DEPARTMENT OF EDUCATION

Syllabus

For

Integrated Teacher Education Programme (ITEP)
B.Sc. B.Ed.; B.A. B.Ed. & B.Com. B.Ed. (Secondary Level)

V Semester (2023-27)

Hemvati Nandan Bahuguna Garhwal (Central) University
Srinagar, Uttarakhand

2024

Integrated Teacher Education Programme (ITEP)
Course-wise Detail

ITEP (B.Sc. B.Ed.) V Semester Course-wise Detail	
Education	
ESSCCPC-501 Stage-Specific Content -cum-Pedagogy Courses (Cr-4) (Any Two)	A. Content cum Pedagogy of Mathematics at Secondary Stage – Course (II) (Cr-2) B. Content cum Pedagogy of Physics at Secondary Stage - Course (II) (Cr-2) C. Content cum Pedagogy of Chemistry at Secondary Stage - Course (II) (Cr-2) D. Content cum Pedagogy of Zoology at Secondary Stage - Course (II) (Cr-2) E. Content cum Pedagogy of Botany at Secondary Stage - Course (II) (Cr-2)
Disciplinary	**DCMJ-5 (Cr6)**
Botany	**DCBOT-501** DSE 1-Biotechnology and Genetic Engineering Theory (Cr-4) and Practical (Cr-2) **DCFBBOT-502** Vocational Course (1&2)
Zoology **DSE (Anyone)**	**DCZOO-501** DSE-1. Applied Zoology DSE-2. Wildlife Conservation & Management DSE-3. Principles of Genetics & Evolutionary Biology DSE-4. Animal Behaviour & Endocrinology DSE-5. Introduction to Developmental Biology DSE-6. Basics of Biotechnology Theory (Cr-4) and Practical (Cr-2) **DCFBZOO-502** Vocational Course/ Field Visit/ Entrepreneurship Skills
Physics	**DCPHY-501** Modern Physics Theory (Cr-4) and Practical (Cr-2) **DCFBPHY-502** Vocational course/ Field Visit/Lab Work/ Entrepreneurship Skills (4 Credits)
Chemistry Students can opt for any one Theory (Cr-4) and Practical (Cr-2)	**DCCHE-501** 1. Analytical Methods in Chemistry 2. Polymer Chemistry 3. Green Chemistry **DCFBCHE-502** **Vocational Course in Chemistry**-(Paper 1-3) (Credit 4: Theory 2 + Practical 2)
Mathematics	**DCM-501** Linear Algebra Theory-6 Cr **DCFBM-502** Vocational Course (a or b)
ITEP (B.A. B.Ed.) V Semester Course-wise Detail	
ESSCCPC-501 Stage-Specific Content -cum-Pedagogy Courses (Cr-4) (Any Two)	F. Content cum Pedagogy of History at Sec. Stage - Course (II) (Cr-2) G. Content cum Pedagogy of Pol. Sci. at Sec. Stage - Course (II) (Cr-2) H. Content cum Pedagogy of Geography at Sec. Stage - Course (II) (Cr-2) I. Content cum Pedagogy of Sociology at Secondary Stage - Course (II) (Cr-2) J. Content cum Pedagogy of Economics at Secondary Stage - Course (II) (Cr-2) K. Content cum Pedagogy of Art at Secondary Stage - Course (II) (Cr-2) L. Content cum Pedagogy of Hindi at Secondary Stage - Course (II) (Cr-2) M. Content cum Pedagogy of English at Secondary Stage - Course (II) (Cr-2) N. Content cum Pedagogy of Sanskrit at Secondary Stage - Course (II) (Cr-2)
Disciplinary	**DCMJ-5 (Cr6)**
Pol Sci	**DCPOL-501** Introduction to Western Political Thought or Global Politics or Introduction to Public Admin. (CR=6)

	502 Field/Visit/Vocational Course/Entrepreneurship Skills (Cr-4)
History	**DCHIS-501** European History (from 1780 - 1939) (CR=6) **502** Field/Visit/Vocational Course/Entrepreneurship Skills (Cr-4)
Geography	**DCGEO-501** Economic Geography (CR=4) **502** Field/Visit/Vocational Course/Entrepreneurship Skills (Cr-4)
	DCGEO-501(P) Practical Geography V (Field Visit, Survey methods and Report Writing (CR=2)
Economics	**DCECO-501** Economic Development and Policy in India–I or Money & Banking or Environmental Economics (CR=6) **502** Field/Visit/Vocational Course/Entrepreneurship Skills (Cr-4)
Sociology	**DCSOC-501** Social Research or Indian Sociological Thinkers (CR=6) **502** Field/Visit/Vocational Course/Entrepreneurship Skills (Cr-4)
Drawing & Painting	**DCDRA-501** Brief History of European Painting-1 or Element of Technical Drawing -1 or Graphic Design (CR=2) **502** Field/Visit/Vocational Course/Entrepreneurship Skills (Cr-4)
	DCDRA-501(P) Creative Composition or Tie and Die or Photography (CR=4)
Hindi	**DCHIN-501** गढ़वाली लोक साहित्य एवं संस्कृति अथवा हिंदी काव्यधारा में हिमालय (CR=6) **502** Vocational Course (Cr-4)
English	**DCENG-501** History of English Literature Part 1 or Literary Moments 1 or Twentieth Century British Poetry &Drama (CR=6) **502** Vocational Course (Cr-4)
Sanskrit	**DCSAN-501** वेद एवं उपनिषद अथवा समास एवं छंदशास्त्र (CR=6) **502** Vocational Course/Field Visit (Cr-4)
ITEP (B.Com. B. Ed.) V Semester Course-wise Detail	
ESSCCPC-501 Stage-Specific Content -cum-Pedagogy Courses (Cr-4)	O.Content cum Pedagogy of Business Studies at Secondary Stage - Course (II) (Cr-2) P. Content cum Pedagogy of Accountancy at Secondary Stage - Course (II) (Cr-2)
Disciplinary	**501:** Management Accounting (Cr6) **502:** Field Training (4)
Compulsory for All (B.Sc. B.Ed., B.A. B.Ed. & B.Com. B.Ed.)	
Internship	**ESEC-502** Pre-internship Practice (Cr-2)
Research	**RM-503** Introduction to Research – (Cr-4)
	RM-504 Interdisciplinary Research (Cr-2)

The students may complete one MOOC of 6 to 8 weeks in the interdisciplinary area in any semester. The certificate of completion of the MOOC should be submitted in the eighth semester.

Hemvati Nandan Bahuguna Garhwal University

Dept of Education

ITEP Curriculum (B.Sc. B.Ed.)

Semester-V

S.N.	Code	Courses	Credit
1.	ESSCCPC-501-A	Content cum Pedagogy of Mathematics at Secondary Stage – Course (II)	2
2.	ESSCCPC-501-B	Content cum Pedagogy of Physics at Secondary Stage – Course (II)	2
3.	ESSCCPC-501-C	Content cum Pedagogy of Chemistry at Secondary Stage – Course (II)	2
4.	ESSCCPC-501-D	Content cum Pedagogy of Zoology at Secondary Stage – Course (II)	2
5.	ESSCCPC-501-E	Content cum Pedagogy of Botany at Secondary Stage – Course (II)	2
6.	ESEC-502	Pre-internship Practice	2
7.	RM-503	Introduction to Research	4
8.	RM-504	Interdisciplinary Research	2

ESSCCPC-501: Stage-Specific Content -cum-Pedagogy Courses (Any Two)

501-A: Content cum Pedagogy of Mathematics at Secondary Stage – Course (II)

Credits: 2

501-A.1 About the Course

The teaching and learning of Mathematics is a complex activity, and many factors determine the success of this activity. The nature and quality of instructional material, the presentation of content, the pedagogic skills of the teacher, and the learning environment. Students at this stage are keen on exploring and constructing their own knowledge, so providing resources is important for the school teacher. This course will provide illustrative exposure to the resource materials for Mathematics teaching and learning. Teaching Mathematics requires a thorough understanding of the pedagogical content knowledge. It is the integration or the synthesis of teachers' pedagogical knowledge and their subject matter knowledge that comprises pedagogical content knowledge. Planning of the learning experiences is a must for the quality learning outcome and the better use of resources. This course provides skills to develop the planning of Mathematics teaching and learning for the classroom. This course also extends the support of technology integration for the enhancement of pedagogical planning. The course will be helpful for Student teachers in knowing how the mathematical content knowledge is organised and used in the teaching and learning process with the support of technological tools.

501-A.2 Learning Outcomes

After completion of the course, student teachers will be able to:

- discuss the nature and functions of various instructional resources,
- explore and utilise the teaching and learning resources to support pedagogical experiences of Mathematics,
- organize and manage supportive activities for the development of the mathematical aptitude of secondary school students,

- plan appropriate experiences for teaching Mathematics,
- explore diverse backgrounds and interests' children bring to set up the inclusive classroom for Mathematics learning,
- elaborate technological tools for teaching and learning of Mathematics,
- integrate technology to judiciously facilitate learning for enhancing an inclusive environment.

UNIT - I
Teaching Learning Resources

A. Teaching learning materials: meaning and importance for secondary school Mathematics.
B. Types of teaching learning resources: print media (Mathematics textbook, teachers' manual/ handbook, laboratory manual), non-print and digital media (charts, 2-D and 3-D models, games, web resources, interactive boards, animations, videos, images, simulations) for offline/ online classroom teaching and learning
C. Identification and use of learning resources in Mathematics from the local environment, community resources and pooling of resources.
D. Mathematics resource room/ laboratory – equipment and management, concept of virtual laboratories. Organisation of Mathematics club, fairs, exhibitions, and learner community.

UNIT - II
Content Analysis and Planning for Teaching Mathematics

A. Analysis for identification of axioms, concepts, rules, formulas, theorems, corollaries; pedagogical content knowledge of arithmetic, algebra, geometry, mensuration, and trigonometry of the secondary stage.
B. Planning and evaluating learning experiences in an inclusive setup based on learning outcomes and competencies, building a community of mathematicians in classrooms.
C. Developing annual plan, unit plan, lesson plan – need, main consideration, and format.
D. Strategies for method-based lesson plan for secondary classes - inductive-deductive, analytical-synthetic, lecture cum demonstration, problem-solving, laboratory, and project-based.

UNIT - III
ICT Integration and Applications in the Teaching of Mathematics

A. Scope and importance of ICT for teaching and learning Mathematics.
B. Use of ICT (digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources, open education resources, blogs, forums, interactive boards, and devices) in the teaching, learning, assessment and resource management of secondary Mathematics.
C. Use of tools, software, and platforms such as GeoGebra, Khan Academy, along with the national teachers' portal, DIKSHA, and SWAYAM.
D. Developing ICT-integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for the mathematics classroom and online teaching.

501-A.3 Suggestive Practicum (Any Three)

1. Develop learning resources for Mathematics teaching and learning.
2. Prepare an annual plan for any secondary class.
3. Prepare a unit plan from the mathematics textbook at the secondary stage.
4. Prepare a learning outcomes-based lesson plan using experiential learning for any one topic of Mathematics at the secondary stage.
5. Develop a lesson plan on a topic of Mathematics at the secondary stage by integrating ICT tools.
6. Write a script for developing e-content on any one topic of Mathematics for online teaching.
7. Any other Project assigned by HEI.

501-A.4 Suggestive Mode of Transaction

Lecture cum discussion, group work, ICT-enabled methods, Activity-based and Art Integrated Demonstration, Field-based experiences, Library Visits, Self-study, Field observations, and Assignment preparation. Classroom presentations, Discussion forums, Observation, Flip classroom, and use of digital platforms.

501-A.5 Suggestive Mode of Assessment

Written test, classroom presentation, workshop, assignments, practicum, sessional, and terminal semester examination (As per UGC norms).

501-A.6 Suggestive Reading Materials

- NCERT: A Handbook for Designing Mathematics Laboratory in Schools (Code- 1555)
- NCERT: Manual for Higher Secondary Mathematics Kit (Code- 3165)

*Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-B: Content cum Pedagogy of Physics at Secondary Stage - Course (II)

Credit: 2

501-B.1 About the Course

This course comprises three units and the practicum. The course is devoted to introducing various teaching aids, material types, and uses for teaching the concepts of Physics at the secondary stage. Enough space is provided to discuss different types of teaching aids/materials for teaching learning concepts of Physics. It focuses on learning resources in Physics to enable student teachers to make use of available learning resources and generate new resources for teaching and learning the concepts of Physics. It also focuses on textbook analysis and planning for teaching Physics. and its pedagogical issues in the light of NEP 2020. Student teachers are expected to identify various concepts and processes, list learning and outcomes, and find out about various activities and experiments. Accordingly, they are expected to develop a lesson plan based on learning outcomes and experiential learning for classroom and online teaching.

501-B.2 Learning Outcomes

After completion of this course, student teachers will be able to:

- identify teaching learning aids/materials and illustrate their importance in teaching learning the concepts of Physics,
- categorize teaching aids/materials/learning resources,
- develop teaching learning aids/material/kits/learning resources for teaching learning the concepts of Physics,
- utilize teaching aids/materials/learning resources for teaching learning the concepts of Physics,
- analyze the content of Physics textbooks at the secondary stage,
- develop a lesson plan based on learning outcomes and experiential learning using appropriate strategies.

UNIT - I
Teaching Learning Resources

A. Teaching learning aids/materials: concept, definition, role and importance in classroom teaching learning Physics.

B. Types of teaching learning aids/ materials: print media such as textbook, teachers' manual/ handbook, laboratory manual and other print materials, non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning reflective journals, charts, 2-D and 3-D models, games, cards, worksheets, multimedia.

C. Identification and use of learning resources in Physics from the local environment.

D. Resource room/ laboratory/ library, virtual laboratories, teaching learning kits, Physics clubs, fairs, exhibitions, educational parks, excursions, community resources and pooling of resources.

UNIT - II
Content Analysis and Planning for Teaching Physics

A. Pedagogical analysis of content, taking examples from topics of Physics textbooks at the secondary stage, identification of concepts, listing learning outcomes and competencies, planning, and evaluating learning experiences in an inclusive setup.

B. Concept, types and importance of unit and lesson planning.

C. Developing unit plans and lesson plans based on learning outcomes and experiential learning by selecting topics from textbooks of Physics at the secondary stage.

UNIT - III
ICT Integration and Applications

A. Scope and importance of ICT in Physics.

B. Use of ICT such as Artificial Intelligence, machine learning, and smart boards in teaching, learning, assessment, and resource management.

C. Tools, software, and platforms for teaching and learning Physics at the secondary stage.

D. Developing ICT-integrated lesson plans by taking topics of Physics at the secondary stage using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching.

501-B.3 Suggestive Practicum (Any Three)

1. Develop e-content for the concepts of Physics at the Secondary Stage.
2. Analyze the content of textbooks of Physics (Classes 9-12).
3. Identify the learning resources for transitioning the concepts of Physics.
4. Develop teaching aids/teaching materials for teaching concepts of Physics at the secondary stage.
5. Develop learning outcomes for the concepts of Physics at the secondary stage.
6. Prepare learning outcomes and an experiential learning-based lesson plan for the concepts of Physics.
7. Develop a project on the concepts of Physics using interdisciplinary and multidisciplinary approaches as recommended in NEP 2020.
8. Any other project.

501-B.4 Suggestive Mode of Transaction

Lecture cum discussion/demonstration, hands-on activities, demonstration, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, experiential learning and ICT integrated approach.

501-B.5 Suggestive Mode of Assessment

Written test, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations (as per UGC norms).

501-B.6 Suggestive Reading Materials

- Draft National Curriculum Framework for School Education,
- Laboratory Manual of Science (Grade 9 & 10), NCERT.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks (2023).
- NCERT Laboratory Manuals.
- NCERT Textbooks, Chemistry for Class XI and XII.
- NCERT Textbooks, Physics for Class XI and XII.
- NCERT Textbooks, Science for Class IX and XI.

*Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-C: Content cum Pedagogy of Chemistry at Secondary Stage - Course (II)

Credit: 2

501-C.1 About the Course

This course comprises three units and the practicum. The course is devoted to introducing various teaching aids, material types, and uses for teaching the concepts of Chemistry at

the secondary stage. Enough space is provided to discuss different types of teaching aids/materials for teaching learning concepts of Chemistry. It focuses on learning resources in Chemistry to enable student teachers to make use of available learning resources and generate new resources for teaching and learning the concepts of Chemistry. It also focuses on textbook analysis and planning for teaching Chemistry. and its pedagogical issues in the light of NEP 2020. Student teachers are expected to identify various concepts and processes, list learning and outcomes, and find out about various activities and experiments. Accordingly, they are expected to develop a lesson plan based on learning outcomes and experiential learning for classroom and online teaching.

501-C.2 Learning Outcomes

After completion of this course, student teachers will be able to:

- identify teaching learning aids/materials and illustrate their importance in teaching learning the concepts of Chemistry,
- categorize teaching aids/materials/learning resources,
- develop teaching learning aids/material/kits/learning resources for teaching learning the concepts of Chemistry,
- utilize teaching aids/materials/learning resources for teaching learning the concepts of Chemistry,
- analyze the content of Chemistry textbooks at the secondary stage,
- develop a lesson plan based on learning outcomes and experiential learning using appropriate strategies.

UNIT - I
Teaching Learning Resources

A. Teaching learning aids/materials: concept, definition, role and importance in classroom teaching learning Chemistry.

B. Types of teaching learning aids/ materials: print media such as textbook, teachers' manual/ handbook, laboratory manual and other print materials, non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning reflective journals, charts, 2-D and 3-D models, games, cards, worksheets, multimedia.

C. Identification and use of learning resources in Chemistry from the local environment.

D. Resource room/ laboratory/ library, virtual laboratories, teaching learning kits, Chemistry clubs, fairs, exhibitions, educational parks, excursions, community resources and pooling of resources.

UNIT - II
Content Analysis and Planning for Teaching Chemistry

A. Pedagogical analysis of content, taking examples from topics of Chemistry textbooks at the secondary stage, identification of concepts, listing learning outcomes and competencies.

B. Planning and evaluating learning experiences in an inclusive setup.

C. Concept, types and importance of unit and lesson planning.
D. Developing unit plans and lesson plans based on learning outcomes and experiential learning by selecting topics from textbooks of Chemistry at the secondary stage.

UNIT - III
ICT Integration and Applications

A. Scope and importance of ICT in Chemistry.
B. Use of ICT such as Artificial Intelligence, machine learning, and smart boards in teaching, learning, assessment, and resource management.
C. Tools, software, and platforms for teaching and learning Chemistry at the secondary stage.
D. Developing ICT-integrated lesson plans by taking topics of Chemistry at the secondary stage using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching.

501-C.3 Suggestive Practicum (Any Three)

1. Develop e-content for the concepts of Chemistry at the Secondary Stage.
2. Analyze the content of textbooks of Chemistry (Classes 9-12).
3. Identify the learning resources for transitioning the concepts of Chemistry.
4. Develop teaching aids/teaching materials for teaching concepts of Chemistry at the secondary stage.
5. Develop learning outcomes for the concepts of Chemistry at the secondary stage.
6. Prepare learning outcomes and an experiential learning-based lesson plan for the concepts of Chemistry.
7. Develop a project on the concepts of Chemistry using interdisciplinary and multidisciplinary approaches as recommended in NEP 2020.
8. Any other project.

501-C.4 Suggestive Mode of Transaction

Lecture cum discussion/demonstration, hands-on activities, demonstration, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, experiential learning and ICT integrated approach.

501-C.5 Suggestive Mode of Assessment

Written test, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations (as per UGC norms).

501-C.6 Suggestive Reading Materials

- Draft National Curriculum Framework for School Education,
- Laboratory Manual of Science (Grade 9 & 10), NCERT.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks (2023).
- NCERT Laboratory Manuals.
- NCERT Textbooks, Chemistry for Class XI and XII.
- NCERT Textbooks, Physics for Class XI and XII.

- NCERT Textbooks, Science for Class IX and XI.

*Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-D: Content cum Pedagogy of Zoology at Secondary Stage - Course (II)

Credits: 2

501-D.1 About the Course

A wide array of teaching-learning resources is available to modern-day teachers. This course comprises three units that aim to introduce various resources and discuss their appropriate utilisation in teaching. In this course, student teachers are introduced to different units and lesson plan based on learning outcomes and experiential learning. Requisite skills such as the use of print media, non-print media and digital resources are discussed in the course. This course also focuses on familiarising student teachers with ICT integration in teaching and preparing ICT-based lesson plans for online teaching using suitable tools. This course aims to prepare student teachers for teaching Zoology using different dimensions of pedagogical and technological aspects.

501-D.2 Learning Outcomes

After completion of this course, Student teachers will be able to:

- categorize different teaching and learning resources and plan their appropriate usage in teaching and learning concepts of Zoology,
- develop simple teaching learning materials using easily available/local materials,
- analyze the content of Zoology textbooks at the secondary stage,
- review various methods and strategies for teaching Zoology,
- develop a learning outcome-based lesson plan to promote experiential learning and higher order thinking skills,
- develop unit plans and lesson plans on different chapters in biology (Grades IX to XII).

UNIT - I

Teaching Learning Resources

A. Teaching learning aids/materials: concept, definition, role, and importance in classroom teaching learning Zoology.

B. Types of teaching learning aids/ materials: print media such as textbook, teachers' manual/ handbook, laboratory manual and other print materials, non-print and digital media such as museum, aquarium, terrarium, TV, websites, animations, audios, videos, simulations; Zoology mobile apps, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning (reflective journals, charts, 2-d and 3-d models, games, cards, worksheets, multimedia etc.

