and anti-spermiogenic compounds and also discuss transgenic animals that elevated the potential of biological research for human welfare. They will able to demonstrate the development of *Lymnea* and mounting of Chick embryo.

MZO2T07 -Electives

1. Mammalian Reproductive Endocrinology

Course Outcomes (COs)

Students will be able to comprehend the structural and functional aspect of hypothalamus. Illustrate regulations and feedback mechanism of various neurohormones, neurotransmitters and neural signals, structural and physiological role of pituitary. Elucidate the histological organization of endocrine glands, gonads and correlate it with the health issues. Describe and explain the non-steroidal regulators of reproduction, the hypothalamic-pituitary axis with the help of gonads, adrenal and thyroid gland, the mechanism of biosynthesis, mode of action and function of reproductive hormones such as estrogen, progesterone, androgen and inhibin that are involved in sexuality and fertility. Prepare, identify, differentiate and explain the histological slides of endocrine gland.

2. Brain and Muscle Physiology

Course Outcomes (COs)

Students will be able to differentiate and classify the various morphological differentiation and analysis of the mammalian brain, brain stem and cerebellum. Elaborate on the physiology and mechanism of learning, memory and sleep. Classify and illustrate the ultrastructure of neurons and synapses, functional and bioelectrical properties of the neurons, molecular mechanism of synaptic transmission and mechanism of neurotropins and growth factors affecting the neuronal growth. Classify and analyse the biosynthesis, storage, release and mechanism of the action of various neurotransmitters and neuropeptides. Differentiate between the structure and physiology of various organs involved in photoreception and phonoreception. Analyse the various causes, symptoms, mechanism of pathogenesis, diagnosis and treatment of neurodegenerative disorders. Explain and describe the classification, ultrastructure, properties and structural proteins of muscle. Illustrate the molecular mechanism of muscular contraction, ultrastructure of the neuromuscular junction and types, causes, symptoms and treatment of various neuromuscular disorders. They could able to demonstrate and estimate liver and muscle glycogen, protein and lipid.

3. Economic Aquaculture

Course Outcomes (COs)

Students will be able to describe, explain and compare different water bodies of India, basic techniques used for fish breeding, concepts of fish culture, culture of air breathing fishes, trout fish culture, Ornamental fish culture, integrated fish farming, sewage fed fisheries and cultivation of Indian major carp's. Describe, explain and compare advanced techniques used in aquaculture-based organisms such as pearls, crab, prawn, and oyster.

4. Insect Morphology and Physiology

Course Outcomes (COs)

Students will able to explain, describe and compare morphology of integument, head, thorax, abdomen, appendages and wings. They could describe, explain and differentiate structure and physiology of systems like digestive, circulatory, respiratory, nervous and neuroendocrine system etc. Students will be able to describe, explain and compare the sensory organs like visual organs, sound and light producing organs, bioluminescence, different mechanoreceptors and chemoreceptors. Describe, explain and compare mechanism of communication, colour change, mimicry and camouflage.

MZO2P03-

On Job Training

COs

Students will gain hands on training of any activity associated with Zoology.

M.Sc. Zoology Semester-III

MZO3T08 - Parasitology and Immunology

Course Outcomes (COs)

Students will be able to illustrate and differentiate life cycle, mode of transmission, infection and treatment of various bacterial infection and viral infections such as covid, dengue, hepatitis. Describe, explain, classify and differentiate organs of immune system, innate immunity, adaptive immunity, antigen, antibodies, toxin anti-toxin and their cellular target. Demonstrate antigen-antibody interaction with the help of ODD. Illustrate the maturation, activation, differentiation of T and B cell, inheritance of MHC molecules and various pathways of complement system. Classify, describe and differentiate various types of cytokines, hypersensitivity, autoimmunity and immunodeficiency diseases. Explain and describe activation and migration of leucocyte, mast cell, transplantation, tumor immunology, various infectious diseases and vaccines. Illustrate and differentiate working principle and significance of immunotechniques such as RIA and ELISA.

MZO3T09 - Wild Life and Avian Biology

Course Outcomes (COs)

Students will explain, describe and analyze importance of wildlife and its conservation, international conservation bodies, predator-prey relationship, population dynamics of ungulates and carnivores. They could also explain, describe and analyze morphology, morphometry of birds, birds diversity, techniques of bird counting, bird breeding population and breeding group maps, bird hotspots, bird sanctuaries and role of birds in ecosystem.

MZO3T10- Comparative Endocrinology

Course Outcomes (COs)

Students will be able to identify, classify, differentiate, describe and explain different types of cells and organs of neuroendocrine system of invertebrates. Illustrate the role of hormones in the regulation of various physiological processes in invertebrates such as metamorphosis, reproduction and colour change mechanisms. Describe, explain, and differentiate the hypothalamo-hypophysial system, structure, hormones, functions and feedback mechanisms of pituitary, thyroid, parathyroid, pancreas, gastro-intestinal tract and adrenal gland. Comprehend the role of hormones in pharmaceuticals, including contraception, sex hormones, cancer, immune system and immune regulating hormones (IRH). Raise awareness about the significance of pharmaceutical applications. Students could demonstrate compare the preparation of histological slides of endocrine glands.