C. Identification and use of learning resources in Zoology from the local environment - using nature as a laboratory; biology laboratory - designing, management and safe practices; virtual laboratories and museums.

D. Resource room/ laboratory/ library, virtual laboratories, teaching learning kits, science clubs, fairs, exhibitions, science parks, zoo, botanical gardens, excursions, community resources and pooling of resources.

UNIT - II

Content Analysis and Planning for Teaching Zoology

A. Pedagogical analysis of content taking examples from topics of Zoology textbooks at the secondary stage, identification of concepts, listing learning outcomes and competencies, planning, and evaluating learning experiences in an inclusive setup.
B. Concept, types and importance of unit and lesson planning.
C. Developing unit plans and lesson plans based on learning outcomes and experiential learning by selecting topics from textbooks of Zoology at the secondary stage.

UNIT - III

ICT Integration and Application

A. Scope and benefits of using IT in the teaching and learning process; Artificial Intelligence, machine learning, smart boards.
B. Specific features and limitations of using ICT.
C. Open Educational Resources in Zoology – BIOIDAC, MOOC, National Teachers Portal, DIKSHA, SWAYAM.
D. Developing ICT-integrated lesson plans by taking topics of physical sciences at the secondary stage using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching.

501-D.3 Suggestive Practicum (Any Three)

1. Analyze the content of textbooks of Zoology (Classes 9-12).
2. Develop e-content for the concepts of Zoology at the Secondary Stage.
3. Develop unit plans for selected chapters of the Textbooks of Zoology.
4. Prepare learning outcomes and an experiential learning-based lesson plan for the concepts of Zoology.
5. Developing ICT-integrated lesson plans for offline and online classes.
6. Explore a course in Zoology of MOOC and prepare a write-up.
7. Any other projects.

501-D.4 Suggestive Mode of Transaction

Lecture cum discussion, demonstration, Hands-on activities, experiential learning, inquiry, Group work, Presentations, multimedia.

501-D.5 Suggestive Mode of Assessment

Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations (as per UGC norms).

501-D.6 Suggestive Reading Material

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.

- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks (2023). Draft National Curriculum Framework for School Education.
- NCERT, Textbooks of Zoology at Secondary Stage.

*Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-E: Content cum Pedagogy of Botany at Secondary Stage - Course (II)

Credits: 2

501-E.1 About the Course

A wide array of teaching-learning resources is available to modern-day teachers. This course comprises three units that aim to introduce various resources and discuss their appropriate utilisation in teaching. In this course, student teachers are introduced to different units and lesson plans based on learning outcomes and experiential learning. Requisite skills such as the use of print media, non-print media and digital resources are discussed in the course. This course also focuses on familiarising student teachers with ICT integration in teaching and preparing ICT-based lesson plans for online teaching using suitable tools. This course aims to prepare student teachers for teaching Botany using different pedagogical and technological aspects.

501-E.2 Learning Outcomes

After completion of this course, Student teachers will be able to:

- categorise different teaching and learning resources and plan their appropriate usage in teaching and learning concepts of Botany.
- develop simple teaching learning materials using easily available/local materials,
- analyze the content of Botany textbooks at the secondary stage,
- review various methods and strategies for teaching Botany,
- develop a learning outcome-based lesson plan to promote experiential learning and higher-order thinking skills,
- develop unit plans and lesson plans on different chapters in biology (Grades IX to XII).

UNIT - I
Teaching Learning Resources

A. Teaching learning aids/materials: concept, definition, role, and importance in classroom teaching learning Botany.

B. Types of teaching learning aids materials: print media such as textbook, teachers' manual/ handbook, laboratory manual and other print materials, non-print and digital media such as museum, aquarium, terrarium, TV, websites, animations, audios, videos, simulations; Botany mobile apps, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning (reflective journals, charts, 2-d and 3-d models, games, cards, worksheets, multimedia etc.

C. Identification and use of learning resources in Botany from the local environment - using nature as a laboratory; biology laboratory - designing, management and safe practices; virtual laboratories and museums.
D. Resource room/ laboratory/ library, virtual laboratories, teaching learning kits, Botany clubs, fairs, exhibitions, science parks, zoo, botanical gardens, excursions, community resources and pooling of resources.

UNIT - II

Content Analysis and Planning for Teaching Botany

A. Pedagogical analysis of content taking examples from topics of Botany textbooks at the secondary stage, identification of concepts, listing learning outcomes and competencies,
B. Planning and evaluating learning experiences in an inclusive setup.
C. Concept, types and importance of unit and lesson planning.
D. Developing unit plans and lesson plans based on learning outcomes and experiential learning by selecting topics from textbooks of Botany at the secondary stage.

UNIT - III

ICT Integration and Application

A. Scope and benefits of using IT in the teaching and learning process; Artificial Intelligence, machine learning, smart boards.
B. Specific features and limitations of using ICT.
C. Open Educational Resources in Botany – BIOIDAC, MOOC, National Teachers Portal, DIKSHA, SWAYAM.
D. Developing ICT-integrated lesson plans by taking topics of physical sciences at the secondary stage using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching.

501-E.3 Suggestive Practicum (Any Three)

1. Analyze the content of textbooks of Botany (Classes 9-12).
2. Develop e-content for the concepts of Botany at the Secondary Stage.
3. Develop unit plans for selected chapters of the Textbooks of Botany.
4. Prepare learning outcomes and an experiential learning-based lesson plan for the concepts of Botany.
5. Developing ICT-integrated lesson plans for offline and online classes.
6. Explore a course in Botany of MOOC and prepare a write-up.
7. Any other projects.

501-E.4 Suggestive Mode of Transaction

Lecture cum discussion, demonstration, Hands-on activities, experiential learning, inquiry, Group work, Presentations, multimedia.

501-E.5 Suggestive Mode of Assessment

Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations (as per UGC norms).

501-E.6 Suggestive Reading Material

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks (2023). Draft National Curriculum Framework for School Education.
- NCERT, Textbooks of Botany at Secondary Stage.

*Teachers may also suggest books/readings as per the needs of the learners and the learning content.

B.Sc. B.Ed. Semester-V

	Subject	Course	Credits
1.	**Botany (Major)**	1. DSE 1-Biotechnology and Genetic Engineering Theory and Practical	4+2
2.		i.Vocational Course 1: Algal Biotechnology/ ii.Vocational Course 2-Applied Palynology	4 4
3.	**Zoology (Major)**	2. DCZOO-501 DSE (Anyone) • DSE-1. Applied Zoology • DSE-2. Wildlife Conservation & Management • DSE-3. Principles of Genetics & Evolutionary Biology • DSE-4. Animal Behaviour & Endocrinology • DSE-5. Introduction to Developmental Biology • DSE-6. Basics of Biotechnology: Theory and Practical.	4+2
4.	**Vocational Course/ Field Visit/ Entrepreneurship Skills**	i.Poultry Farming ii.Apiculture iii.Sericulture iv.Aquaculture v.Fish Hatchery Operations vi.Vermiculture	4
5.	**Physics (Major)**	1. Modern Physics Theory and Practical	4+2
6.	**Vocational course/ Field Visit/ Lab Work/ Entrepreneurship Skills**	2. Lab Testing of Electronics Components	
7.	**Chemistry (Major)**	i. Students can opt for any one • Analytical Methods in Chemistry • Polymer Chemistry • Green Chemistry Theory and Practical	4+2
8.	**Vocational Course in Chem-I (Th- 2 + P 2)**	i. Chemistry Laboratory Guidelines and Techniques: Theory & Practical ii. Basics of Natural Products Theory & Practical iii. Laboratory safety and solution preparation: Theory & Practical	2 + 2 2 + 2 2 + 2
9.	**Mathematics (Major)**	1. Linear Algebra Theory	6
10.	**Vocational Course**	2. Choose any one of the following: (a)-Elementary Cryptography, (b)-Combinatorics and Graph Theory.	4

DCMJ-501: Disciplinary
Major Botany
DSE 1-Biotechnology and Genetic Engineering
SOLS/BOT/DSE-1 (T)

Credits: 04, Lectures: 60

UNIT I

Concept: Definition of Biotechnology, history and the multidisciplinary nature of Biotechnology, applications of Biotechnology, Biotechnology and developing countries, and commercialisation of Biotechnology in a developing country.

UNIT II

Biotechnology in Food: Introduction, dairy products, fish and meat products, food enzymes, sweeteners, bakery products, food wastes, microbial products, oriental fermented foods, drinks, alcoholic and non-alcoholic beverages.

UNIT III

Enzymology and Enzyme Technology: Definition of enzyme, enzymology and enzyme technology, nature of the enzymes, applications of enzymes, the technology of enzyme production, and immobilisation of enzymes.

UNIT IV

Recombinant DNA Technology: Concepts of Recombinant DNA, biological tools of Recombinant DNA technology, modification of the gene, methods of gene transfer, transgenic organisms.

UNIT V

DNA Structure and Manipulation - Techniques for DNA isolation and purification. Methods for quantification and characterisation of DNA samples. RNA Analysis and Gene Expression- Methods for RNA isolation and purification. Analysis of gene expression.

UNIT VI

Gene Manipulation Techniques – Methods of gene delivery. Physical, chemical, and biological methods. Transformation, transfection, electroporation and micro-injection. Gene knockout techniques in bacterial and eukaryotic organisms.

UNIT VII

Genome Editing - Introduction to genome editing techniques- Principles and applications of genome editing techniques. CRISPR-Cas9, site-directed mutagenesis, and other genome editing methods.

Suggested Readings

1. Bilgrami and Pandey. 1990. Introduction to Biotechnology. CBS Publishers, India.

2. Bullock, J. and Uritiansen, B. 1995. Basic Biotechnology. Academic Press, UK.
3. Dubey, R. C. 2014. A Textbook of Biotechnology. S. Chand and Co. Pvt. Ltd. New Delhi, India, ISBN: 81-219-2608-4.
4. Jack, G. Chirikjian. 1995. Biotechnology: Theory and Techniques Volume I. Jones and Bartlett Publishers, Boston, London, Singapore.
5. Natesh, S. 1993. Biotechnology in Agriculture. Oxford and IBM Pvt. Ltd., India.
6. Smith, J. E. 1988. Biotechnology. Edward Arnold Pub. NY, UK.

DSE 1-Biotechnology and Genetic Engineering (Practical)

SOLS/BOT/DSE-1(P)

Credits: 2

1. Demonstration of Agarose Gel Electrophoresis.
2. Confirmation of plasmid by restriction digestion and Agarose Gel Electrophoresis
3. Ligation of the DNA insert and the plasmid vector backbone using the DNA ligase enzyme.
4. Transformation of plasmid DNA in *E. coli* cells by the Calcium Chloride method.
5. Isolation of plasmid DNA from bacterial cells by the alkaline lysis method.
6. Screening of plasmid DNA transformed colonies by the Blue-white method.
7. Confirmation of gene integration by polymerase chain reaction (PCR).
8. Micropropagation of plant organs, i.e Leaf, stem, shoot tips and axillary buds.

Suggested Readings:

1. E. Pullaiah, T., Rao, M.V. Subba, Sreedevi 2017. Plant Tissue Culture: Theory and Practicals 2nd Edition.
2. P V G K Sarma, 2021. A Practical Textbook of Genetic Engineering in Bacteria.
3. B.D. Singh, 2015. Biotechnology.

Vocational Course 1: Algal Biotechnology

Course Code: SOLS/BOT/VC-1

Credits– 4

UNIT-I

Methods for mass cultivation of microalgae, Microalgal production in Photobioreactors. Microalgae-Based Biorefineries.

UNIT-II (4 Lectures)

Algal blooms: factors responsible for the formation of blooms in freshwater and marine systems, strategies for controlling nuisance blooms, and consequences of blooms.

UNIT-III (10 Lectures)

High-rate algal ponds for the treatment of wastewaters and the production of useful biomass and energy; Carbon sequestration, hydrogen production by algae; immobilised, self-immobilised and inactivated algal biomass for metal and nutrient removal.

UNIT-IV (4 Lectures)

Paddy field cyanobacteria: Use of algae as biofertilizers, reclamation of usar lands. Other roles of microalgae in agriculture.

UNIT-V (6 Lectures)

Algae as a source of nutraceuticals and pharmaceuticals; Commercial perspective of Spirulina, Chlorella, Dunaliella, Porphyra and other seaweeds; Importance of periphytic algal community to aquatic systems.

Suggested Readings:

1. R.E. Lee, Phycology, Cambridge University Press
2. Bux, Faizal, Chisti, Yusuf, Algae Biotechnology Products and Processes, Springer International Publishing
3. Posten, Clemens, Feng Chen, Steven, Microalgae Biotechnology, Springer International Publishing
4. Anderson, RA, Algal Culturing Techniques, Academic Press
5. Tripathi, BN, Kumar, D., Prospects and Challenges in Algal Biotechnology, Springer Singapore

Vocational Course 2: Applied Palynology
Course Code: SOLS/BOT/VC-2

Credits– 4

UNIT-I (6 Lectures)

Palynology- Introduction and history; basic vs applied palynology. Methods used in pollen grain analysis (Wodehouse and Erdtman), micrometry and terminology. Practical applications of palynology.

UNIT-II (8 lectures)

Melissopalynology: General introduction; types of honey bee in India. Bee biology; honey, nectar and how honey is formed? Types of honey. Bee pasturage, pollen pellets; pollen grains in honey. Chemical and physical characteristics of honey; assessment of honey quality, floral source. Methods in Melissopalynology- qualitative and quantitative analysis; estimation of absolute number of plant elements in honey.

UNIT-III (6 Lectures)

Aeropalynology: Introduction to Aerobiology, aeropalynology- definition and scope; history. Airborne biological material: types and its transport; types of sampling devices. Pollen calendar and pollen forecasting. Methods for pollen allergy diagnosis.

UNIT-IV (5 Lectures)

Forensic palynology: Introduction; techniques in Forensic palynology. Types of palynomorphs and their identification. Applications and importance of Forensic palynology.

UNIT-V (5 Lectures)

Quaternary Paleopalynology: Introduction, Quaternary pollen records in India. Laboratory techniques used for pollen/spore extraction. Pollen diagram construction. Applications of Paleopalynology. Paleopalynology in hydrocarbon exploration- coal and petroleum.

Suggested readings:

1. Kashinath Bhattacharya, Manas Ranjan Majumdar, Swati Gupta Bhattacharya, A Textbook of Palynology, New Central Book Agency, Kolkata.
2. S. T. Tilak, Aerobiology, Satyajeeta Prakashan, Pune
3. Prabhawati Tiwari, J.K. Tiwari, Dinesh Singh Rawat, P. K Publishers and Distributors, New Delhi

Major Zoology

SOLS/ZOO/DSE-1 Applied Zoology

Credits: 4, 60 Hours

UNIT I

Introduction to Host-parasite Relationship: Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis [4 Hours]

UNIT II

Epidemiology of Diseases: Transmission, Prevention and control of diseases—Tuberculosis, swine flu, typhoid, Covid-19 [5 Hours]

UNIT III

Rickettsiae and Spirochaetes: Brief account of Rickettsia prowazekii, Borrelia recurrentis and Treponema pallidum [4 Hours]

UNIT IV

Parasitic Protozoa: Life history and pathogenicity of Entamoeba histolytica, Plasmodium vivax, Leishmania donovani and Trypanosoma gambiense [5 Hours]

UNIT V

Parasitic Helminthes: Life history and pathogenicity of Schistosoma haematobium, Ancylostoma duodenale and Wuchereria bancrofti [5 Hours]

UNIT VI

Insects of Economic Importance: Biology, Control and damage caused by Helicoverpa armigera, Pyrilla perpusilla and Papilio demoleus, Callosobruchus chinensis, Sitophilus oryzae and Tribolium castaneum; Safe storage of stored grains [8 Hours]

UNIT VII

Insects of Medical Importance: Life cycle, medical importance and control of Pediculus humanus corporis, Anopheles, Culex, Aedes, Xenopsylla cheopis, Phlebotomus argentipes [10 Hours]

UNIT VIII

Animal Husbandry: Domestic animals of economic importance; Preservation and artificial insemination in cattle; Induction of early puberty and synchronisation of estrus in cattle [8 Hours]

UNIT IX

Poultry Farming: Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs [6 Hours]

UNIT X

Fish Technology: Genetic improvements in the aquaculture industry; Induced breeding and transportation of fish seed [5 Hours]

Suggested Readings

1. Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications and Distributors.
2. Atwal, A.S. (1986). Agricultural Pests of India and South East Asia, Kalyani Publishers.
3. Dennis, H. (2009). Agricultural Entomology. Timber Press (OR).
4. Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology: Genetic Approaches. CABI publications, U.K.
5. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
6. Kumar, Vinay et al. (2014). Robbins And Cotran Pathologic Basis of Disease South Asia Edition
7. Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B. Publishers.
8. Pedigo, L.P. (2002). Entomology and Pest Management, Prentice Hall.

SOLS/ZOO/DSE-1(P) Applied Zoology (Practical)

Credits:2

1. Study of Plasmodium vivax, Entamoeba histolytica, Trypanosoma gambiense, Ancylostoma duodenale, Leishmania donovani and Wuchereria bancrofti and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: Pediculus, Culex, Anopheles, Aedes and Xenopsylla.
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of Helicoverpa armigera, Papilio demoleus, Pyrilla perpusilla, Callosobruchus chinensis, Sitophilus oryzae and Tribolium castaneum
5. Visit to poultry farm or animal breeding centre and submission of visit report.
6. Preparation and maintenance of freshwater aquarium.

Wildlife Conservation & Management

SOLS/ZOO/DSE-2

Credits: 4, 60 Hours

UNIT I

Wildlife - Values of wild life; Our conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies [4 Hours]

UNIT II

Habitat analysis; Evaluation and management of wildlife - Physical parameters (Topography, Geology, Soil and Water); Biological Parameters (food, cover, forage, browse and cover estimation); Standard evaluation procedures: remote sensing and GIS [8 Hours]

UNIT III

Management of habitats - Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity [6 Hours]

UNIT IV

Population estimation: Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method [10 Hours]

UNIT V

National Organisations involved in wildlife conservation; Wildlife Legislation – Wildlife Protection Act - 1972, its amendments and implementation; CITES; IUCN Red Data Book [6 Hours]

UNIT VI

Management planning of wildlife in protected areas; Estimation of carrying capacity; Ecotourism /wildlife tourism in forests; Concept of climax persistence; Ecology of disturbance [8 Hours]

UNIT VII

Management of excess population and translocation; Bio-telemetry; Care of injured and diseased animals; Quarantine; Common diseases of wild animals [6 Hours]

UNIT VIII

Zoogeographic areas of the Indian Subcontinent; Protected Areas: National Parks/ Sanctuaries/Biosphere Reserves of the Indian Subcontinent; Important features of protected areas in India; Tiger conservation – Tiger reserves in India; Management challenges in the Tiger reserve [12 Hours]

Suggested Readings

1. Sharma, BD: High Altitude Wildlife of India. Oxford 7 IBH Publ. Co. Pvt. Ltd. 1994.

2. Negi, SS: Himalayan Wildlife: Habitat and Conservation. Indus Publ. Company, New Delhi 1992.
3. Pullin, AS: Conservation Biology, Cambridge University Press, 2002.

Wildlife Conservation & Management (Practical)

SOLS/ZOO/DSE-2(P)

Credits: 2

1. Identification of flora, mammalian fauna, avian fauna, and herpetofauna
2. Demonstration of basic equipment needed in wildlife studies, use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
3. Familiarisation and study of animal evidence in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers, etc.
4. Demonstration of different field techniques for flora and fauna
5. PCQ, Ten tree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
6. Trail/ transect monitoring for abundance and diversity estimation of mammals and birds (direct and indirect evidence)
7. Photograph of wild animals.
8. Zoogeographic areas of the Indian Subcontinent.
9. National Parks/ Sanctuaries/Biosphere Reserves of the Indian subcontinent.
10. Population estimation: capture-recapture method.

Principles of Genetics & Evolutionary Biology

SOLS/ZOO/DSE-3

Credits: 4, 60 Hours

A. Genetics

UNIT I

Mendel's law; Exceptions to Mendel's law; Chromosomal theory of Inheritance; Sex-linked inheritance & genetic disorders; Linkage & Crossing Over [8 Hours]

UNIT II

Chromosome structure; Euchromatin; Heterochromatin; Polytene and lampbrush chromosomes. Chromosome banding, Karyotyping; Fine structure of gene and allelism; Sex determination and Sex Linkage [10 Hours]

UNIT III

Cytoplasmic Inheritance, Polygenic Inheritance, Mutation, population and evolution genetics, Hardy-Weinberg Principle [10 Hours]

B. Evolution

UNIT IV

Historical development of the concept of evolution. Theories of organic evolution: Lamarckism (Neo-Lamarckism); Darwinism (Neo-Darwinism); Modern synthetic theory. Evidence in favour of evolution: Comparative anatomy, Comparative Embryology, Palaeontology, Biochemistry & Genetics [10 Hours]

UNIT V

Processes of Evolutionary Change: Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilising, Disruptive), Artificial selection. Species Concept: Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric) [10 Hours]

UNIT VI

Palaeontology: Fossils and fossilisation, Incompleteness of fossil record, Dating of fossils, Significance of fossil record; Geological distribution of animals; Mass extinction (Causes, five major extinctions, K-Textinction in detail), Role of extinction in evolution; Evolution of Horse [12 Hours]

Suggested Readings

1. Allendorf, Fred W., Gordon H. Luikart, Sally N. Aitken (2012). Conservation and the Genetics of Populations,2nd edition, Wiley-Blackwell
2. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
3. Benjamin A. Peirce (2017). Genetics: A Conceptual Approach, W.H. Freeman and Company
4. Brown, TA (2020). Gene Cloning and DNA Analysis and Introduction, 8th edition, Wiley-Blackwell
5. Daniel L. Hartl, Elizabeth W. Jones (2004). Genetics Analysis of Genes and Genomes, 6th edition, Jones and Bartlett Publishers
6. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
7. Gardner, Gimmons and Snustad (2006). Principles of Genetics, 8th edition, John Wiley & Sons.
8. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
9. Minkoff, E. (1983). Evolutionary Biology. Addison-Wesley
10. Reece, Jane B. (2011). Campbell Biology, 9th Edition, Pearson
11. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
12. Robert, H. Tamarin (2009). Principles of Genetics, Tata McGraw-Hill Education Pvt. Ltd.
13. Strickberger, M.W. (1989). Evolution, Jones and Bartlett Publishers
14. William S. Klung Cummings, Spencer and Palldino (2019). Concepts of Genetics, Pearson Education, Pearson.

Principles of Genetics & Evolutionary Biology (Practical)

SOLS/ZOO/DSE-3(P)

Credits:2

A. Genetics

1. Study of Mendelian Inheritance and gene interactions (Non-Mendelian Inheritance) using suitable examples. Verify the results using the Chi-square test.
2. Study of Linkage, recombination, and gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).

B. Evolution

1. Study of fossil evidence from plaster cast models and pictures
2. Study of homology and analogy from suitable specimens/ pictures
3. Charts:
   a. Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
   b. Darwin's Finches with diagrams/cut-outs of beaks of different species
4. Visit to the Natural History Museum, submission of report.

Animal Behaviour & Endocrinology

SOLS/ZOO/DSE-4

Credits: 4, 60 Hours

A. Animal Behaviour

UNIT I

The science of behaviour: History, scope and terminology. Proximate and ultimate causes of behaviour. Instinct: Definition and characteristics (sign stimuli and Fixed Action Pattern). Learning behaviour: Definition. Spatial learning. Associative learning, classical conditioning, operant conditioning, and language learning. Imprinting. Kin recognition. Instinct versus learning behaviour. Timing of behaviour: Biological rhythms. The Biological Clock. Circadian rhythm and its synchronisation with seasonal rhythms. Photoperiodism [12 Hours]

UNIT II

Communication: Visual, olfactory, acoustic (bird songs, amphibian calls); echolocation in bats, electrolocation in fish. Chemoreception: Chemicals (pheromones) as signals in insects, fish and mammals. Role of olfaction in communication behaviour (territorial, sex recognition, feeding, etc) in fish and mammals. Neural control of behaviour: Components of the brain involved in various behaviours. Neural control of drinking, learning, eating, activity & rest, sleep, aggression, sexual behaviour. Hormonal Control of behaviour: Hormone brain relationships. Sexual behaviour in mammals (e.g. rat). Sociobiology: Elements of sociality and social grouping in animals [15 Hours]

B. Endocrinology

UNIT III

Endocrine messengers: hormones, neurohormones, hormone-like substances (neuronal peptides, autocoids, pheromones, neurosecretion). Hormones and Physiological actions of

the endocrine glands in mammals: Pituitary, Thyroid, Parathyroid, Pancreas, Gastro-intestinal tract, Adrenal cortex and Medulla, Thymus and Pineal. Hormone biosynthesis: Protein peptide hormones (gonadotropins, thyrotropin, corticotropin, steroids and catecholamines). Mechanism of action of Protein hormones and Catecholamines: membrane-bound receptors, G-protein and control of adenylate cyclase, Cyclic nucleotide cascade [18 Hours]

UNIT IV

Organisation & physiological actions of the Testis: Androgen binding protein (ABP), Inhibin. Neuroendocrine control of testicular functions (Gn RH regulation, FSH- effects on germinal epithelium, LH- effects on Leydig cells, negative feedback regulation). Organisation & physiological actions of the Ovary: Folliculogenesis, Ovulation, Luteinisation, Ovarian cycles; Seasonal reproductive cycles; sexual dysfunctions in man [15 Hours]

Suggested Readings

1. Alcock, John: Animal Behaviour, 4th edition, Sinauer Associates, Inc., 1989.
2. Bentley P.J.: Comparative Vertebrate Endocrinology S. Chand & Company Ltd, Ram Nagar, New Delhi, 1980

Animal Behaviour & Endocrinology (Practical)

SOLS/ZOO/DSE-4(P)

Credits: 2

1. Animal Behaviour photographs/videos/models
2. Slides & Photographs of Endocrine Disorders
3. Examination of histological sections from photomicrographs/ permanent slides of rat/human endocrine glands
4. Cholesterol estimation from a serum sample
5. Glucose estimation from a blood sample

Introduction to Developmental Biology

SOLS/ZOO/DSE-5

Credits: 4, 60 Hours

UNIT I

Basic concepts in developmental biology; Gametogenesis: Events in spermatogenesis. Morphology of mature mammalian spermatozoon; Events in Oogenesis, Significance of Oogenesis. Vitellogenesis in birds: Comparison between Spermatogenesis & Oogenesis
Fertilisation: Mechanism of fertilisation; Capacitation, Molecular events - Block to polyspermy. Egg activation: An Elementary idea of parthenogenesis.

UNIT II

Types of eggs and cleavage. Role of yolk during cleavage; Products of cleavage (Morula and Blastula). Fate map: fate map of the early blastula of the Frog, Fate of germ layers.

Types of morphogenetic movements. Gastrulation in sea urchin, frog, chick and mammal. Neurogenesis & Notogenesis.

UNIT III

Extra Embryonic Foetal Membrane (Chick). Development of the chick embryo up to 72 hours. Types, formation and function of the Placenta in mammals. Metamorphic events in the frog life cycle and their hormonal regulation.

UNIT IV

Elementary concept of primary organizer; Induction; nature and its mechanism of action; Development of eye and limbs; Totipotency; Teratogenesis; Drosophila development up to gastrulation; Differential expression of genes in Drosophila.

Suggested Readings

1. Berrill, NJ: Developmental Biology, Tata McGraw-Hill Publishing Co. Ltd., 1979
2. Gilbert, SF: Developmental Biology, 3rd edition, Sinauer Associates, 1991
3. Twyman, R.M.: BIOS Instant Notes in Developmental Biology, Taylor & Francis, 2000

Introduction to Developmental Biology (Practical)

SOLS/ZOO/DSE-5(P)

Credits: 2

1. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.
2. Chick- Study of developmental stages - sections through permanent slides – cleavage stages, primitive streak stage, 24, 36, 48, 72 hours of incubation
3. Study of the different types of placentae- histological sections through permanent slides or photomicrographs.
4. Study of placental development in humans by ultrasound scans.
5. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.

Basics of Biotechnology

SOLS/ZOO/DSE-6

Credits: 4, 60 Hours

UNIT I

What is Biotechnology? Historical inputs. Biotechnology as a `tool' not a `product'. Interdisciplinary nature. Foundation of Biotechnology: Importance of basic Biology disciplines eg, Human, Animal and Plant Physiology, Genetics, Cell and Molecular Biology, Microbiology, Biochemistry, Immunology and Chemical engineering [12 Hours]

UNIT II

Introduction to Genetic Engineering. Tools and techniques.

Enzymes, Restriction endonuclease. Ligases, Alkaline phosphatase, Reverse transcriptase, DNA polymerase, Vectors-plasmids, phages, cosmids. Biotechnology hazards and safety. Social, moral and ethical issues [12 Hours]

UNIT III

Biotechnology in health care. Therapeutic products (Hormones, regulatory proteins, antibiotics). Prenatal diagnosis of genetic diseases. Vaccines, Immunodiagnostics (RIA, ELISA, IRMA) and DNA probes for disease identification. Gene therapy. Human Genome and Biomedicine [12 Hours]

UNIT IV

Introduction to Environmental Biotechnology. Bioprocessing Techniques. Enzyme Biotechnology. Single-cell proteins. Food and Beverage Biotechnology. Biotechnology in animal agriculture. Biotechnology in plant agriculture [12 Hours]

UNIT V

Genetics and Biotechnology: Introduction, Animal Cloning (therapeutic and Reproductive), Genetic manipulation at the organism level: Transgenesis, Knock-in and Knock-out models (Cre-Lox P system), CRISPR-Cas9 technology, genome editing in nature and artificial species improvement of plants and animals. Genetic manipulation at the cellular and molecular level, transfection technologies, adenoviral and lentiviral-based methods; Industrial genetics; Cell fusion and hybridoma techniques [12 Hours]

Suggested Readings

1. Das H.K.: Textbook of Biotechnology, Wiley India Pvt. Limited, ISBN 8126505567, 2004
2. Dubey R.C.: A Textbook of Biotechnology, S. Chand Publishing, 1993
3. Thieman, William, Michael A. Palladino: Introduction to Biotechnology, Pearson Education India; 3rd edition, ISBN-10: 9789332535060, 2014

Basics of Biotechnology (Practical)

SOLS/ /ZOO/DSE-6(P)

Credits:2

1. Isolation of plasmid DNA from E. coli.
2. Transformation of E. coli (pUC 18/19) and calculation of transformation efficiency.
3. Restriction Endonuclease Digestion of plasmid DNA.
4. Ligation of Target DNA
5. Gene amplification using PCR
6. DNA sequencing: Interpretation of sequence from the data provided.
7. Analysis of DNA fingerprint
8. Separation of proteins by SDS-PAGE

VOCATIONAL COURSE (VCZ-1—VCZ-6)
[Student will elect any one related to Core Subject 1]
SOLS/ZOO/VCZ-1 Poultry Farming

4 Credits [60 Hours]

UNIT- I Introduction

Poultry breeds – description of different breeds – day-old chicks, broilers and layers, Japanese Quail, Ducks, Turkey Farming. Different systems of Poultry Farming – Layers for Egg Production (day-old chicks, rearing from 20th week), Broilers for Table purposes and Hatcheries for chick production. Rearing Types/ Systems - Deep litter system and Cage System, multitiered cage system. External morphology of a variety of Fowls: Plymouth Rock, Light Sussex, Minorca, Rhode Island, Red and White Leghorn. Game and Ornamental purpose varieties [20 Hours].

UNIT- II Poultry shed

The layout of Poultry houses: Shed for the placement of chicks – ventilation opening, feeder, water, moisture level, and dust. Infrastructure requirements, Types of Shed and their construction. Poultry Equipment, its use and maintenance [6 Hours]

UNIT- III Feeding of Poultry

Poultry feed classification and principles of feeding; Feed additives and supplements; Feed requirement of chicks, birds, feed chart, balanced feed, waste minimisation, proper Feed Conversion Ratio [6 Hours]

UNIT- IV Management of a Poultry Farm

Management of Egg Layers – Management of Broilers in large-scale farms. Cleaning, disinfection, sanitization and fumigation of tools/ equipment and shed; maintenance of comfort environment for chicks- adequate light, heat, clean water, feed; Footbath at the entrance (Chemicals/ disinfectants); Handling & caring health management, vaccination etc.; Poultry diseases - Viral, Bacterial, Fungal, Protozoan and Parasitic Lice etc.; Prevention and precautions during vaccination [12 Hours]

UNIT- V

Progressive plans to promote Poultry as a Self-Employment venture; Support systems available at various District/State, /National levels; State/Central Government Schemes for giving impetus to entrepreneurship development.

Indian breed of poultry: Aseel, Chittagong, Kadaknath and Busra Field Visit & Interaction with Poultry Farmers and other Support Agencies [16 Hours] (Students will prepare and submit a report on their field visit)

Suggested Readings

1. Poultry Production and Management by J. Prasad, Kalyani Publishers (2015)
2. Poultry Science and Practice by N. Ghosh, CBS Publishers & Distributors (2015)

SOLS/ZOO/VCZ-2 Apiculture

Credit: 4

UNIT I

Biology of Bees: History, classification and biology of honey bees; Species of honey bees (Apis dorsata, Apis cerana indica, Apis florea, Apis mellifera, Melipona irridipennis; Specific Characteristics and suitability for geographic condition; Climatic requirement of different bee species; Social organisation of honey bee colony [18 Hours] 4 Credits [60 Hours]

UNIT II

Rearing of Bees. Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth; Flora for apiculture; Selection of Bee Species for Apiculture; Modern method of apiculture – Tools and appliances for the modern method. Enemies and diseases of the Honey bee, Control and Preventive measures [16 Hours]

UNIT III

Harvesting, Processing and Preservation of Honey. Methods of harvesting honey; Processing of honey; Preservation of honey; Indigenous method for extraction of honey [6 Hours]

UNIT IV

Economic Importance. Honey, Bees Wax, Propolis etc.- Production, Chemical composition of Honey bee wax; Economic, nutritional and medicinal value [4 Hours]

UNIT V

Entrepreneurship in Apiculture. Beekeeping industry – Requirements of Commercial Bee Keeping, Recent efforts, Government-sponsored scheme, Modern method in employing honey bees for cross-pollination in horticultural gardens. Field Visit & Interaction with Bee Keepers and other Support Agencies [16 Hours] (Students will prepare and submit a report on their field visit)

SUGGESTED READINGS

1. Bisht D.S. (2016). Apiculture, ICAR Publication
2. Gupta, JK. (2016). Apiculture ICAR PDF Book
3. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
4. Singh S. (1962). Beekeeping in India, Indian Council of Agricultural Research, New Delhi

SOLS/ZOO/VCZ-3 Sericulture

Credit: 4

UNIT I

Introduction to Sericulture: Origin and history of sericulture. Ancient silk route and map of India; Temperate and tropical climate for sericulture practice. Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture 4 Credits [60 Hours] 23 Types of silkworms: Mulberry Silkworm (Bombyx mori), Tasar Silkworm (Antherea

paphia), Muga Silkworm (Antheraea assama), Eri Silkworm (Attacus ricinii), Oak Silkworm (Antheraea pernyi) and Giant Silkworm (Attacus alts) [20 Hours]

UNIT II

Biology of Silkworm: Life cycle of Bombyx mori, Morphology of the egg, larva, pupa, adult; Structure of silk gland and secretion of silk. Voltinism in silk worm: univoltine, bivoltine, poly or multivoltine. Biology of Mulberry: Botanical description of mulberry. Economic importance of the mulberry Plant, Morus L. and its species [10 Hours]

UNIT III

Rearing of Silkworms: Selection of mulberry variety and establishment of mulberry garden, rearing house and rearing appliances disinfectants (formalin, bleaching powder); RKO Silkworm rearing technology: types of mountages, spinning, harvesting and storage of cocoons; Physical and commercial characters of Cocoons, Importance of by-products of Sericulture [10 Hours]

UNIT IV

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates. Silkworm diseases: Protozoan disease, Bacterial disease, Fungal disease, Viral disease, Sotto disease, septicemia, galtine; Control and prevention of pests and diseases [6 Hours]

UNIT V

Entrepreneurship in Sericulture: Prospects of Sericulture in India, Sericulture industry in different states, self-employment venture, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres [14 Hours] (Students will prepare and submit a report on their field visit)

Suggested Readings

1. A Guide for Bivoltine Sericulture: K. Sengupta, Director, CSR & TI, Mysore (1989)
2. An Introduction to Sericulture: Ganga, G., J. Sulochana Chetty, Oxford & IBH Pub. Co. (1991)
3. Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore (1987)
4. Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore (1987)
5. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan (1972)
6. Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore (1986)
7. Manual of Silkworm Egg Production: M. N. Narasimhanna, CSB, Bangalore (1988)
8. Principles of Sericulture (Translated from Japanese): Hasao Aruga, Oxford & IBH Pub. Co. Pvt.. Ltd., New Delhi (1994)
9. Silkworm Rearing: Wupang-Chun and Chen Da-Chung, FAO, Rome (1988)

SOLS/ZOO/VCZ-4 Aquaculture

Credit: 4

UNIT I

Aquaculture: Definition and Scope, commercially important cultivable finfish species in freshwater, brackish water and marine water environments; Types of farming systems: extensive, semi-intensive and intensive culture; Cage culture; Integrated fish farming [14 Hours] 4 Credits [60 Hours]

UNIT II

Fish ponds: types and their management; Fish polyculture with special reference to indigenous & exotic major carps; Induced breeding: Hypophysation and use of synthetic hormone, significance of Induced breeding [12 Hours]

Unit III

Prawn culture, ornamental fish culture and its significance; Commercially important fresh water and marine ornamental fish species; Maintenance of aquaria; Farming of pearl oyster [10 Hours]

UNIT IV

Fish feed: Fish feed ingredients; Type of feeds and feeders used in Aquaculture; Commonly occurring diseases in aquaculture and their control [8 Hours]

UNIT V

Field visit to fish farm, hatchery complex, and onsite interactions with progressive fish farmers [16 Hours] (Students will prepare and submit a report on their field visit)

Suggested Readings

1. A Textbook of Fish Biology and Fisheries, 3rd Edition by S.S. Khanna and H.R. Singh, NPH, Delhi (2014)
2. Aquaculture by John E. Bardach, Wiley India Pvt Ltd (1974)
3. Aquaculture: Principles and Practices by T.V.R. Pillay, Wiley India Pvt Ltd (2011)
4. Introduction to Aquaculture by Matthew Landau, Wiley (1991)
5. Textbook of Fish Culture by Marcel Heut, Fishing News Books Ltd (1972)

SOLS/ZOO/VCZ-5 Fish Hatchery Operations

4 Credits [60 Hours]

UNIT I

Freshwater fish seed resources; Natural breeding of finfishes; Historical perspective of fish seed collection; Sexual maturity, breeding season and development of gonads [10 Hours]

UNIT II

Induced breeding of Indian major carps (Catla, Rohu, Mrigala) and exotic carps (Silver carp, Grass carp); Environmental factors affecting spawning; Fish pituitary gland, synthetic hormones for induced breeding of fishes; Fish brood stock management and transportation of brood fish [12 Hours]

UNIT III

Different types of fish hatcheries: traditional double-walled hapa, Chinese carp hatchery, glass jar hatchery, Flow throw hatchery; Egg and embryonic developmental stages; Causes of mortality of fish eggs and spawn in hatchery operation and their treatment [12 Hours]

UNIT IV

Spawn rearing techniques: nursery and rearing pond management; Packing and transportation of fish seed and use of anaesthetics/ disinfectants in fish breeding and transport; Cryopreservation of semen [10 Hours]

UNIT V

Field visits to *Fish hatchery [16 Hours] (Students will prepare and submit a report on their field visits) *

Suggested hatcheries in Uttarakhand: Trout hatchery, Bairangna, District Chamoli; Gangori hatchery, District Uttarkashi; Koteshwar hatchery (Common carp and Masheer fish seed), Koteshwar, District Tehri; Carp hatchery, Kashipur, US Nagar

Suggested Readings

1. Broodstock Management and Quality Fish Seed Production in Freshwater Fishes by K K Marx, NPH, Delhi (2019)
2. Fish Hatchery Management by Robert G. Piper, Andesite Press (2015)
3. Induced Fish Breeding: A Practical Guide for Hatcheries by Nihar Ranjan Chattopadhyay, Academic Press; 1st edition (2016)
4. Text Book of Breeding and Hatchery Management of Carps by Gupta and Mohapatra, NPH, Delhi (2008)

SOLS/ZOO/VCZ-6 Vermiculture

Credit: 4

UNIT I

Introduction to vermiculture: Definition, meaning, history, economic importance; Role in bio transformation of the residues and production of organic fertilisers; The matter and humus cycle. Ground population, transformation process in organic matter; useful species of earthworms (Local species and Exotic species of earthworms) [12 Hours] 4 Credits [60 Hours]

UNIT II

The earthworm species: Biology of Eisenia fetida (Taxonomy, anatomy, physiology and reproduction of Lumbricidae; Vital cycle of Eisenia fetida: alimentation, fecundity, annual

reproducer potential and limit factors (gases, diet, humidity, temperature, pH, light, and climatic factors). Biology of Eudrilus eugeniae (Taxonomy, anatomy, physiology and reproduction of Eudrilidae; Vital cycle of Eudrilus eugeniae: alimentation, fecundity, annual reproducer potential and limiting factors) [12 Hours]

UNIT III

Earthworm farming: Earthworm compost for home gardens; Conventional commercial composting; Earthworm Farming (Vermiculture), Extraction (harvest), vermicomposting harvest and processing; Nutritional Composition of Vermicompost for plants; Vermiwash collection, composition & use; Enemies of Earthworms, Common problems their prevention and solution [12 Hours]

UNIT IV

The working group's experience with E. fetida populations' comportment with farm industrial residues (frigorific, cow places, feed-lot, aviaries exploitations, and solid urban residues); Lineaments to vermicomposting elaboration projects; Considerations about economic aspects of this activity [12 Hours]

UNIT- V

Demonstration of vermiculture in the field [12 Hours] (Students will prepare and submit a report on their visit to the demonstration unit)

Suggested Readings

1. Ahmad, S Rehan: CBCS Skill Enhancement Course Vermicompost Production (Set of 5 Books), Nitya Publications, Bhopal, 2020
2. Edwards, Clive A., Norman Q. Arancon, Rhonda L. Sherman: Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management, CRC Press, 2010
3. Keshav Singh: A Textbook of Vermicompost: Vermiwash and Biopesticides, Biotech Books, 2014
4. NPCS Board of Consultants & Engineers: The Complete Technology Book on Vermiculture and Vermicompost, Asia Pacific Business Press Inc., 2004

Major Physics

Modern Physics

Credits: 4, 60 hours

Wave–Particle Duality

Planck's quantum theory, photo-electric effect, Compton scattering, pair production, De Broglie hypothesis and matter waves, phase and group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle, energy-time uncertainty.