MZO3T11- Electives

1. Mammalian Reproductive Physiology –Female

Course Outcomes (COs)

Students will be able to understand and evaluate the different processes and hormonal control of ovarian cycle. Describe and specify the mechanism and hormonal control of uterine cycle in different mammalian species. Comprehend the structure, function, regulation, anomalies and disease of female reproductive tract. Discuss the physiological and hormonal reasons behind bodily changes at puberty, the importance of prostaglandins in reproduction. Recognize the anatomical structure and development of breasts, mechanism of synthesis, secretion and ejaculation of milk via hormonal influence. They could detect and confirm the pregnancy by using female urine sample.

2. Blood and Cardiac Physiology

Course Outcomes (COs)

The students will be able to illustrate the structure, properties and function of cardiac muscle along with the anatomy, histology, nerve innervation and valves of the heart. They will further be able to classify and compare the pacemakers and conducting fibers present in the heart, and illustrate various types, causes, symptoms, diagnosis, and factors affecting blood pressure and treatment. Illustrate and compare the mechanism of the cardiac cycle, heart sound, working principle of ECG, cardiac output, haemodynamic, haemorrhage, cardiac murmur, circulatory shock and cardiac failure. Describe, explain and compare the cellular composition and functions of blood, blood groups, blood transfusion, bone marrow aspiration and pathological conditions of blood glucose and lipids along with blood coagulation. Compare and illustrate the transport of gases by blood, diagnosis, symptoms and treatment of bleeding disorders and blood cancer. Illustrate the mechanism of formation, composition, transport and functions of lymph. Differentiate, describe and explain anaemia and polycythemia, platelets and Blood substitute. Students will be able to demonstrate the components of the blood such as RBCs, WBCs, DLCs, Hb etc. along with the blood group.

3. Fish Physiology

Course Outcomes (COs)

Students will be able to describe, explain and compare structure and physiology of associated system like digestive, sensory organs, osmoregulation, nervous system and reproductive system of teleost. They could explain and describe different mode of migration in fishes with respect to periodicity and role of hormones. They could also explain, describe and analyse hormonal control via hypothalamo-hypophysial system and neuroendocrine system of gametogenesis and reproductive behavior in fishes. Students could also able to demonstrate and explain ablation of gonad in fishes.

4. Insect Pest Management

Course Outcomes (COs)

Students will study about life cycle, host plants, damage and control measures of various insect-pests of field crops. Identify common insects and insect pest of different orders available in local area and could form local or regional insect diversity register as well as demonstrate different pathogen in insect tissues. Students will be able to illustrate and compare the properties, mode of action and uses of inorganic insecticide, chlorinated hydrocarbons, organophosphates and botanical insecticides. Explain and describe biological control measure, nano-biopesticide, pathogenic viruses, bacteria, parasitoids and predators of insect pests. Describe various

MZO3P07, Research Project (RP) Minor Work

Course Outcomes (COs)

After completion of minor research project, the student will able to search research articles online and offline. Draft scientific writeup and submit in the form of report. They will able to check the script for plagiarism. Discuss particular topic and could arrange it in a proper manner. Learn and write bibliography by various styles.

M.Sc. Zoology Semester-IV

MZO4T12 - Biotechniques, Biostatistics, Toxicology and Bioinformatics

Course Outcomes (COs)

Students will be able to elaborate, discuss and describe sterilization, animal cells, tissue culture, primary culture, cell lines, cell quantification, and growth kinetics and cryopreservation technique. Describe, demonstrate and explain the principle and working mechanism of sedimentation, centrifugation, TLC, gas chromatography and electrophoretic technique. Illustrate and explain the biostatistical measures such as central tendency, dispersion, probability, sampling types, methods and significance test. Describe and explain neuronal genetics, environmental components in the development of animal behaviour, organization and functions of animal ethics. Illustrate and explain about the significance of toxicity test in the projects and research. Describe and explain the importance and scope of bioinformatics, various biological databases such as BLAST and FASTA, PSI- BLAST etc. and various program runs for the construction of phylogenetic tree like MEGA. Students could construct, analyze and interpret phylogenetic tree.

MZO4T13- Radiation and Chronobiology

Course Outcomes (COs)

The students will be able to define and explain the scope and significance of radiobiological scope in human welfare. Identify ionizing radiation, linear energy transfer, radiation dose and units and conceptualize the radiation types. Describe, explain and analyze application of radiology and gainful and harmful effects of radiation. Comprehend the concept of circadian rhythm, central clock system and peripheral clock system. Students will describe, explain and analyze centers of biological clock, relevance of biological clock in human welfare, mechanism of regulation of biological clock and effects of irregularity of biological clock and its remedies.

MZO4T14 -Molecular Biology and Biotechnology

Course Outcomes (COs)

Students will be able to analyse the basics of cellular genome, organization of genetic material, fundamental process of duplication of genetic material in prokaryotes and eukaryotes important for cell division. Evaluate the different types of DNA damage and repair mechanism. Illustrate the fundamentals of various mobile DNA elements useful in horizontal gene transfer, evolutionary process and gene expression in prokaryotes and eukaryotes. Explain the mechanisms and regulation of operon models significant in regulation of gene expression in prokaryotes. Illustrate the fundamental process of protein synthesis with explanation of antisense and ribozyme technology. They could differentiate and distinguish DNA sequencing and gene amplification methods, cloning by different cloning vectors for recombinant DNA technology. Explain and describe the applications of

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