Atomic Structure

Rutherford and Bohr’s models, atomic spectra, Bohr's quantisation rule and atomic stability, energy level and spectra, atomic excitation, electron spin, Pauli's exclusion

principle, fine structure, spin-orbit coupling, L-S and J-J couplings, total angular momentum.

Atoms in Electric and Magnetic Fields

Electron Angular Momentum, Space Quantisation, electron Spin and Spin Angular Momentum, Larmor's Theorem, Spin Magnetic Moment, Stern-Gerlach Experiment, Normal and Anomalous Zeeman Effect, Stark effect, Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

Nuclear Properties and Transformation

Size and structure of nucleus, non-existence of electrons in the nucleus, atomic weight, binding energy, semi-empirical mass formula, nature of nuclear force. Radioactivity: stability of nucleus, law of radioactive decay, half-life and Mean lifetime, α-Decay, β-decay, energy released, γ-ray emission, fission and fusion, mass deficit and generation of energy, elementary idea of nuclear reactors, thermonuclear reactions.

Reference Books

1. Concepts of Modern Physics. Arthur Beiger, 4th Edition. 2019, Tata McGraw-Hill
2. Modern Physics for Scientists and Engineers. John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, 2nd Edition, 2015, University Science Books, U.S.
3. Six Ideas that Shaped Physics: Particles Behave like Waves. Thomas A. Moore, 3rd Edition, 2016. Tata McGraw-Hill.
4. Quantum Physics, Berkeley Physics Course Vol. 4. E.H. Wichman, 2008, Tata McGraw-Hill
5. Modern Physics. R.A. Serway. C.J. Moses, and C.A. Moyer. 3rd Edition, 2012. Cengage Learning
6. Modern Physics. R Murugeshan, Kiruthiga Sivaprasath, 18th Edition, 2016, S. Chand & Company Pvt Ltd.
7. Modern Physics. Kenneth S. Krane, 4th Edition, 2019,

Modern Physics (Practical)

Credits: 2

List of Experiments:

1. To determine the value of the Boltzmann constant using the V-l characteristic of the PN diode.
2. To determine the work function of the material of the filament of the directly heated vacuum diode.
3. To determine the value of Planck's constant using LEDs of at least 4 different colours.
4. To determine the ionisation potential of mercury.
5. To determine the wavelength of the H-alpha emission line of the Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photosensor and compare with incoherent source - Na light.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light

9. To determine the value of e/m by magnetic focusing.
10. To set up the Millikan oil drop apparatus and determine the charge of an electron.

Reference Books:

1. Advanced Practical Physics for students. B.L. Worsnop & H.T. Flint,1971, Asia Publishing House.
2. Advanced level Practical Physics. Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985.Heinemann Educational Publishers
3. A Text Book of Practical Physics. Indu Prakash, Ramakrishna, A.K. Jha, 11th Edition, 2012, Kitab Mahal, New Delhi.

Vocational Course Physics: Lab Testing of Electronic Components

4 Credits

Identification of various electronic components, understanding galvanometer, voltmeter, ammeter and Multimeter for their use in measurements, resistor, capacitor, and inductors testing and measurements and understanding their fundamentals.

AC and DC voltage and current, testing, measurements and understanding their fundamentals, testing of battery, fuse, and circuit continuity, tube light and heaters, switches and relays, testing of diodes, LED, transistors and ICs and their fundamentals.

Introduction to soldering and desoldering practices, fault finding and repair of electronic instruments, design and demonstration of an electronic circuit.

Reference Books

1. Testing of Electronic Components. E. A. Fernandez, P. J. Sarkar, 2021, Shroff Publishers
2. Principles of Testing Electronic Systems. S. Mourad, Y. Zorian, 2000, John Wiley & Sons, Inc.
3. Mastering Electronics Repair: A Practical Handbook for Beginners and Experts. V T Sreekumar (Author & Publisher)
4. Practical Electronics - A Self-Teaching Guide. R. Morrison 2003, Wiley Self-Teaching Guides
5. Basic Electronics. Mitchel E. Schultz, McGraw-Hill, Special Indian Edition

Major Chemistry

Students can opt for any one of the following papers:

1. **Analytical Methods in Chemistry**
2. **Polymer Chemistry**
3. **Green Chemistry**

Analytical Methods in Chemistry

Credits: 04, 60 Lectures

Qualitative and quantitative aspects of analysis

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data, F, Q and t test, rejection of data, and confidence intervals. (5 Lectures)

Optical methods of analysis

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instruments;

Basic principles of quantitative analysis: Estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of the composition of metal complexes using Job's method of continuous variation and the mole ratio method.

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instruments; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution.

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace levels of metal ions from water samples. (25 lectures)

Thermal methods of analysis

Theory of thermogravimetry (TG), the basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture. (5 lectures)

Electroanalytical methods

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values. (10 lectures)

Separation techniques

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation.

Techniques of extraction: batch, continuous and counter-current extractions.

Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from aqueous and nonaqueous media.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange.

Development of chromatograms: frontal, elution and displacement methods.

Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Stereoisomeric separation and analysis: Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of

enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC).
Role of computers in instrumental methods of analysis. (15 Lectures)

Reference Books:

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. *Vogel's Textbook of Quantitative Chemical Analysis*, John Wiley & Sons, 1989.
2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed.
3. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
4. Christian, G.D; *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
5. Harris, D. C. *Exploring Chemical Analysis*, Ed. New York, W.H. Freeman, 2001.
6. Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age, International Publisher, 2009.
7. Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
8. Mikes, O. *Laboratory Handbook of Chromatographic & Allied Methods, Elsevier* Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
9. Ditts, R.V. *Analytical Chemistry; Methods of Separation*, van Nostrand, 1974.

Analytical Methods in Chemistry: Practical

Credits: 02

I. Separation Techniques

1. Chromatography:

(a) Separation of mixtures

(i) Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}.

(ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.

(b) Separate a mixture of Sudan yellow and Sudan Red by the TLC technique and identify them on the basis of their Rf values.

(c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

II. Solvent Extractions:

(i) To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+} - DMG complex in chloroform, and determine its concentration by spectrophotometry.

(ii) Solvent extraction of zirconium with Amberlite LA-1, separation from a mixture of iron and gallium.

3. Determine the pH of the given aerated drinks, fruit juices, shampoos and soaps.
4. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.
5. Analysis of soil:
   (i) Determination of pH of soil.

(ii) Total soluble salt (iii) Estimation of calcium, magnesium, phosphate, nitrate

6. Ion exchange:
   (i) Determination of the exchange capacity of cation exchange resins and anion exchange resins.
   (ii) Separation of metal ions from their binary mixture.
   (iii) Separation of amino acids from organic acids by ion exchange chromatography.

III Spectrophotometry

1. Determination of pKa values of the indicator using spectrophotometry.
2 Structural characterisation of compounds by infrared spectroscopy.
3 Determination of dissolved oxygen in water.
4 Determination of chemical oxygen demand (COD).
5 Determination of Biological Oxygen Demand (BOD).
6 Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

Reference Books:

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. *Vogel's Textbook of Quantitative Chemical Analysis*, John Wiley & Sons, 1989.
2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.
6. Skoog, D.A., Holler, F.J., & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
7. Mikes, O. Laboratory Handbook of Chromatographic & Allied Methods, Elsevier Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
8. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.

Polymer Chemistry

Credits: 04, 60 Lectures

Introduction and History of Polymeric Materials

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers. (4 Lectures)

Functionality and Its Importance

Criteria for synthetic polymer formation, classification of polymerisation processes, Relationships between functionality, extent of reaction and degree of polymerisation. Bi-functional systems, Polyfunctional systems. (8 Lectures).

Kinetics of Polymerisation

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques. (8 lectures).

Crystallization and crystallinity

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. (4 lectures).

Nature and structure of polymers

Structure Property relationships. (2 lectures)

Determination of the molecular weight of polymers

(*Mn*, *Mw*, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index. (8 Lectures).

Glass transition temperature (Tg) and determination of Tg,

Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg). (8 Lectures)

Polymer Solution

Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymer solutions, Flory-Huggins theory, Lower and Upper critical solution temperatures. **(**8 Lectures).

Properties of Polymers

(Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly (vinyl chloride) and related polymers, poly (vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly (p-phenylene sulphide polypyrrole, polythiophene]. (10 Lectures)

Reference Books:

1. Seymour, R.B. & Carraher, C.E. *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc., New York, 1981.
2. Odian, G. *Principles of Polymerisation*, 4th Ed. Wiley, 2004.
3. Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Inter science, 1971.
4. Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.
5. Lenz, R.W. *Organic Chemistry of Synthetic High Polymers.* Inter science Publishers, New York, 1967.

Polymer Chemistry Practical

Credits: 02

Polymer Synthesis

1. Free radical solution polymerisation of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA), / Acrylic acid (AA).
   a. Purification of monomer
   b. Polymerisation using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN)
2. Preparation of nylon 66/6
   1. Interfacial polymerisation, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein
      a. Preparation of IPC
      b. Purification of IPC
      c. Interfacial polymerization
3. Redox polymerisation of acrylamide
4. Precipitation polymerisation of acrylonitrile
5. Preparation of urea-formaldehyde resin
6. Preparations of novolac resin/resol resin.
7. Microscale Emulsion Polymerisation of Poly(methylacrylate).

Polymer characterization

1. Determination of molecular weight by viscometry:
   (a) Polyacrylamide-aq. $NaNO_2$ solution
   (b) (Polyvinyl propylidene (PVP) in water
2. Determination of the viscosity-average molecular weight of poly (vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer.
3. Determination of molecular weight by end group analysis: Polyethene glycol (PEG) (OH group).
4. Testing of mechanical properties of polymers.
5. Determination of the hydroxyl number of a polymer using the colourimetric method.

Polymer analysis

1. Estimation of the amount of HCHO in the given solution by the sodium sulphite method
2. Instrumental Techniques
3. IR studies of polymers
4. DSC analysis of polymers
5. Preparation of polyacrylamide and its electrophoresis

Reference Books:

1. M.P. Stevens, *Polymer Chemistry: An Introduction*, 3rd Ed., Oxford University Press, 1999.
2. H.R. Allcock, F.W. Lampe & J.E. Mark, *Contemporary Polymer Chemistry*, 3rd ed. Prentice-Hall (2003)
3. F.W. Billmeyer, *Textbook of Polymer Science*, 3rd ed. Wiley-Interscience (1984)
4. J.R. Fried, *Polymer Science and Technology*, 2nd ed. Prentice-Hall (2003)

5. P. Munk & T.M. Aminabhavi, *Introduction to Macromolecular Science*, 2nd ed. John Wiley & Sons (2002)
6. L. H. Sperling, *Introduction to Physical Polymer Science*, 4th ed. John Wiley & Sons (2005)
7. M.P. Stevens, *Polymer Chemistry: An Introduction,* 3rd ed. Oxford University Press (2005).
8. Seymour/ Carraher's Polymer Chemistry, 9th ed. by Charles E. Carraher, Jr. (2013).

Green Chemistry

Credits: 04, 60 Lectures

Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry (4 Lectures).

Principles of Green Chemistry and Designing a Chemical Synthesis

Twelve principles of Green Chemistry with their explanations and examples, and special emphasis on the following:

Designing a Green Synthesis using these principles: Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.

Prevention/minimisation of hazardous/ toxic products, reducing toxicity. risk = (function) hazard × exposure; waste or pollution prevention hierarchy.

Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents.

Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy.

Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups.

Use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis.

Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD "What you don't have cannot harm you", greener alternative to Bhopal Gas Tragedy (safer route to carcarbaryl) and Flixiborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation.

Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes. (30 Lectures).

Examples of Green Synthesis/ Reactions and some real-world cases

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)

2. Microwave-assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave-assisted reactions in organic solvents: Diels-Alder reaction and Decarboxylation reaction
3. Ultrasound-assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)
4 Surfactants for carbon dioxide – replacing smog-producing and ozone-depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.
5 Designing an environmentally safe marine antifoulant.
6 Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.
7 An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.
8 Healthier fats and oils by Green Chemistry: Enzymatic interesterification for the production of no Trans-Fats and Oils
9 Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting (16 Lectures).

Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co-crystal controlled solid state synthesis (C_2S_3); Green chemistry in sustainable development. (10 Lectures).

Reference Books:

1. Ahluwalia, V.K. & Kidwai, M.R. *New Trends in Green Chemistry*, Anamalaya Publishers (2005).
2. Anastas, P.T. & Warner, J.K.: *Green Chemistry - Theory and Practical*, Oxford University Press (1998).
3. Matlack, A.S. *Introduction to Green Chemistry*, Marcel Dekker (2001).
4. Cann, M.C. & Connely, M.E. *Real-World cases in Green Chemistry*, American Chemical Society, Washington (2000).
5. Ryan, M.A. & Tinnesand, M. *Introduction to Green Chemistry*, American Chemical Society, Washington (2002).
6. Lancaster, M. *Green Chemistry: An Introductory Text,* RSC Publishing, 2nd Edition, 2010.

Green Chemistry Practical

Credits: 02

1. Safer starting materials

- Preparation and characterisation of nanoparticles of gold using tea leaves.

2. Using renewable resources

- Preparation of biodiesel from vegetable/ waste cooking oil.

3. Avoiding waste

Principle of atom economy.

- Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.
- Preparation of propene by two methods can be studied

(I) Triethylamine ion + OH^- → propene + trimethylpropene + water H_2SO_4/D
(II) 1-propanol → propene + water

- Other types of reactions, like addition, elimination, substitution and rearrangement, should also be studied for the calculation of atom economy.

4. Use of enzymes as catalysts

- Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.

5. Alternative Green solvents

- Extraction of D-limonene from orange peel using liquid CO2 prepared from dry ice.
- Mechanochemical solvent-free synthesis of azomethines

6. Alternative sources of energy

- Solvent-free, microwave-assisted one-pot synthesis of phthalocyanine complex of copper (II).
- Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Reference Books:

1. Anastas, P.T., & Warner, J.C. *Green Chemistry: Theory and Practice,* Oxford University Press (1998).
2. Kirchoff, M. & Ryan, M.A. *Greener approaches to undergraduate chemistry experiment*. American Chemical Society, Washington, DC (2002).
3. Ryan, M.A. *Introduction to Green Chemistry*, Tinnes and (Ed.), American Chemical Society, Washington, DC (2002).
4. Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. I.K. *Green Chemistry Experiment: A monograph, International Publishing House Pvt Ltd., New Delhi*. Bangalore CISBN 978-93-81141-55-7 (2013).
5. Cann, M.C. & Connelly, M. E. *Real world cases in Green Chemistry*, American Chemical Society (2008).

Vocational Course in Chemistry-I (Paper 1)
Chemistry Laboratory Guidelines and Techniques Theory

(Credit 4: Theory 2 + Practical 2)

Introduction to Chemistry Laboratory:

General introduction of the chemistry laboratory, common instructions for safe working in chemical laboratories, Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP). Laboratory design, Storage, ventilation, lighting, fume cupboard, arrangement of the store, Safety provisions, organisation of practical work, Maintenance of laboratory equipment, Cleaning of laboratories and glasswares/plasticwares and preparation room. Classification of apparatus in the store and the laboratory.

Introduction of Chemistry Apparatus Glass apparatus –

Beaker, test tube, boiling tube, funnel, separating funnel, filtration flask, round bottom flask, flat bottom flask, condenser, Liebig flask, watch glass, etc., measuring conical or condenser, Petridis, desiccators. Volumetric Apparatus -Measuring cylinder, burette,

pipette, volumetric flask, analytical balance, single-pan electronic balance/ electrical analytical balance, Micropipette, Three-way Pipette Bulb, etc.

Introduction of Chemistry Equipment:

Clevenger apparatus, Buchner funnel, Soxhlet extractor, wire gauze, cork borers, filter pumps, crucible, Mohr clip, pipe clay triangle, pestle and mortar, spirit lamp, spatulas, thermometer, pH meter, and laboratory centrifuge. Apparatus for heating and reaction: Magnetic Stirrer, Bunsen burner, water bath, oil bath, hot plate, sand bath, hot air oven, heating mantle, etc.

Practical: Chemistry Laboratory Guidelines and Techniques

Credit: 2

1. Handling of common laboratory equipment
2. Preparation of solutions, indicators and reagents (e.g. ceric ammonium nitrate, 2,4-dinitrophenyl hydrazine, Tollen's reagent, Fehling solution, etc).
3. Preparation of some organic compounds and determination of their boiling point and melting point (e.g. ester derivative of benzoic acid, ester of alcohol like ethanol, butanol, etc).
4. Cork boring experiment
5. Calibration of volumetric glassware

References:

1. Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
2. Vogel's textbook of chemical quantitative analysis, Longman Scientific
3. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, Universities Press.
4. Laboratory Manual of Organic Chemistry, R. K. Bansal, New Age Pub.
5. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
6. Chemistry Practical, O. P. Pandey, D.N. Bajpai, S. Giri, S. Chand.

Vocational Course in Chemistry-II (Paper 2)
Basics of Natural Products Theory (Credit 2)

Basic Chemistry of Natural Products:

Introduction to primary and secondary metabolites and their applications. Simple structure and detection methods of Alkaloids, Terpenoids, Flavonoids, Steroids, Pigments, Lipids and Carbohydrates.

General Extraction and Isolation Methods:

Clevenger apparatus, Soxhlet Extractor, Percolation, Column Chromatography, Flash Chromatography, Preparative and Analytical HPLC. Steps of the structure elucidation of synthetic and naturally occurring compounds.

Basics of Natural Products Practical (Credit 2)

1. Isolation and Purification of natural product (Caffeine from tea, Lactose and casein from milk)

2. To determine the saponification value of an oil/fat.
3. To determine the iodine value of an oil/fat.
4. Preparation of plant extract and phytochemical screening for alkaloids, glycosides, terpenoids and flavonoids by performing simple colour tests.

References:

1. Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
2. Vogel's textbook of chemical quantitative analysis, Longman Scientific
3. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, Universities Press.
4. Laboratory Manual of Organic Chemistry, R. K. Bansal, New Age Pub.
5. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
6. Introduction to Computer Science by Perry Donham.

Vocational Course in Chemistry-III (Paper 3)
Laboratory safety and solution preparation Theory (Credit 2)

Chemistry Laboratory Safety

Safety Data Sheet (SDS), Fire Hazards: Causes of fires, classification of fires, fire prevention protocols and measures, fire alarms, fire escapes, fire extinguishers and their uses. Classification of hazardous chemicals based on the information given on the labels.
Chemical Hazards: Classification and handling of hazardous chemicals, storage of chemicals, and transfer from large containers
Gas Hazards: usage of LPG and CNG safer in the laboratory, detection, and handling of Gas Leakage, health hazards of gases. Uses of Helium, Nitrogen, and Carbon Dioxide gases in the laboratory. To learn the use of a carbon dioxide fire extinguisher.

Solution Preparation

Water as a solvent, types of water, solutions, components of a solution, types of solution, solubility, concentration of solutions: percentage, molarity, normality, molality (in ppm), calculation of masses and volumes for preparation of solutions, solids, liquids.

Laboratory Safety and Solution Preparation Practical

Credit: 2

1. Preparation of hydrogen sulphide (H2S) gas using Kipp's apparatus.
3. Preparation of distilled and deionised water.
4. Purification of organic compounds by recrystallisation (e.g. Benzoic acid, etc)
5. Preparation of inorganic double salts.
6. Weighing of chemicals using analytical balance (e.g. preparing 1N solution, 1M solutions, etc).
7. Preparation of buffer solutions and determination of their pH Values (e.g. phosphate buffer, acetate buffer of varied pH, etc).

References:

- Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
- Vogel's textbook of chemical quantitative analysis, Longman Scientific
- Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, Universities Press.
- Laboratory Manual of Organic Chemistry, R. K. Bansal, New Age Pub.
- Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
- Chemistry Practical, O. P. Pandey, D.N. Bajpai, S. Giri, S. Chand.

Major Mathematics
Linear Algebra

Credits: 6

UNIT I

Vector spaces, Subspaces, Algebra of subspaces, Quotient spaces, Linear combination of Vectors, Linear span, Linear independence/dependence, Basis and dimension, Dimension of subspaces.

UNIT II

Linear transformations, Null space, Range, Rank and nullity of a linear transformation, rank-nullity theorem, Isomorphism, Isomorphism theorems, Inevitability and isomorphisms.

UNIT III

Matrix representation of a linear transformation, Algebra of linear transformations, Dual space, Dual basis, Double dual, Annihilator.

UNIT IV

Eigenvalues and eigen-vectors of Linear Transformation, Characteristic polynomial, algebraic and geometric multiplicities of eigen-value, Applications of eigen-value and eigen-vectors in finding the power of Matrix A, exp(A), sin(A), cos (A), and p(A), similar Matrices, diagonalisation of matrix.

Books Recommended

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, Linear Algebra and Its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, Introduction to Linear Algebra, 2nd Ed, Springer, 2005

Choose any one of the following:

(a)-Elementary Cryptography

Credit: 4

UNIT I

The Shift Cipher, The Substitution Cipher, The Affine Cipher, The Vigenere Cipher, The Hill Cipher, The Permutation Cipher, Stream & Block ciphers.

UNIT II

Shannon's Theory of Perfect Secrecy, Vernam One Time Pad, Random Numbers, Mode of operations in block cipher, the Data Encryption Standard (DES), Feistel Ciphers, the Advanced Encryption Standard (AES), Prime Number Generation, Fermat Test, Miller Rabin Test.

UNIT III

Public Key Cryptography, RSA Cryptosystem, Factoring problem, Rabin Cryptosystem, Quadratic Residue Problem, Diffie-Hellman (DH) Key Exchange Protocol, Discrete Logarithm Problem (DLP), ElGamal Cryptosystem, Elliptic Curve, Elliptic Curve Cryptosystem (ECC)

UNIT IV

Hash and Compression Functions, Security of Hash Functions, Iterated Hash Functions, SHA-1, MD-5, Message Authentication Codes.

Books recommended:

1. J Buchmann, Introduction to Cryptography, Springer (India) 2004
2. D R Stinson, Cryptography: Theory and Practice. CRC Press, 2000.
3. B Forouzan, Cryptography and Network Security, Tata McGraw-Hill, 2011
4. Wenbo Mao, Modern Cryptography: Theory and Practice. Pearson Education, 2004

(b)-Combinatorics and Graph Theory

Credit: 4

UNIT-I

Pigeonhole principle: Simple form, Strong form, Permutations and Combinations of multisets.

UNIT-II

The inclusion-exclusion principle, Combinations with repetitions, Derangements, Permutation with forbidden positions.

UNIT-III

Introduction to graph theory, Basic properties, Eulerian and Hamilton graphs, Bipartite multigraphs.

UNIT-IV

Trees, spanning trees, Digraphs and networks, directed cycle.

Books recommended:

1. Introductory Combinatorics - Fifth Edition, by Richard A. Brualdi, 2019, Pearson India Education Services Pvt. Ltd.
2. Graph Theory by Narsingh Deo, PHI
3. A Text Book of Graph Theory by R. Balakrishnan, K. Rangnathan, Springer.
4. Foundations of Combinatorics with Applications by Edward A. Bender, S. Gill Williamson, Dover Books on Mathematics.

ITEP Curriculum B.A. B.Ed. Semester-V

S.N.	Code	Courses	Credit
1.	ESSCCPC-501-F	Content cum Pedagogy of History at Sec. Stage - Course (II)	2
2.	ESSCCPC-501-G	Content cum Pedagogy of Political Science at Sec. Stage - Course (II)	2
3.	ESSCCPC-501-H	Content cum Pedagogy of Geography at Sec. Stage - Course (II)	2
4.	ESSCCPC-501-I	Content cum Pedagogy of Sociology at Secondary Stage - Course (II)	2
5.	ESSCCPC-501-J	Content cum Pedagogy of Economics at Secondary Stage - Course (II)	2
6.	ESSCCPC-501-K	Content cum Pedagogy of Art at Secondary Stage - Course (II)	2
7.	ESSCCPC-501-L	Content cum Pedagogy of Hindi at Secondary Stage - Course (II)	2
8.	ESSCCPC-501-M	Content cum Pedagogy of English at Secondary Stage - Course (II)	2
9.	ESSCCPC-501-N	Content cum Pedagogy of Sanskrit at Secondary Stage - Course (II)	2

ESSCCPC-501: Stage-Specific Content -cum-Pedagogy Courses (Any Two)

501-F: Content cum Pedagogy of History at Secondary Stage – Course (II)

Credits: 2

501-F.1 About the Course:

This course comprises three units and the practicum. The course introduces various teaching aids, material types, and uses for teaching history concepts at the secondary stage. Enough space is provided to discuss different teaching aids/materials for teaching learning history concepts. It focuses on learning resources to enable student teachers to use available learning resources and also processes to generate new resources for teaching and learning the concepts of History. It also focuses on textbook analysis and planning for teaching History and its pedagogical issues in light of NEP 2020. Student teachers are expected to identify various concepts and processes, list learning outcomes, and learn about various activities. Accordingly, they are expected to develop lesson plans based on learning outcomes and experiential learning for classroom and online teaching. Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centred, discussion-based, flexible, and enjoyable. This pedagogical course in History enhances prospective teachers' pedagogical knowledge and skills through different learning approaches. Student teachers are expected to identify various concepts

and processes, list learning and behavioral outcomes, learn about various activities and experiments, and identify relevant evaluation techniques and strategies. It focuses on psychological, sociological, and philosophical perspectives of History. In this course, student teachers will learn how to plan different types of activities in online and offline modes. It emphasises how to integrate and use ICT in the History classroom.

501-F.2 Learning Outcomes

After completion of this course, the student teacher will be able to:

- utilise online and other resources in the teaching-learning process of History,
- prepare lesson plans based on learning outcomes,
- identify learning resources from the local environment and apply the concepts of History in daily life,
- utilize teaching learning resources effectively in teaching History content at the secondary stage,
- prepare ICT-integrated lesson plans for online classroom teaching using digital resources and multimedia.

UNIT - I
Teaching Learning Resources

A. Teaching learning aids/materials: concept, definition, role, and importance in classroom teaching learning History.
B. Types of teaching-learning aids/ materials: print media such as textbooks, teachers' manual/handbooks, and other print materials; non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning (reflective journals, charts, 2-D and 3-D models, games, toys, flashcards, worksheets, multimedia etc.)
C. Identification and use of learning resources in History from the local environment
D. History projects, clubs, fairs, exhibitions, and visits to places of historical and geographical importance. History museum as a learning resource, including virtual laboratories, community resources, and pooling of learning resources.

UNIT - II
Content Analysis and Planning for Teaching History

A. Concept, types, and importance of unit and lesson planning.
B. Pedagogical analysis of content, taking examples from topics of subject textbooks of secondary stage, identification of concepts, listing learning outcomes and competencies, planning and evaluating learning experiences in an inclusive setup.
C. Developing unit plans and lesson plans based on learning outcomes and experiential learning (art and sports integration) of History.
D. Need for enrichment of content knowledge in History.

UNIT - III
ICT Integration and Application

A. Scope and importance of using ICT in the learning process of History.
B. Use of ICT in the classroom: Artificial Intelligence, machine learning, smart boards for student development.
C. Tools, software, and platforms for teaching and learning of History at the secondary stage.
D. Developing ICT-integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching using digital resources and multimedia.

501-F.3 Suggestive Practicum (Any Three)

1. Prepare one working model/toy/game on the History concepts.
2. Create an e-content on any two History concepts at the secondary stage.
3. Prepare a lesson plan considering the blended learning approach of History, followed by a presentation in the class.
4. Select a topic for teaching learning History and develop a write-up (name of unit, name of theme/topic, learning outcomes, material used, and procedure).
5. Identify and use learning resources from the surroundings in History and write a detailed report.
6. Prepare lesson plans based on learning outcomes and experiential learning by selecting two topics from the History textbooks at the secondary stage.
7. Any other project assigned.

501-F.4 Suggestive Mode of Transaction

Lectures, hands-on activities, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, collaborative & co-operative approach, experiential learning, art integrated learning, sport integrated learning.

501-F.5 Suggestive Mode of Assessment

Written tests, classroom presentations, workshops, seminars, assignments, practicums, and sessional and terminal semester examinations (as per UGC norms).

501-F.6 Suggestive Reading Material

• *National Policy on Education, 1968, 1986 and 2020*
• NCERT (2023) *National Curriculum Framework of School Education (Draft)*
• NCTE (2009) National *Curriculum Framework for Teacher Education: Towards Preparing Professional and Humane Teachers*. NCTE, New Delhi.
• UNESCO (1984) Epistemology of Social Science, the Scientific Status, Values and Institutionalisation, Vol. XXXVI, UNESCO Publications.

*Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-G: Content cum Pedagogy of Political Science at the Secondary Stage - Course (II)

Credits: 2

501-G.1 About the Course:

This course comprises three units and the practicum. The course is devoted to introducing various teaching aids, material types, and uses for teaching the concepts of Political Science at the secondary stage. Enough space is provided to discuss different types of teaching aids/materials for teaching learning concepts of Social Sciences. It focuses on learning resources in Political Science to enable student teachers to make use of available learning resources and also processes to generate new resources for teaching and learning the concepts of Social Sciences. It also focuses on textbook analysis and planning for teaching Political Science and its pedagogical issues in the light of NEP 2020. Student teachers are expected to identify various concepts and processes, list learning outcomes, and find out about various activities. Accordingly, they are expected to develop lesson plan based on learning outcomes and experiential learning for classroom and online teaching. Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centred, discussion-based, flexible, and enjoyable. This pedagogical course in Political Science enhances the pedagogical knowledge and skills of prospective teachers through different learning approaches. Student teachers are expected to identify various concepts and processes, list learning and behavioral outcomes, find out about various activities and experiments, and identify relevant evaluation techniques and strategies. It focuses on psychological, sociological and philosophical perspectives of the Social Sciences. In this course, student teachers will learn how to plan different types of activities in online and offline modes. It emphasises how to integrate and use ICT in the Social Sciences classroom.

501-G.2 Learning Outcomes

After completion of this course, student teachers will be able to:

Utilize online and other resources in the teaching-learning process of Social Sciences.

Prepare lesson plans based on learning outcomes,

Identify learning resources from the local environment and apply the concepts of Political Science in daily life.

Utilize teaching learning resources effectively in teaching Political Science content at the secondary stage.

Prepare ICT-integrated lesson plans for online classroom teaching using digital resources and multimedia.

UNIT-I

Teaching Learning Resources

A. Teaching learning aids/materials; concept, definition, role, and importance in classroom teaching learning political science.

B. Types of teaching learning aids/ materials: print media such as textbooks, teachers' manuals/handbooks and other print materials, non-print and digital media such as radio,

TV, websites, animations, audios, videos, images, simulations, and digital repositories. Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom

C. Identification and use of learning resources in Political Science from the local environment and local administration

D. Political Science projects, clubs, fairs, exhibitions and visits places of historical and geographical importance, Political Science laboratory and museum as a learning resource, including virtual laboratories, community resources and pooling of learning resources.

UNIT-II

Content Analysis and Planning for Teaching Politial Science

A. Concept, types and importance of unit and lesson planning.

B. Pedagogical analysis of content, taking examples from topics of subject textbooks of the secondary stage, identification of concepts, listing learning outcomes and competencies planning and evaluating learning experiences in an inclusive setup

C. Developing unit plans and lesson plans based on learning outcomes and experiential learning (art and sports integration) of political science.

D. Need for enrichment of content knowledge in political science.

UNIT-III

ICT Integration and Application

A. Scope and importance of using ICT in the learning process of political science.

B. Use of ICT in the classroom: Artificial Intelligence, machine learning, smart boards for student development.

C. Tools, software, and platforms for teaching and learning of political scienceat the secondary stage.

D. Developing ICT-integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching using digital resources and multimedia.

501-G.3 Suggestive Practicum (Any Three)

1. Prepare one working model/toy/game on the concepts of Political Science.
2. Create an e-content on any two concepts of Political Science at the secondary stage.
3. Prepare a lesson plan keeping in view the blended learning approach for the concepts. of Political Science, followed by a presentation in the class.
4. Select a topic for teaching learning of Social Science and develop a write-up (name of unit, name of theme/topic, learning outcomes, material used and procedure).
5. Identify and use learning resources from the surroundings in Political Science and write a detailed report.
6. Prepare lesson plans based on learning outcomes and experiential learning by selecting two topics from the Political Science textbooks at the secondary stage.
7. Visit any local administrative body and prepare a report
8. Make a drama club and perform with different stakeholder groups at the local to state level.
9. Any other project assigned by HEL

501-G.4 Suggestive Mode of Transaction

Lectures, hands-on activities, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, collaborative & co-operative approach, experiential learning, art integrated learning, sport integrated learning.

501-G.5 Suggestive Mode of Assessment

Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations (as per UGC norms).

501-G.6 Suggestive Reading Material

1. National Policy on Education, 1968, 1986 and 2020
2. NCERT (2023) National Curriculum Framework of School Education (Draft)
3. NCTE (2009) National Curriculum Framework for Teacher Education: Towards Preparing Professional and Humane Teachers. NCTE, New Delhi.
4. UNESCO (1984). Epistemology of Social Science: The Scientific Status. Values and Institutionalisation, Vol. XXXVI, UNESCO Publications.
5. "Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-H: Content cum Pedagogy of Geography at the Secondary Stage - Course (II)

Credits: 2

501-H.1 About the Course:

This course comprises three units and the practicum. The course is devoted to introducing various teaching aids, material types, and uses for teaching the concepts of Geography at the secondary stage. Enough space is provided to discuss different types of teaching aids/materials for teaching learning concepts of Geography. It focuses on learning resources in Geography to enable student teachers to make use of available learning resources and also processes to generate new resources for teaching and learning the concepts of Geography. It also focuses on textbook analysis and planning for teaching Geography and its pedagogical issues in the light of NEP 2020. Student teachers are expected to identify various concepts and processes, list learning outcomes, and find out about various activities. Accordingly, they are expected to develop a lesson plan based on learning outcomes and experiential learning for classroom and online teaching. Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centred, discussion-based, flexible, and enjoyable. This pedagogical course of Geography enhances the pedagogical knowledge and skills of prospective teachers through different learning approaches. Student teachers are expected to identify various concepts and processes, list learning and behavioral outcomes, find out about various activities and experiments, and identify relevant evaluation techniques and strategies. It focuses on psychological, sociological and philosophical perspectives of Geography. In this course, student teachers will learn how to plan different types of activities in online and offline modes. It emphasises how to integrate and use ICT in the Geography classroom.

501-H.2: Learning Outcomes

After completion of this course, student teachers will be able to:

- utilize online and other resources in the teaching-learning process of Geography.
- prepare lesson plans based on learning outcomes.
- identify learning resources from the local environment and apply the concepts of Geography in daily life
- utilize teaching learning resources effectively in teaching Geography content at the secondary stage.
- prepare ICT-integrated lesson plans for online classroom teaching using digital resources and multimedia.

UNIT – I

The Context of Learning Geography at the Secondary Level

A. Curriculum Frameworks and Policy Influences on Geography Education.
B. Learner Diversity and Inclusive Geography Classrooms.
C. The Role of Teachers and Pedagogical Approaches in Geography Learning.
D. School Environment, Resources, and Technology in Geography Learning.

UNIT - II

Teaching Learning Resources

A. Teaching learning aids/materials: concept, definition, role, and importance in classroom teaching learning Geography.

B. Types of teaching learning aids/ materials: print media such as textbook, teachers' manual/ handbook and other print materials, non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence, machine learning, smart boards for student development. Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom 94 teaching learning (reflective journals, charts, 2-D and 3-D models, games, toys, flash cards, worksheets, multimedia etc.)

C. Identification and use of learning resources in Geography from the local environment

D. Geography projects, clubs, fairs, exhibitions and visits places of geographical importance, Geography laboratory and museum as a learning resource including virtual laboratories, community resources and pooling of learning resources.

UNIT - III

Content Analysis and Planning for Teaching Geography

A. Concept, types and importance of unit and lesson planning.

B. Pedagogical analysis of content, taking examples from topics of subject textbooks of the secondary stage, identification of concepts, listing learning outcomes and competencies, planning and evaluating learning experiences in an inclusive setup.

C. Developing unit plans and lesson plans based on learning outcomes and experiential learning (art and sports integration) of Geography.

D. Need for enrichment of content knowledge in Geography. ICT in the learning process of Geography: Tools, software, and educational platform. Technological Pedagogical Content Knowledge (TPCK).

501-H.3 Suggestive Practicum (Any Three)

1. Prepare one working model/toy/game on the concepts of Geography.
2. Create an e-content on any two concepts of Geography at the secondary stage.
3. Prepare a lesson plan keeping in view the blended learning approach for the concepts of Geography, followed by a presentation in the class.
4. Select a topic for teaching and learning Geography and develop a write-up (name of unit, name of theme/topic, learning outcomes, material used and procedure).
5. Identify and use learning resources from the surroundings in Geography and write a detailed report.
6. Prepare lesson plans based on learning outcomes and experiential learning by selecting two topics from the Geography textbooks at the secondary stage.
7. Any other project assigned by HEI.

501-H.4 Suggestive Mode of Transaction

Lectures, hands-on activities, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, collaborative & co-operative approach, experiential learning, art integrated learning, sport integrated learning.

501-H.5 Suggestive Mode of Assessment

Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations (as per UGC norms).

501-H.6 Suggestive Reading Material

- Hamm. B. (1992). Europe: A Challenge to the Social Sciences. International Social Science Journal, 44.
- Mayor. F. (1992). The role of the social sciences in a changing Europe. International social science journal, 44.
- Wagner. P. (1999). The Twentieth Century – the Century of the Social Sciences? World social science report.

• National Policy on Education, 1968, 1986 and 2020
• NCERT (2023) National Curriculum Framework of School Education (Draft)
• NCTE (2009) National Curriculum Framework for Teacher Education: Towards Preparing Professional and Humane Teachers. NCTE, New Delhi.
• UNESCO (1984) Epistemology of Social Science, the Scientific Status, Values and Institutionalisation, Vol. XXXVI, UNESCO Publications.

Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-I: Content cum Pedagogy of Sociology at the Secondary Stage - Course (II)

Credits: 2

501-I.1 About the Course:

This course comprises three units and the practicum. The course introduces various teaching aids, material types, and uses for teaching Sociology concepts at the secondary stage. Enough space is provided to discuss different teaching aids/materials for teaching and learning Sociology concepts. It focuses on learning resources to enable student teachers to use available learning resources and also processes to generate new resources for teaching and learning the concepts of Sociology. It also focuses on textbook analysis and planning for teaching Sociology and its pedagogical issues in light of NEP 2020. Student teachers are expected to identify various concepts and processes, list learning outcomes, and learn about various activities. Accordingly, they are expected to develop lesson plans based on learning outcomes and experiential learning for classroom and online teaching. Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centred, discussion-based, flexible, and enjoyable. This pedagogical course in Sociology enhances prospective teachers' pedagogical knowledge and skills through different learning approaches. Student teachers are expected to identify various concepts and processes, list learning and behavioral outcomes, learn about various activities and experiments, and identify relevant evaluation techniques and strategies. It focuses on psychological, sociological, and philosophical perspectives of Sociology. In this course, student teachers will learn how to plan different types of activities in online and offline modes. It emphasizes how to integrate and use ICT in the Sociology classroom.

501-I.2 Learning Outcomes

After completion of this course, the student teacher will be able to:

- Utilize online and other resources in the teaching-learning process of Sociology.
- Prepare lesson plans based on learning outcomes,
- Identify learning resources from the local environment and apply the concepts of Sociology in daily life.
- Utilize teaching learning resources effectively in teaching Sociology content at the secondary stage.
- Prepare ICT-integrated lesson plans for online classroom teaching using digital resources and multimedia.

UNIT - I

Teaching Learning Resources

A. Teaching learning aids/materials: concept, definition, role, and importance in classroom teaching learning Sociology.

B. Types of teaching-learning aids/ materials: print media such as textbooks, teachers' manual/handbooks, and other print materials; non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/

online classroom teaching learning (reflective journals, charts, 2-D and 3-D models, games, toys, flashcards, worksheets, multimedia etc.)

C. Identification and use of learning resources in Sociology from the local environment
D. Sociology projects, field trips, Debates and discussions, case studies, Simulations, fairs, exhibitions, and visits to places of sociological value. community resources, and pooling of learning resources.

UNIT - II

Content Analysis and Planning for Teaching Sociology

A. Concept, types, and importance of unit and lesson planning.
B. Pedagogical analysis of content, taking examples from topics of subject textbooks of secondary stage, identification of concepts, listing learning outcomes and competencies, planning and evaluating learning experiences in an inclusive setup.
C. Developing unit plans and lesson plans based on learning outcomes and experiential learning (art and sports integration) of Sociology.
D. Need for enrichment of content knowledge in Sociology.

UNIT - III

ICT Integration and Application

A. Scope and importance of using ICT in the learning process of Sociology.
B. Use of ICT in the classroom: Artificial Intelligence, machine learning, smart boards for student development.
C. Tools, software, and platforms for teaching and learning sociology at the secondary stage.
D. Developing ICT-integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching using digital resources and multimedia.

501-I.3 Suggestive Practicum (Any Three)

1. Prepare one working model/toy/game on the Sociological concepts.
2. Create an e-content on any two Sociological concepts at the secondary stage.
3. Prepare a lesson plan considering the concepts' blended learning approach of Sociology, followed by a presentation in the class.
4. Select a topic for teaching learning Sociology and develop a write-up (name of unit, name of theme/topic, learning outcomes, material used, and procedure).
5. Identify and use learning resources from the surroundings in Sociology and write a detailed report.
6. Prepare lesson plans based on learning outcomes and experiential learning by selecting two topics from the Sociology textbooks at the secondary stage.
7. Any other project assigned.

501-I.4 Suggestive Mode of Transaction

Lectures, hands-on activities, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, collaborative & co-operative

approach, experiential learning, art integrated learning, and Community integrated learning.

501-I.5 Suggestive Mode of Assessment

Written tests, classroom presentations, workshops, seminars, assignments, practicums, and sessional and terminal semester examinations (as per UGC norms).

501-I.6 Suggestive Reading Material

- *National Policy on Education, 1968, 1986 and 2020*
- NCERT (2023) *National Curriculum Framework of School Education (Draft)*
- NCTE (2009) National *Curriculum Framework for Teacher Education: Towards Preparing Professional and Humane Teachers*. NCTE, New Delhi.
- UNESCO (1984) Epistemology of Social Science, the Scientific Status, Values and Institutionalisation, Vol. XXXVI, UNESCO Publications.

501-J: Content cum Pedagogy of Economics at the Secondary Stage - Course (II)

Credits: 2

501-J.1 About the Course:

This course comprises three units and the practicum. The course is devoted to introducing various teaching aids, material types, and uses for teaching the concepts of Economics at the secondary stage. Enough space is provided to discuss different types of teaching aids/materials for teaching learning concepts of economics. It focuses on learning resources in Economics to enable student teachers to make use of available learning resources and also processes to generate new resources for teaching and learning the concepts of Social Sciences. It also focuses on textbook analysis and planning for teaching Economics and its pedagogical issues in the light of NEP 2020. Student teachers are expected to identify various concepts and processes, list learning outcomes, and find out about various activities. Accordingly, they are expected to develop a lesson plan based on learning outcomes and experiential learning for classroom and online teaching. Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centred, discussion-based, flexible, and enjoyable. This pedagogical course in Economics enhances the pedagogical knowledge and skills of prospective teachers through different learning approaches. Student teachers are expected to identify various concepts and processes, list learning and behavioral outcomes, find out about various activities and experiments, and identify relevant evaluation techniques and strategies. It focuses on psychological, sociological and philosophical perspectives of the Social Sciences. In this course, student teachers will learn how to plan different types of activities in online and offline modes. It emphasises how to integrate and use ICT in the Economics classroom.

501-J.2 Learning Outcomes

After completion of this course, student teachers will be able to:

- utilize online and other resources in the teaching-learning process of economics.

- prepare lesson plans based on learning outcomes,
- identify learning resources from the local environment and apply the concepts of economics in daily life.
- utilize teaching learning resources effectively in teaching economics content at the secondary stage.
- prepare ICT-integrated lesson plans for online classroom teaching using digital resources and multimedia.

UNIT-I
Teaching Learning Resources

A. Teaching learning aids/materials: concept, definition, role, and importance in classroom teaching learning Economics.

B. Types of teaching learning aids/ materials: print media such as textbooks, teachers' manuals/handbooks and other print materials, non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, and digital repositories. Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom

C. Identification and use of learning resources in Economics from the local environment and local administration

D. Economics projects, clubs, fairs, exhibitions and visits places of historical and geographical importance, the Economics laboratory and museum as a learning resource, including virtual laboratories, community resources and pooling of learning resources.

UNIT-II
Content Analysis and Planning for Teaching Social Sciences

A. Concept, types and importance of unit and lesson planning.

B. Pedagogical analysis of content, taking examples from topics of subject textbooks of secondary stage, identification of concepts, listing learning outcomes and competencies planning and evaluating learning experiences in an inclusive setup

C. Developing unit plans and lesson plans based on learning outcomes and experiential learning (art and sports integration) of Economics.

D. Need for enrichment of content knowledge in Economics.

UNIT-III
ICT Integration and Application

A. Scope and importance of using ICT in the learning process of Economics

B. Use of ICT in the classroom: Artificial Intelligence, machine learning, smart boards for student development.

C. Tools, software, and platforms for teaching and learning of Economics at the secondary stage.

D. Developing ICT-integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching using digital resources and multimedia.

501-J.3 Suggestive Practicum (Any Three)

1. Prepare one working model/toy/game on the concepts of Economics.
2. Create an e-content on any two concepts of Economics at the secondary stage.
3. Prepare a lesson plan keeping in view the blended learning approach for the concepts. of Economics, followed by a presentation in the class.
4. Select a topic for teaching and learning of Economics and develop a write-up (name of unit, name of theme/topic, learning outcomes, material used and procedure).
5. Identify and use learning resources from the surroundings in Economics and write a detailed report.
6. Prepare lesson plans based on learning outcomes and experiential learning by selecting two topics from the Economics textbooks at the secondary stage.
7. Visit any local administrative body and prepare a report
8. Make a drama club and perform with different stakeholder groups at the local to state level.
9. Any other project assigned by HEL

501-J.4 Suggestive Mode of Transaction

Lectures, hands-on activities, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, collaborative & co-operative approach, experiential learning, art integrated learning, sport integrated learning.

501-J.5 Suggestive Mode of Assessment

Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations (as per UGC norms).

501-J.6 Suggestive Reading Material

National Policy on Education, 1968, 1986 and 2020
NCERT (2023) National Curriculum Framework of School Education (Draft)
NCTE (2009) National Curriculum Framework for Teacher Education: Towards Preparing Professional and Humane Teachers. NCTE, New Delhi.
UNESCO (1984). Epistemology of Social Science: The Scientific Status. Values and Institutionalization, Vol. XXXVI, UNESCO Publications.
"Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-K: Content cum Pedagogy of Art at Secondary Stage - Course (II)

Credits: 2

501-K.1 About the Course

Art focuses on the presentation of ideas, sentiments, and visual aspects. A person who produces or develops Arts by applying deliberate skill and imaginative creativity is called an Artist. It's crucial to comprehend content analysis if one wants to teach Arts. It gives teachers the ability to gather and compare variations in the subjects being taught, as well as student perceptions and relevant trends. This course encompasses three key areas of Arts

Education, Teaching Learning Resources for Arts Teaching, Content Analysis and Planning for Teaching Arts and ICT Integration and Applications in Arts Education. The course aims to develop the skills of student teachers related to effective teaching, such as listing behavioural outcomes, planning activities and experiments, evaluation procedures, identification and selection of teaching and learning resources, and integrating various pedagogical techniques in the teaching of content related to Arts Education. It emphasises the skill of developing lesson plans for the teaching of the Arts (Visual and Performing).

501-K.2 Learning Outcomes

After completion of this course, student teachers will be able to:

- distinguish learning resources and e-resources for Arts teaching,
- classify, identify, and use learning resources from the local environment,
- analyse different contents from textbooks for pedagogical aspects,
- apply Artificial Intelligence in various fields of Arts education.
- develop skills of meaningful observation and judgment.
- design and maintain portfolios.
- value Arts and TPCK and provide ICT-based opportunities to learn.
- develop unit and lesson plans for the content of Arts education.

UNIT - I
Teaching Learning Resources for Arts Teaching

A. Teaching learning resources: concept, characteristics, and importance in teaching of the Arts.

B. Types of teaching learning aids/ materials: print media (such as textbook, teachers' manual/ handbook, laboratory manual and other print materials), non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classrooms, reflective journals, posters, charts, 2-D and 3-D models, worksheets, multimedia etc.

C. Identification and use of learning resources from the local environment in the teaching of the arts.

D. Resource room/ laboratory/ library - management and practices; virtual laboratories, teaching learning kits, subject clubs, fairs, exhibitions, excursions, community resources and pooling of resources; management of resource centre for arts, crafts and design, maintaining reports, records and registers.

UNIT - II
Content Analysis and Planning for Teaching Arts

A. Pedagogical Analysis of Content: taking examples from topics of arts textbooks of the secondary stage, identification of concepts.

B. Listing Learning Outcomes and Competencies, Planning and Evaluating Learning Experiences in an Inclusive Setup.

C. Concept, Types and Importance of Unit Planning and Lesson Planning. Essential components of a lesson plan for the teaching of the Arts.

D. Developing Unit Plans and Lesson Plans based on Learning Outcomes (topics to be taken from textbooks). Experiential Learning in Arts Teaching.

UNIT - III

ICT Integration and Applications in Arts Education

A. Scope and importance of ICT in arts education.
B. Use of ICT such as Artificial Intelligence, machine learning, smart boards in the teaching of arts, assessment process and resource management.
C. Use of tools, software, and platforms for teaching and learning of arts at the secondary stage.
D. Developing ICT-integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for face-to-face and online teaching.

501-K.3 Suggestive Practicum (Any Three)

1. Analyze Arts Education textbooks and prepare a suggestive report.
2. Prepare a report on the pedagogical analysis of any two topics from the Arts textbook.
3. Organize activities such as Drama, Theatre, Poster designing, sketching and land escapes and prepare a report.
4. Maintain a diary on Arts interactions.
5. Develop an e-content for teaching and learning of the Arts.
6. Critically evaluate the available MOOCs on Arts Education and prepare a report.
7. Any other project assigned by HEI.

501-K.4 Suggestive Mode of Transaction

Lecture cum demonstration, experimental method, field-based experiences, project method, laboratory method, hands-on activity, problem-solving method, inquiry method, success stories, discussions, self-study, brainstorming and experiential method.

501-K.5 Suggestive Mode of Assessment

Written test, classroom presentations, discussion forums, observation, research/study report, assignments, practicum, performance-based, sessional and terminal examination (As per UGC Norms).

501-K.6 Suggestive Reading Materials

- Draft National Curriculum Framework for School Education,
- National Education Policy 2020, MoE, Government of India
- National Steering Committee for National Curriculum Frameworks (2023).
- NCERT Textbooks for Art Education
- UNESCO (2006), Appeals for the Promotion of Arts Education and Creativity at School to help Construct a Culture of Pace, Paris, November 3, No.99-241, UNESCO PRESSE.
  http://www.://www.unesco.org/education/ecp/Arts_edu.htm,19.09.2019, 20:20.9.
- UNESCO (2006), Road Map for Arts Education. The World Conference on Arts Education: Building Creative Capacities for the 21st Century, Lisbon, 6-9 March 2006,

http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CLT/CLT/pdf/Arts_Edu_RoadMap_en.pdf,13.08.2019,09(PDF) 3.

*Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-L: Content cum Pedagogy of Hindi at the Secondary Stage - Course (II)

Credits: 2

501-L.1 पाठ्यक्रम के बारे में **(About the Course):**

पूर्व स्तर पर अर्जित भाषा-दर्शन संबंधी ज्ञान के आधार पर यह पाठ्यक्रम माध्यमिक स्तर पर हिन्दी भाषा शिक्षण में शिक्षण-विधि (पेडागॉजी) और शिक्षण-योजना के मूलभूत ज्ञान से छात्र-शिक्षकों को परिचित कराता है। इस पाठ्यक्रम का उद्देश्य छात्र-शिक्षकों को हिन्दी भाषा शिक्षण को अर्थपूर्ण और आनंददायक बनाने के लिए उपलब्ध तथा निर्मित शिक्षण-अधिगम सहायक सामग्री और संसाधनों से अवगत कराना है। यह उन्हें इन संसाधनों की प्रभावशीलता तथा बच्चों की हिन्दी भाषा-कौशल पर पड़ने वाले प्रभाव को समझने में भी सहायता प्रदान करेगा।

यह पाठ्यक्रम पाठ्यपुस्तक विश्लेषण**,** हिन्दी भाषा एवं साहित्य शिक्षण की योजना तथा इसके शैक्षिक पक्षों पर भी केन्द्रित है**,** विशेष रूप से राष्ट्रीय शिक्षा नीति **2020 (NEP 2020)** के आलोक में। छात्र-शिक्षकों से अपेक्षा की जाती है कि वे विविध अवधारणाओं एवं प्रक्रियाओं की पहचान करें तथा अधिगम परिणामों एवं अनुभवात्मक अधिगम (**experiential learning)** के आधार पर कक्षा शिक्षण एवं ऑनलाइन शिक्षण हेतु पाठ योजनाएँ विकसित करें।

501-L.2 **अधिगम की प्राप्तियाँ** (**Learning Outcomes)**

इस पाठ्यक्रम के पूर्ण होने के उपरांत छात्र-शिक्षक निम्नलिखित कार्यों में सक्षम होंगे:

- राष्ट्रीय शिक्षा नीति **2020 (NEP 2020)** के संदर्भ में हिन्दी भाषा शिक्षा से संबंधित शिक्षण-अधिगम सामग्री की व्याख्या कर सकेंगे**,**
- कक्षा शिक्षण के दौरान विभिन्न प्रकार के शिक्षण-अधिगम सहायक उपकरणों का प्रयोग कर सकेंगे**,**
- हिन्दी भाषा शिक्षण में मल्टीमीडिया का प्रयोग कर सकेंगे तथा ऑनलाइन संसाधनों के माध्यम से हिन्दी भाषा से संबंधित ज्ञान अर्जित कर सकेंगे**,**
- हिन्दी भाषा के प्रभावी शिक्षण हेतु पाठ योजना (लेसन प्लान) विकसित कर सकेंगे**,**
- हिन्दी भाषा की अवधारणाओं को सीखने के अर्थ और आवश्यकता का सार प्रस्तुत कर सकेंगे**,**
- हिन्दी भाषा अधिगम में शिक्षक की भूमिका की पहचान कर सकेंगे।

इकाई – I

शिक्षण-अधिगम संसाधन (Teaching Learning Resources)

क. शिक्षण-अधिगम सहायक सामग्री/संसाधन: अवधारणा**,** कक्षा में हिन्दी भाषा शिक्षण-अधिगम में इसकी भूमिका एवं महत्त्व।

ख. हिन्दी भाषा शिक्षण में शिक्षण-अधिगम सहायक सामग्री/संसाधनों के प्रकार:

- मुद्रित माध्यम जैसे पाठ्यपुस्तकें, क्रमच्युत (**scrambled**) पुस्तकें, शिक्षकों की मार्गदर्शिका/हस्तपुस्तिका एवं अन्य मुद्रित सामग्री।
- अमुद्रित एवं डिजिटल माध्यम जैसे रेडियो, टेलीविज़न, वेबसाइट्स, एनीमेशन, ऑडियो, वीडियो, चित्र, सिमुलेशन, डिजिटल भंडार (**repository**), संवर्धित वास्तविकता (**Augmented Reality - AR**), आभासी वास्तविकता (**Virtual Reality - VR**) तथा कृत्रिम बुद्धिमत्ता (**Artificial Intelligence - AI**) आधारित डिजिटल संसाधन एवं मुक्त शैक्षिक संसाधन (**Open Educational Resources-OERs**) - जो ऑफलाइन/ऑनलाइन कक्षा शिक्षण-अधिगम में प्रयुक्त होते हैं (जैसे चिंतनात्मक जर्नल, चार्ट, 2-डी एवं 3-डी मॉडल, खेल, खिलौने, फ्लैश कार्ड, वर्कशीट, मल्टीमीडिया आदि)।

ग. पर्यावरण से शिक्षण सहायक सामग्री/शिक्षण-अधिगम संसाधनों की पहचान एवं उपयोग।

घ. हिन्दी भाषा प्रयोगशाला– प्रकार, संरचना, प्रबंधन एवं व्यवहार; आभासी प्रयोगशालाएँ, शिक्षण-अधिगम किट्स, विषय क्लब, मेले, प्रदर्शनियाँ, शैक्षिक उद्यान, शैक्षिक भ्रमण, सामुदायिक संसाधन एवं संसाधनों का साझाकरण।

इकाई – II

सामग्री विश्लेषण एवं हिन्दी भाषा शिक्षण के लिए योजना निर्माण

(Content Analysis and Planning for Hindi Teaching Language):

क. हिन्दी शिक्षण की इकाई योजना (**Unit Plan**) एवं पाठ योजना (**Lesson Plan**) की अवधारणा, प्रकार तथा महत्त्व।

ख. माध्यमिक स्तर की हिन्दी भाषा शिक्षण की पाठ्यपुस्तकों के विषयों के उदाहरण लेकर सामग्री का शैक्षिक विश्लेषण— अवधारणाओं की पहचान, अधिगम प्रतिफल (**Learning Outcomes**) एवं दक्षताओं की सूची बनाना, समावेशी वातावरण में अधिगम अनुभवों की योजना बनाना एवं उनका मूल्यांकन करना।

ग. अधिगम प्रतिफल एवं अनुभवात्मक अधिगम (कला-संयोजित शिक्षण सहित) के आधार पर इकाई योजना एवं पाठ योजना का निर्माण।

इकाई – III

आईसीटी का एकीकरण एवं अनुप्रयोग (ICT Integration and Application)

क. हिन्दी शिक्षण के अधिगम प्रक्रिया में सूचना एवं संचार प्रौद्योगिकी (**ICT**) के प्रयोग की सीमा एवं महत्त्व।

ख. हिन्दी शिक्षण की कक्षा में आईसीटी का प्रयोग: अधिगम संवर्धन के लिए कृत्रिम बुद्धिमत्ता (**Artificial Intelligence**), मशीन लर्निंग (**Machine Learning**), स्मार्ट बोर्ड आदि का उपयोग।

ग. माध्यमिक स्तर पर हिन्दी भाषा शिक्षण-अधिगम के लिए उपकरण, सॉफ्टवेयर एवं प्लेटफ़ॉर्म।

घ. डिजिटल संसाधनों एवं मल्टीमीडिया का उपयोग करते हुए तकनीकी-शैक्षिक-विषयवस्तु ज्ञान (**Technological Pedagogical Content Knowledge – TPCK**) के आधार पर कक्षा एवं ऑनलाइन शिक्षण के लिए आईसीटी एकीकृत पाठ योजनाओं का विकास।

501-L.3 सुझावात्मक प्रायोगिक कार्य (कोई भी तीन चुनें)

[Suggestive Practicum (Any Three)]

1. हिन्दी भाषा-कौशल के विकास हेतु एक शिक्षण-अधिगम संसाधन तैयार करें।
2. माध्यमिक स्तर की हिन्दी भाषा पाठ्यपुस्तक से किसी एक विषय पर ई-सामग्री (**e-content)** विकसित करें।
3. हिन्दी साहित्य की सूची तैयार करें जो पाठ्यचर्या को समृद्ध बनाने में सहायक हो सकता है।
4. राष्ट्रीय शिक्षा नीति 2020 (NEP 2020**)** के संदर्भ में हिन्दी भाषा शिक्षण के शैक्षिक पक्षों पर एक लेख तैयार करें।
5. हिन्दी शिक्षण की गद्य**,** पद्य एवं व्याकरण विषयवस्तु पर अधिगम-प्रतिफल आधारित पाठ योजनाएँ तैयार करें।
6. उच्च शिक्षण संस्था (**HEI)** द्वारा सौंपा गया कोई अन्य परियोजना कार्य।

501-L.4 सुझावात्मक संप्रेषण विधियाँ (Suggestive Mode of Transaction)

हिन्दी भाषा शिक्षण की व्याख्यान-सह-चर्चा विधि, परियोजना आधारित विधि, समस्या समाधान विधि, अनुभवात्मक अधिगम, जिज्ञासा आधारित दृष्टिकोण, सूचना एवं संचार प्रौद्योगिकी (ICT) एकीकृत अधिगम, संवादात्मक विधियाँ जैसे समूह चर्चा, सहपाठी शिक्षण, टीम शिक्षण, कार्यशालाएँ, पर्यवेक्षण एवं प्रस्तुतीकरण।

501-L5 सुझावात्मक मूल्यांकन विधियाँ (Suggestive Mode of Assessment)

हिन्दी भाषा के पाठ्यक्रम की अधिगम-प्राप्तियों का मूल्यांकन निम्नलिखित माध्यमों से किया जाएगा — लिखित परीक्षण, कक्षा प्रस्तुतियाँ, संगोष्ठियाँ, असाइनमेंट, प्रायोगिक कार्य, सत्रीय मूल्यांकन तथा अंतिम सेमेस्टर परीक्षा (यूजीसी के मानदंडों के अनुसार)।

501-L.6 सुझावात्मक पठनीय सामग्री (Suggestive Reading Materials)

• विद्यालय शिक्षा के लिए राष्ट्रीय पाठ्यचर्या प्रारूप, भारत सरकार

• राष्ट्रीय शिक्षा नीति 2020 (NEP 2020), भारत सरकार (अंग्रेज़ी/हिन्दी)।

• राष्ट्रीय शिक्षा नीति (1992 में किए गए संशोधनों सहित), मानव संसाधन विकास मंत्रालय: नई दिल्ली।

• बच्चों के मुफ्त और अनिवार्य शिक्षा का अधिकार अधिनियम-2009, भारत गजट, 2009।

*शिक्षक विद्यार्थी की आवश्यकता और अधिगम सामग्री के आधार पर पुस्तकें/पठनीय सामग्री सुझा सकते हैं।

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501-M: Content cum Pedagogy of English at the Secondary Stage - Course (II)

Credits: 2

501-M.1 About the Course

Building on the previous level's knowledge of the philosophy of the Language, the course will introduce students to the core knowledge of pedagogy and planning in Language education at the secondary level. It is designed to make the student-teacher aware of the teaching-learning aids and other resources available, as well as to make Language learning meaningful and joyful. It will also help them to know the effectiveness of such resources and the impact on the children's Language skills. It also focuses on textbook analysis and planning for teaching Language and Literature and its pedagogical issues in the light of NEP 2020. Student teachers are expected to identify various concepts and processes.

Accordingly, they are expected to develop lesson plans based on learning outcomes and experiential learning for classroom and online teaching.

501-M.2 Learning Outcomes

After completion of this course, student teachers will be able to:

- explain teaching-learning materials related to Language education with reference to NEP 2020,
- apply different types of teaching-learning aids during classroom teaching,
- make use of multimedia in Language teaching. Acquire knowledge about Language through online resources,
- develop lesson plan for effective teaching of Language,
- summarize the meaning and need of how to learn concepts of Language,
- Identify the role of a teacher in facilitating the learning of the Language.

UNIT - I

Teaching Learning Resources

A. Teaching learning aids/materials: concept, role, and importance in classroom teaching and learning of Language. Identification and use of teaching aids/teaching learning materials from the environment.
B. Types of teaching learning aids/ materials: print media such as textbook, scrambled books, teachers' manual/ handbook and other print materials., non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources.
C. Open Educational Resources (OERs) for offline/ online classroom teaching learning (reflective journals, charts, 2-D and 3-D models, games, toys, flash cards, worksheets, multimedia, etc.)
D. Language laboratory – types, design, management, and practices; Virtual laboratories, teaching learning kits, subject clubs, fairs, exhibitions, educational parks, excursions, community resources and pooling of resources.

UNIT - II

Content Analysis and Planning for Teaching Language

A. Concept, types and importance of unit and lesson planning.
B. Pedagogical analysis of content, taking examples from topics of Language textbooks of the secondary stage, identification of concepts, listing learning outcomes and competencies, planning, and evaluating learning experiences in an inclusive setup.
C. Developing unit plans and lesson plans based on learning outcomes and experiential learning (art integrated) of Languages.

UNIT - III

ICT Integration and Application

A. Scope and importance of using ICT in the learning process of Languages. Use of ICT in the classroom: artificial intelligence, machine learning, smart boards, for enhancing learning.

B. Tools, software and platform for teaching and learning of Language at the secondary stage.
C. Developing ICT-integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching using digital resources and multimedia.

501-M. 3 Suggestive Practicum (Any Three)

1. Prepare a teaching learning resource for developing Language skills.
2. Develop an e-content on any one topic from the Language textbooks at the secondary stage.
3. Develop a list of Literature that can play an instrumental role in curriculum enrichment.
4. Prepare a write-up on pedagogical aspects of Language teaching in reference to NEP 2020.
5. Prepare outcome-based lesson plans on Prose, Poetry, and Grammar of Language.
6. Any other project assigned by the HEI.

501-M. 4 Suggestive Mode of Transaction

Lecture-Cum-Discussion, Project-Based Method, Problem-Solving Method, Experiential Learning, Inquiry Approach, ICT Integrated Learning, Interactive Methods Such as Group Discussions, Peer Tutoring, Team Teaching, Workshops, Observations and Presentations.

501-M.5 Suggestive Mode of Assessment

Written tests, classroom presentations, seminars, assignments, practicum, sessional, and terminal semester examinations will be used to assess the course outcomes (As per UGC norms).

501-M.6 Suggestive Reading Materials

- National Curriculum Framework for School Education, Government of India
- National Education Policy 2020 (NEP 2020). Government of India. (English/ Hindi).
- National Policy on Education (With Modifications Undertaken In 1992). Ministry of Human Resource Development: New Delhi.
- The Right of Children to Free and Compulsory Education Act-2009, The Gazette of India, 2009.

*Teachers may also suggest books/readings as per the needs of the learners and the learning content.

501-N: Content cum Pedagogy of Sanskrit at the Secondary Stage - Course (II)

Credits: 2

501-N.1 पाठ्यक्रम परिचय:

प्रशिक्षार्थी पूर्व स्तर पर प्राप्त भाषा दर्शन के ज्ञान के आधार पर यह पाठ्यक्रम माध्यमिक स्तर पर संस्कृत भाषा शिक्षा में शिक्षण पद्दति एवं योजनाबद्धता का मूल ज्ञान प्रदान करेगा। यह प्रशिक्षार्थी को संस्कृत भाषा शिक्षण–

अधिगम सहायता तथा अन्य उपलब्ध संसाधनों से परिचित कराएगा एवं स्वयं उन्हें बनाने के लिए प्रेरित करेगा, ताकि भाषा अधिगम अर्थपूर्ण एवं आनंददायी हो सके। साथ ही इन संसाधनों की प्रभावशीलता एवं विद्यार्थियों की भाषा कौशल पर इनके प्रभाव को जानने में सहायता करेगा। पाठ्यपुस्तक विश्लेषण एवं भाषा व साहित्य शिण के लिए योजनाबद्धता तथा NEP 2020 की दृष्टि में संबद्ध शैक्षिक मुद्दों पर भी यह केंद्रित है। प्रशिक्षार्थी विभिन्न अवधारणाओं एवं प्रक्रियाओं की पहचान करेंगे और अधिगम परिणामों एवं अनुभवात्मक अधिगम के आधार पर कक्षा तथा ऑनलाइन शिक्षण के लिए पाठ योजनाएँ विकसित करेंगे।

501-N.2 सीखने के परिणाम

इस पाठ्यक्रम के समापन पर प्रशिक्षार्थी सक्षम होंगे कि वे–

- राष्ट्रीय शिक्षा नीति-2020 के संदर्भ में संस्कृत भाषा शिक्षा से संबंधित शिक्षण–अधिगम सामग्री का वर्णन कर सकें।
- कक्षा में विभिन्न प्रकार के शिक्षण–अधिगम साधनों का प्रयोग कर सकें।
- संस्कृत भाषा शिक्षण में मल्टीमीडिया का उपयोग कर सकें तथा ऑनलाइन संसाधनों से भाषा संबंधी ज्ञान अर्जित कर सकें।
- प्रभावी संस्कृत भाषा शिक्षण के लिए पाठ योजना विकसित कर सकें।
- संस्कृत भाषा की अवधारणाएँ, सीखने के अर्थ एवं आवश्यकताओं का संक्षेप में विवेचन कर सकें।
- संस्कृत भाषा अधिगम में शिक्षक की भूमिका की पहचान कर सकें।

इकाई-I

शिक्षण–अधिगम संसाधन

अ. शिक्षण–अधिगम सामग्री: अवधारणा, भूमिका एवं माध्यमिक स्तर पर संस्कृत भाषा शिक्षण–अधिगम में इसका महत्व।

ब. शिक्षण–अधिगम साधनों के प्रकार:

- **मुद्रित: पाठ्यपुस्तक, संदर्भ पुस्तकें, शिक्षक मार्गदर्शिका/हैंडबुक आदि**
- **डिजिटल: रेडियो, टीवी, वेबसाइट, एनीमेशन, ऑडियो, वीडियो, छवि, सिमुलेशन, डिजिटल रिपॉजिटरी, संवर्धित वास्तविकता (AR),आभासी वास्तविकता (VR), कृत्रिम बुद्धिमत्ता (AI) पर आधारित संसाधन, एवं खुले डिजिटल शैक्षणिक संसाधन (OERs), भौतिक एवं आभासी शिक्षण हेतु (जर्नल, चार्ट, 2-D एवं 3-D मॉडल, खेल, खिलौने, फ्लैशकार्ड, वर्कशीट, मल्टीमीडिया आदि)**

C. **पर्यावरण से उपलब्ध शिक्षण–अधिगम साधनों की पहचान एवं उपयोग।**

D. **भाषा प्रयोगशाला: प्रकार, संरचना, प्रबंधन व अभ्यास; आभासी प्रयोगशालाएँ, किट, विषय क्लब, मेले, प्रदर्शनियाँ, शैक्षिक पार्क, भ्रमण, सामुदायिक संसाधन एवं संसाधन संयुक्तीकरण**

इकाई-II

संस्कृत भाषा शिक्षण हेतु सामग्री विश्लेषण एवं योजनाबद्धता

अ. संस्कृत भाषा की इकाई एवं पाठ योजना की अवधारणा, प्रकार एवं महत्व।

ब. माध्यमिक स्तर में संस्कृत भाषा पाठ्यपुस्तकों की विषय वस्तु का शैक्षिक विश्लेषण: अवधारणाओं की

पहचान, अधिगम परिणाम एवं दक्षताओं की सूची, समावेशी वातावरण में अधिगम अनुभवों की योजना और मूल्यांकन।

स. अधिगम परिणाम एवं कला-समन्वित अनुभवात्मक अधिगम के आधार पर संस्कृत भाषा के शिक्षण हेतु इकाई व पाठ योजनाओं का विकास।

इकाई-III

ICT समन्वय एवं अनुप्रयोग

अ. संस्कृत भाषा की अधिगम प्रक्रिया में ICT के उपयोग का क्षेत्र एवं महत्व।

ब. कक्षा में ICT का प्रयोग: कृत्रिम बुद्धिमत्ता, मशीन लर्निंग, स्मार्ट बोर्ड्स आदि के माध्यम से अधिगम संवर्द्धन।

स. माध्यमिक स्तर पर संस्कृत भाषा शिक्षण के लिए उपकरण, सॉफ्टवेयर एवं प्लेटफॉर्म।

द. डिजिटल संसाधन एवं मल्टीमीडिया के उपयोग से तकनीकी शैक्षणिक ज्ञान सामग्री (Technological Pedagogical Content Knowledge -TPCK) आधारित ICT-समन्वित पाठ योजनाओं का विकास (भौतिक एवं आभासी दोनों कक्षाओं के लिए)।

501-N.3 प्रायोगिक कार्य (कृपया इनमें से किसी तीन का चयन करें)

1. **संस्कृत भाषा कौशल विकास हेतु एक शिक्षण–अधिगम संसाधन तैयार करें।**
2. **माध्यमिक स्तर की संस्कृत भाषा पाठ्यपुस्तक से किसी एक विषय पर ई-कंटेंट विकसित करें।**
3. **पाठ्यक्रम संवर्धन में संबंधित साहित्य की सूची तैयार करें।**
4. **राष्ट्रीय शिक्षा नीति-2020 के संदर्भ में संस्कृत भाषा शिक्षण के शैक्षिक पहलुओं पर एक लिखित शोध–लेख तैयार करें।**
5. **संस्कृत भाषा शिक्षण हेतु गद्य, पद्य एवं व्याकरण पर आधारित पाठ योजनाएँ तैयार करें।**
6. **संस्थान द्वारा आवंटित अन्य कोई प्रोजेक्ट।**

501-N.4 भाषा आदान प्रदान की पद्धतियाँ:

व्याख्यान-सह-चर्चा पद्धति, योजना-आधारित पद्धति, समस्या-समाधान पद्धति, अनुभवात्मक अधिगम, अन्वेषणात्मक दृष्टिकोण, ICT एकीकृत अधिगम, अन्तरक्रियात्मक पद्धतियाँ: सामूहिक चर्चाएँ, सह-शिक्षण, कार्यशाला, अवलोकन एवं प्रस्तुतियाँ।

501-N.5 मूल्यांकन के तरीके:

लिखित परीक्षा, कक्षा में प्रस्तुतियाँ, संगोष्ठी, सत्र से संबंधित कार्य (असाइनमेंट), प्रायोगिक कार्य (प्रैक्टिकम), सत्रीय एवं अन्तिम सेमेस्टर परीक्षाएँ (यूजीसी/एनसीटीई के मानकानुसार)

501-N.6 सुझावित पठनीय सामग्री:

1. **भारत सरकार के अनुसार विद्यालयी शिक्षा की राष्ट्रीय पाठ्यचर्या रूपरेखा (NCF)**
2. **राष्ट्रीय शिक्षा नीति 2020 (NEP 2020), भारत सरकार (अंग्रेजी/हिन्दी)**

3. **राष्ट्रीय शिक्षा नीति (1992 में संशोधित), मानव संसाधन विकास मंत्रालय, नई दिल्ली**
4. **निःशुल्क एवं अनिवार्य शिक्षा अधिनियम–2009, भारत का राजपत्र, 2009**

B.A. B.Ed. Semester-V

	Subject	Course	Credits
11.	**Political Science (Major)**	DCPOL-501 Introduction to Western Political Thought or Global Politics or Introduction to Public Administration.	6
12.	**History (Major)**	DCHIS-501 European History (from 1780 - 1939)	6
13.	**Geography (Major)**	DCGEO-501 Economic Geography	4
		DCGEO-501(P) Practical Geography V (Field Visit, Survey methods and Report Writing	2
14.	**Economics (Major)**	DCECO-501 Economic Development and Policy in India–I or Money & Banking or Environmental Economics	6
15.	**Drawing & Painting (Major)**	DCDRA-501 Brief History of European Painting-1 or Element of Technical Drawing -1 or Graph	2
		DCDRA-501(P) Creative Composition or Tie and Die or Photography	4
16.	**Hindi (Major)**	DCHIN-501 गढ़वाल लोक साहय एवं सं कत अथवा हद कायधारा म हमालय	6
17.	**English (Major)**	DCENG-501 History of English Literature Part 1 or Literary Moments 1 or Twentieth Century British Poetry & Drama	6
18.	**Sanskrit (Major)**	DCSAN-501 वेद एवं उपनषद अथवा समास एवं छंदशा	6

DCMJ-501: Disciplinary
Major Political Science
DCPOL-501 Introduction to Western Political Thought

Credits: 6

Course Outcome: This course aims to give basic knowledge of Western Political Thought

Course content:

1. Plato (Justice, Ideal state)
2. Aristotle (Citizenship, State)
3. St. Aquinas (Concept of State and Law)
4. Machiavelli (State Craft Theory)
5. Social Contract Theory (Hobbes, Locke, Rousseau)
6. Karl Marx (Class Theory, Dialectical Materialism and Surplus Value)

Reading list:

Dunning, W.A. (2012) A History of Political Theories, Allahabad (any edition). Ebenstein, William (1999). Great Political Thinkers, IBH, Oxford (any edition).

Russell, Bertrand (1945). History of Western Philosophy, Simon and Schuster, New York (any edition).

Sabine, G.H. (2019) *A History of Political Theory*, Oxford and IBH, Bombay (any edition). Strauss, Leo and Joseph Cropsey (1968). *History of Political Philosophy*, Rand McNally.

Grube, G. M. A.1980. *Plato's Thoughts*. Cambridge: Hackett Pub Co. Inc. Miller, David, Janet

Coleman, William Connolly (et.al.) 1991. *The Blackwell Encyclopaedia of Political Thought*. New Delhi: Wiley-Blackwell.

Shields, Christopher. 2007. Aristotle. New York: Routledge.

Strauss, Leo, Joseph Cropsey. 1987. *A History of Political Philosophy*. Chicago: University of Chicago Press.

Wolff, Jonathan. 2006. *An Introduction to Political Philosophy*. New Delhi: OUP Oxford. Mukherjee Subrata and Sushila Ramaswamy (2011) A *History of Political Thought: Plato to Marx*. PHI Learning

Core Elective (Option 2)
Global Politics

Credit-6

Course outcome:

The Purpose of this course is to impart a basic understanding of Global Politics.

Course Content:

1. Understanding the Dynamics and Dimensions of Global Politics and Globalization and Deglobalization
2. Power Politics, The Question of Sovereignty, Regional Interests
3. Contemporary World Actors (UN, G-77), World Trade Organization (WTO), IMF and Global Inequalities: The North-South Gap
4. Nuclear Politics, Humanitarian Intervention, Global Environmental Issues (Global Warming, Biodiversity, Global Commons and Sustainable Development), Terrorism: Cross-border, State-Sponsored and Nonstate Actors

Essential Readings:

Art, R.J. and Jervis, R. (eds.) (1999) *International Politics: Enduring Concepts and Contemporary* Issues. 5th Edition. New York: Longman, pp. 495-500; pp.508-516.

Baylis, J. and Smith, S. (eds.) (2021) *The Globalization of World Politics: An Introduction to International Relations*. Fourth Edition. Oxford: Oxford University Press, pp. 312-329;50-385; 468-489.

Chasek, P. S., Downie, D. L. and Brown, J. W. (eds.) (2006) *Global Environmental Politics*. Fourth Edition. Boulder: Colorado: Westview Press.

Halliday, F. (2004) 'Terrorism in Historical Perspective', Open Democracy. 22 April, available at: http://www.opendemocracy.net/conflict/article_1865.jsp

Held, D., McGrew, A. et al. (eds.) (1999) *Global Transformations Reader. Politics, Economics and Culture*, Stanford: Stanford University Press, pp. 1-50.

Heywood, Andrew (2014). *Global Politics*, Palgrave Macmillan.

Klaus Larres, Ruth Wittlinger (2018*) Understanding Global Politics Actors and Themes in International Affairs*. Taylor & Francis.

Lechner, F. J. and Boli, J. (eds.) (2004*) The Globalization Reader*. 2nd Edition. Oxford: Blackwell.

Ravenhill, J. (2008) 'The Study of Global Political Economy', in Ravenhill, John (ed.) *Global Political Economy*. Second Edition. New York: Oxford University Press, pp.18-24.
Richard W. Mansbach, and Kirsten L. Taylor, (2013*) Introduction to Global Politics*, Routledge
Roberts, J.M. (1999) *The Penguin History of the 20th Century*. London: Penguin.
Sauvant, K. (1981) *Group of 77: Evolution, Structure and Organisation*, New York: Oceana Publications.
Smith, M., Little, R. and Shackleton, M. (eds.) (1981) *Perspectives on World Politics*. London: Croom Helm.
Steven L. Lamy, John Masker (2016). *Introduction to Global Politics*. Oxford University Press
Taylor, P. and Grom, A.J.R. (eds.) (2000) *The United Nations at the Millennium*. London: Continuum. pp.1-20.
Thomas, C. (2005) 'Poverty, Development, and Hunger', in Baylis, J. and Smith, S. (eds.) *The Globalization of World Politics*. Third Edition. New Delhi: Oxford University Press, pp. 645-668.
Tickner, J.A. (2008) 'Gender in World Politics', in Baylis, J. and Smith, S. (eds.) *The Globalization of World Politics: An Introduction to International Relation*. 4th Edition. Oxford: Oxford University Press.
Vanaik, A. (2007) 'Political Terrorism and the US Imperial Project', in Vanaik, A. (Ed) *Masks of Empire*. New Delhi: Tulika Books, pp. 103-128.
Viotti, P. R. and Kauppi, M. V. (2007) *International Relations and World Politics-Security, Economy, Identity*. Third Edition. Delhi: Pearson Education, pp. 430-450.
White, B. et al. (eds.) (2005) *Issues in World Politics*. Third Edition, New York: Macmillan, pp. 74-92; 191-211.

Core Elective (Option 3)
Introduction to Public Administration

Credit-6

Course outcome: This course aims to provide an understanding of Public Administration to the students.

Course Content

1. Public Administration: Meaning, nature, scope and approaches.
2. Principles of Organization, Hierarchy, Span of Control, Unity of Command, Centralization and Decentralization
3. Personnel Administration: Recruitment and Training, Bureaucracy
4. Financial Administration: Budget and Budget Making Process
5. New Public administration: Evolution and Features

Books recommended:

Baker, R.J.S. (1972) *Administrative Theory and Public Administration*, London: Hutchinson Bhattacharya, Mohit (2002) *New Horizons of Public Administration*, New Delhi: Jawahar Publications

George, Chande S. (1974) *The History of Management Thought*, New Delhi: Prentice Hall Goel, S. L. (2002) *Advanced Public Administration*, New Delhi: Deep and Deep
Gross, Bertram (1964) *The Managing of Organizations*, New York: Free Press Harman, M. M. and R. Henry, Nicolas (2017) Public Administration & Public Affairs, New Delhi, Routledge Publication
Jena, Saroj Kumar (2001) Fundamentals of Public Administration, New Delhi: Anmol Publications (P) Ltd
Maheswari, Sri Ram (1998) Administrative Theory: An Introduction, New Delhi: MacMillan India Ltd.
Pattanayak, Raimann, (2002) *Modern Public Administration,* New Delhi: Anmol Publications (P) Ltd.
Rao, V.S.P. and P.S. Narayanan (1990) *Organisation Theory and Behaviour*, Delhi: Konark Publications (P) Ltd,
Shafritz, Jay M. and Albert C. Hyde (eds.) (1978) *Classics of Public Administration, Oak Park, IL*: Moore Publishing Company
Silverman, David (2004) *The Theory of Organizations*, New Delhi: Anmol Publication
Singh, Amit (2002) *Public Administration: Roots and Wings*, New Delhi: Galgatia Publishing Company
Sinha, Manoj (2010) *Prashasan evam Lokniti*, New Delhi, Oriant Blackswan.
T. Mayer (1986) *Organizations Theory for Public Administration*, Boston and Toronto: Little Brown and Company

Field Visit by Students Under Any Major Papers (Credit-4)

DFBCPS-502: Field/Visit/Vocational Course/Entrepreneurship Skills

Field Visit by Students Under Any Major Papers
Credit-4

Major History
DCHIS-501 European History (from 1780 - 1939)

Third Year- Semester-V
European History: C.1780-1939 **(6 Credits)**

I. The French Revolution: Genesis, Nature & Consequences
II. Napoleonic and aftermath.
III. Revolutions in Europe: 1830 & 1848.
IV. Unification of Italy &Germany.
V. Fascism in Europe & Russian Revolution
VI. Imperialist Conflicts: World War I
VII. Germany and World War II

DCFBHIS-502: Field Visit/Vocational Course/ Entrepreneurship Skills

Heritage Studies: 4 Credits

I. An Introduction to Indian Culture and Heritage
II. Documentation of Heritage Sites: Films, Videos, Photographs (2D and 3D)
III. Conservation, Preservation and Restoration of Heritage Sites: Theories and Practices.
IV. Culture in transition, Indian Cultural and Architectural Heritage.
V. Organisations, Institutions, and major agencies involved in Heritage Conservation and Preservation.
VI. Field Work and Report Submission

Major Geography

DCGEO-501: Economic Geography UG/C C005

Credits: 4

Course Objective: After completing the course, students will be able to

1. To understand the concept and spatial distribution of economic activities in the world.
2. To analyse the factors affecting economic activity, focusing on Von Thunen and Weber's theory.
3. To describe in detail the regionalisation of different economic activities.

Course Outcomes: Students will be able to understand

1. Distinguish between the different types of economic activities and their utilities.
2. Appreciate the factors responsible for the location and distribution of activities.
3. Examine the significance and relevance of theories in relation to the location of different economic activities

UNIT-I

Definition, approaches and fundamental concepts of Economic Geography; Patterns of development.

UNIT-II

Locational Theories-Agriculture (Von Thunen) and Industrial (Weber).

UNIT-III

Primary Activities - Intensive subsistence farming: Commercial grain farming, Plantation; Commercial dairy farming: Commercial Fishing, and Mining (iron ore, coal and petroleum). Secondary Activities-Cotton textile Industry, Petro-Chemical Industry; Major Manufacturing Regions.

UNIT-IV

Tertiary and Quaternary Activities: Modes of transportation, Patterns of international trade, Information and Communication Technology Industry.

Suggested Readings:

1. Alexander J. W., 1963: Economic Geography, Prentice-Hall Inc., Englewood Cliffs, New Jersey.

2. 2. Bagchi-Sen S. and Smith H. L., 2006: Economic Geography: Past, Present and Future, Taylor and Francis.
3. Coe N. M., Kelly P. F. and Yeung H. W., 2007: Economic Geography: A Contemporary Introduction, Wiley-Blackwell.
4. Combes P., Mayer T. and Thisse J. F., 2008: Economic Geography: The Integration of Regions and Nations, Princeton University Press.
5. Durand L., 1961: Economic Geography, Crowell.
6. Hodder B. W. and Lee R., 1974: Economic Geography, Taylor and Francis.

Wheeler J. O., 1998: Economic Geography, Wiley. 8. Willington D. E., 2008: Economic Geography, Husband Press.

Major Geography P

DCGEO-501(P) Practical Geography V (Field Visit, Survey methods and Report Writing UG/C C005 (P)

Credits: 2

Course Objective: *After completing the course, students will be able to-*

1. To develop proficiency in Report Writing and organizing a report.
2. Enhance Writing and Communication Skills.

Course Outcomes: *Students will be able to understand-*

1. Ability to design and execute geographical field survey and projects, from data collection to analysis and reporting.
2. Understanding the field ethics and different tools of field study.
3. Students will have enough ability to develop comprehensive Report Writing skills.

UNIT-I

Introduction to Field Survey Methods: Importance of field survey in Geography; Planning and preparation for field survey, Field survey Techniques: Sampling, Selection of Study Area

UNIT-II

Developing Data collection tools: preparation of survey questionnaire, other field survey techniques- observation, Interviews and survey tools (Kobo Toolbox ODK - Collect data anywhere, Google Maps, GPS Essentials, Qfield).

UNIT-III

Report Writing and Presentation: Introduction to Report Writing- types and purpose, Different components of field report, Structure and Organization of a Report; Writing Style and Language, Editing and Proofreading

UNIT-IV

Citations and Referencing; Ethical Considerations; Presenting findings using maps, digital cartographical mapping software (ArcGIS, QGIS, Erdas, Google Earth Engine, etc.), charts, and visual aids, Zotero, Mendeley, Citavi, Word's References tool (anyone).

Field Work/ Tour Report

- Each student will prepare an individual report based on primary and secondary data collected during field work.
- The duration of the field work should not **exceed 10 days**.
- The word count of the report should be about 8000 to 12,000 excluding figures, tables, photographs, maps, references and appendices.
- One copy of the report on A4-size paper should be submitted in soft binding.

Suggested Readings:

1. Mahmood Aslam (2008): Statistical Methods in Geographical Studies, New Delhi: Rajesh Publications
2. Singh, R.L. & Singh, Rana P.B. (2008): Elements of Practical Geography, New Delhi, Kalyani Publishers
3. Das, N.G. (2017): Statistical Methods (Combined edition volume 1 & 2), Mc Graw Hill
4. Kothari, C.R. (2008). Research Methodology -Methods and Techniques, New Delhi, New Age International (P) Limited Publishers
5. V.P. Michael, Research Methodology in Management, Himalaya Publishing House, Bombay.
6. O.R. Krishna Swamy, Methodology of Research in Social Sciences, Himalaya Publishing House, Mumbai.
7. Berenson, Conrad and Raymond Cotton, Research and Report Writing for Business and Economics, Random House, New York.

Weblinks

1. https://www.zotero.org/support/quick_start_guide
2. https://gradcoach.com/how-to-use-mendeley/

DCFBGEO-502:

Course- ***Vocational course/field visit/Entrepreneurship skills***
(Theory/ Practical)

Programme/ Class: **Degree: B.A./B.SC.**	Year: **Third**	Semester: **Fifth/ Sixth**
Subject: **Geography**		
Course Code: **UG/VC-001**	Course Title : **FUNDAMENTAL OF REMOTE SENSING & GEOGRAPHIC INFORMATION SYSTEM (GIS)**	

Course Objective: *After completing the course, students will be able to-*

1. Understand the basic concept and application of remote sensing techniques and Geographical Information Systems.
2. Comprehensive awareness of the potential of remote sensing, GIS, and GPS.
3. Understanding visual interpretation.
4. Understanding of GIS analytical workflow and integrated applications in various geographical domains.

Course Learning Outcomes:

1. Students will understand the concept and function of remote sensing
2. Students will be able to comprehend the use and significance of Remote Sensing and GIS in the field of geographical data analysis and presentation.

Credits : **4**	Core Compulsory
Max. Marks: **30+70**	Min. Passing Marks: **35**

Total No. of Lectures- Tutorials - Practical (in hours per week): **L-T-4/W**

Unit	Topics
UNIT-I	Remote Sensing: Definition, Type, Scope and Historical Development. Types of Satellites. Electro-magnetic radiation: Characteristics, spectral regions and bands. Stages or Process of Remote Sensing.
UNIT-II	Remote sensing satellites: Platform and sensors. Resolution: Spatial, Spectral, Temporal, Radiometric Resolution. Remote Sensing data processing and applications: Visual and digital image processing techniques.
UNIT-III	Remote Sensing applications in watershed management, Glacial studies, Land use/Land cover Mapping, Disaster Management, Dasymetric mapping.
UNIT-IV	Introduction to GIS: Definition, concept and history of GIS. Computer fundamentals for GIS, GIS Packages like ARC GIS, ERDAS, QGIS etc. Coordinate system, Datum, Raster and vector data. Hands one excursive on the software's handling.

Suggested Readings:

1. Choniyal, D D, (2016) Sudur Samvadenevam Bhogolic Suchna Pranalikesighant, Sharda Pustak Bhavan, Allahabad.
2. Lillesand, T.M. and Kiefer, R.W. (2000): Remote Sensing and Image Interpretation. 4thedition. John Wiley and Sons, New York.
3. Campbell, J.B. (2002): Introduction to Remote Sensing. 5th edition, Taylor and Francis, London.
4. Bhatta, B. (2010): Remote Sensing and GIS, Oxford University Press, New Delhi.
5. Nag Prithvish and Kudrat M. (1998): Digital Remote Sensing, Concept Publishing Company, New Delhi Curran, P.J. (1985): Principles of Remote Sensing, Longman, London.

Web References:

1 https://onlinecourses.swayam2.ac.in/aic20_ge05/preview

This course can be opted as an elective by the students of following subjects: **Open to all.**

Suggested Continuous Evaluation Methods: **Assignment/ Test/ Quiz (MCQ)/ Seminar/ Presentations** (any two methods)

Marks distribution of theory examination : **30 marks by Internal** assessment and **70 marks by external** assessment.

Note: The paper consists of four units. Two questions will be set from each unit. The candidate will be required to attempt four questions in all. Answer should be precise. All questions carry equal marks.

Bachelor of Arts/ Science (B.A./B.SC.) IIIrd Year

Course- ***Vocational course/field visit/Entrepreneurship skills***

(Theory/ Practical)

Programme/ Class: **Degree: B.A./B.SC.**	Year: **Third**	Semester: **Fifth/ Sixth**
Subject: **Geography**		
Course Code: **UG/VC-002**	Course Title : **WASTE MANAGEMENT**	

Course Objective: *After completing the course, students will be able to-*

1. To examine the various types of solid waste and methods to categorise it.
2. To find out methods to reduce solid waste at the source.
3. To carry out analysis and audit of waste.
4. To understand people's responsibility in reducing and managing waste

Course Learning Outcomes: *Students will be able to understand-*

*Credits : **4***	*Core Compulsory*
*Max. Marks: **30+70***	*Min. Passing Marks: **35***

Total No. of Lectures- Tutorials - Practical (in hours per week): ***L-T-4/W***

Unit	Topics
UNIT-I	Problem of Wastes, Types of Solid Waste, Categories of solid waste, Effects of Excess Waste Generation.
UNIT-II	Solid Waste Reduction, Waste reduction strategies - How to Start a Waste Reduction Program Guideline, Economic benefits of Waste Reduction, Operation on a daily basis.
UNIT-III	Introduction to Terminology of Waste, Waste Analysis, Introduction to Waste Audit, Checklist for performance audit in Waste Collection, Segregation, Transport, Treatment, Responsibility of Waste Management, Polluter Pays Principle (PPP),
UNIT-IV	Report on the Case study of Waste Management during the Course.

Suggested Readings:

1. CPHEEO Manual of Solid Waste Management, GOI Publication, 2001.
2. Manuals, Rules and regulations in India for Municipal Solid Waste, Biomedical waste, flyash, nuclear waste, hazardous waste and E-waste, Government of India.
3. Gitanjali Nain Gill, 2011, SAGE Publications's Green Technology: An A-Z Guide (2011) whose work for that encyclopedia formed the basis of her contributions to Britannica.
4. Hester, R. E. and R. M. Harrison, (2002). Environmental and health impact of solid waste management activities. Cambridge: The Royal Society of Chemistry. https://www.downtoearth.org.in/coverage/costs-and-benefits-of-india-s waste-disposal options-5623.
5. https://swachhindia.ndtv.com/national-aluminium-company-limited advocates-for-use-of-aluminium-foil-as-alternative-to-plastic-26056/
6. https://www.downtoearth.org.in/blog/india-s-challenges-in-waste management-56753 6.
7. http://rsos.royalsocietypublishing.org/content/4/3/160764#sec-17
8. https://www.downtoearth.org.in/coverage/waste-smart-cities-54119
9. Johnson, Michael R.; McCarthy, Ian P. (2014-10-01). "Product recovery decisions within the context of Extended Producer Responsibility". Journal of Engineering and Technology Management. Engineering and Technology Management for Sustainable Business Development, 34 (9) doi:10.1016/j.jengtecman.2013.11.002
10. Rees, J.F., (1980). The fate of carbon compounds in the landfill disposal of organic matter. J. Chem. Tech. Biotechnol, Vol.30, pp.161-175.
11. Misi, S. N and Forster, C.F (2002). "Semi-Continuous Anaerobic Co Digestion of Agro-Waste," Environmental Technology, Vol. 23, No. 1, 2002, pp. 445-451.
12. Srilatha,H.R., Krishna, N., Sudhakar Bada, K. and Madhukara, K. 1995. Fungal pretreatment of orange processing waste by solid state fermentation for improved production of methane. Process Biochem. 30 : 327-331.
13. Tchobanoglous, G, Theisen, H, and Eliassen, R (1977).Solid Waste Engineering. Principles and Management Issues McGraw Hill Book Company, New York.
14. Waste Management, IANS (2016), https://swachhindia.ndtv.com/vegetable-markets-get-rs-10-lakh-setting waste-management-plants-3722/

15. Wastes to Resource : Waste Management Handbook. http://cbs.teriin.org/pdf/Waste_Management_Handbook.pdf
16. Performance audit on "management of Waste in India" https://swachcoop.com/pdf/CAG%20Audit.pdf
17. Technical EIA guidance manual for common hazardous waste treatment, storage and disposal facilities

Further Readings

1. Internal Waste Audit: A Best Practices Guide. https://www.partnersinprojectgreen.com/resources/internal-waste audit-a-best-practices-guide/ Video Links 1. Using Waste Audits to Improve Recycling & Recovery Programs. https://www.youtube.com/watch?v=DVbB7mVY42Y
2. EIA waste sector lecture https://www.youtube.com/watch?v=BbKlkL9qsAM
3. Manual on Sampling, Analysis and Characterization of Hazardous Wastes. http://cpcb.nic.in/cpcbold/upload/Publications/Publication_323_sec6_ 16.pdf

This course can be opted as an elective by the students of following subjects: **Open to all.**

Suggested Continuous Evaluation Methods: **Assignment/ Test/ Quiz (MCQ)/ Seminar/ Presentations** (any two methods)

Marks distribution of theory examination : **30 marks by internal** assessment and **70 marks by external** assessment.

Note: The paper consists of four units. Two questions will be set from each unit. The candidate will be required to attempt four questions in all. Answer should be precise. All questions carry equal marks.

Bachelor of Arts/ Science (B.A./B.SC.) IIIrd Year

Course- ***Vocational course/field visit/Entrepreneurship skills***

(Theory/ Practical)

Programme/ Class: **Degree: B.A./B.SC.**	Year: **Third**	Semester: **Fifth/ Sixth**
Subject: **Geography**		
Course Code: **UG/VC-003**	Course Title : **DISASTER RISK REDUCTION**	

Course Objective: *After completing the course, students will be able to-*

1. *Learn how sustainable development and disaster risk are linked.*
2. *Understand how to make policies for better disaster management.*
2. *3. Explore community strategies to improve disaster preparedness.*

Course Learning Outcomes: *Students will be able to understand-*

Demonstrate skills of identifying linkages between disasters and development and developing disaster risk reduction as a cross-cutting element.

Enable to facilitate communities to develop disaster preparedness and recovery plans.

*Credits : **4***	*Core Compulsory*
*Max. Marks: **30+70***	*Min. Passing Marks: **35***

*Total No. of Lectures- Tutorials - Practical (in hours per week): **L-T-4/W***

Unit	Topics
UNIT-I	Sustainable development and livelihood. Linkages between disasters and development. Disaster-Development continuum. Integrating risk reduction perspective in disaster risk management stages, Mainstreaming disaster risk reduction. Strategies of mainstreaming disaster risk reduction.
UNIT-II	Policy and planning for disaster management, Mainstreaming DRR in all development activities, Maintenance of public infrastructure.
UNIT-III	Community Based Approaches to Disaster Risk Management Course Content Community vulnerability management plan. Community risk assessment. Community based disaster management.
UNIT-IV	Household risk mapping. Community based adaptation. Indigenous knowledge for reducing disaster risks. Facilitating self-help initiatives. Sustaining long-term community-based disaster risk management. Gender responsive approaches.

Suggested Readings:

1. https://www.bracu.ac.bd/sites/default/files/Course%20Content.pdf
2. https://openlearning.unesco.org/courses/course-v1:UNESCO+UNESCO-03+2021_01/about
3. https://www.shareweb.ch/site/disasterriskreduction/themes-and resources/DOC_themesresources/Themes-and resources/Guide_Basic_Course_DRR_Volume_1_2014_SDC_WFP.pdf
4. https://ssp.nidm.gov.in/enrol/index.php?id=148
5. https://openlearning.unesco.org/courses/course-v1:UNESCO+UNESCO-03+2021_01/about
6. https://openlearning.unesco.org/assets/courseware/v1/8409fd36472bc585b50e7545eea97a92/asset-v1:UNESCO+UNESCO-03+2021_01+type@asset+block/Brochure_Resilient_schools_and_DRR_education_.pdf
7. https://unitar.org/courses-learning-events/individual-learners/master-degree-related-qualifications/graduate-certificate-disaster-risk-reduction-drr
8. https://www.newcastle.edu.au/degrees/teach-out/graduate-certificate-disaster-risk-reduction-pre-2024
9. https://www.newcastle.edu.au/degrees/teach-out/graduate-certificate-disaster-risk-reduction-pre-2024
10. https://hpsdma.nic.in/WriteReadData/LINKS/Final%20DRR%20Mainstreaming%20Training%20Modules413f99f4-ddb9-4ca0-affd-0156c7cb7343.pdf

This course can be opted as an elective by the students of following subjects: **Open to all.**

Suggested Continuous Evaluation Methods: **Assignment/ Test/ Quiz (MCQ)/ Seminar/ Presentations** (any two methods)

Marks distribution of theory examination : **30 marks by internal** assessment and **70 marks by external** assessment.

Note: The paper consists of four units. Two questions will be set from each unit. The candidate will be required to attempt four questions in all. Answer should be precise. All questions carry equal marks.

Bachelor of Arts/ Science (B.A./B.SC.) IIIrd Year

Course- ***Vocational course/field visit/Entrepreneurship skills***

(Theory/ Practical)

Programme/ Class: **Degree: B.A./B.SC.**	Year: **Third**	Semester: **Fifth/Sixth**
Subject: **Geography**		
Course Code: **UG/VC-004**	Course Title : **MOUNTAIN FARMING**	

Course Objective: *After completing the course, students will be able to-*

1. To introduce with mountain agricultural systems in fragile ecosystem
2. To work, contribute and show off mountain agricultural processes

Course Learning Outcomes: *Students will be able to understand-*

1. Show off/exhibit their contribution to mountain agricultural system in a limited space.

2. Understand deeper importance of mountain agriculture

*Credits : **4***	*Core Compulsory*
*Max. Marks: **30+70***	*Min. Passing Marks: **35***

Total No. of Lectures- Tutorials - Practical (in hours per week): ***L-T-4/W***

Unit	Topics
UNIT-I	Meaning and concept of agriculture, Agricultural Infrastructure, Types of mountain agriculture
UNIT-II	Types of crops and seeds, Climate-smart agriculture, Urban agriculture, Regenerative Agriculture, Horticultural practices
UNIT-III	Project work and exhibition (any one of the following) • Making bio-compost • Organic fertilizer • Organic farming • High – tech farming • Precision agriculture • Hydroponic, Aero phonics and vertical farming • Agro-tourism

Suggested Readings:

1. Symons, L. (2019). Agricultural geography. Routledge.
2. Grigg, D. (2003). An introduction to agricultural geography. Routledge.
3. Whatmore, S. (1993). Agricultural geography. Progress in Human Geography, 17(1), 84-91.
4. Morgan, W. B., & Munton, R. J. C. (1971). Agricultural geography. Routledge.
5. de Assis, R. L., de Aquino, A. M., Prado, R. B., Borba, M. F. S., Magalhães, L. A., & Tonietto, J. (2019). Mountain agriculture.
6. Saleth, R. M. (1993). Sustainable Mountain Agriculture: Beyond a'Mountain Perspective'.
7. Food and Agriculture Organization of the United Nations. (2014). Mountain farming is family farming. Rome, Italy: Food & Agriculture Organization of the United Nations (FAO).

This course can be opted as an elective by the students of following subjects: **Open to all.**

Suggested Continuous Evaluation Methods: **Assignment/ Test/ Quiz (MCQ)/ Seminar/ Presentations** (any two methods)

Marks distribution of theory examination : **30 marks by internal** assessment and **70 marks by external** assessment.

Note: The paper consists of four units. Two questions will be set from each unit. The candidate will be required to attempt four questions in all. Answer should be precise. All questions carry equal marks.

Bachelor of Arts/ Science (B.A./B.SC.) IIIrd Year

Course: Vocational course/field visit/Entrepreneurship skills

(Theory/ Practical)

Programme/ Class: **Degree: B.A./B.SC.**	Year: **Third**	Semester: **Fifth/ Sixth**

Subject: **Geography**

Course Code: **UG/VC-006**	Course Title : **VIBRANT AND SMART VILLAGE**

Course Objective: *After completing the course, students will be able to-*

1. To understand the concept of Vibrant and Smart Villages
2. To analyse the role of technology in Rural Development
3. To examine the socio-economic empowerment strategies
4. To evaluate the government initiative programme and applied field knowledge.

Course Learning Outcomes: *Students will be able to understand-*

1. *Significance of Vibrant and Smart Villages*
2. *Integrated technological aspects in Rural Development*
3. *Designing strategies for the socio-economic empowerment*
4. *Role of Government policy framework*

*Credits : **4***	*Core Compulsory*
*Max. Marks: **30+70***	*Min. Passing Marks: **35***

*Total No. of Lectures- Tutorials - Practical (in hours per week): **L-T-4/W***

Unit	**Topics**
UNIT-I	Introduction to Vibrant and Smart Villages: Concept, definition, scope and approach and importance of rural development.
UNIT-II	Integration of technology in Vibrant and Smart villages: Concept of ICT, Digital Infrastructure, digital literacy, smart agriculture and water management.
UNIT-III	Social and Economic empowerment: Inclusive development, rural entrepreneurship and skill development, rural livelihood.
UNIT-IV	Policy Framework and Future Prospects: Government policies and programs, and a detailed Report on the Case study of Vibrant and Smart village in India.

Suggested Readings:

1. Gandhi, M., 1963. Village swaraj. Narajivan Publishing House.
2. Nakka, S.B.R., How to Create Vibrant Smart Villages in the World. SAI BHASKAR REDDY NAKKA.
3. Rajan, Y.S., 2022. Smart Villages–Indian Realities, Opportunities and Way Forward. Smart Villages: Bridging the Global Urban-Rural Divide.
4. Singh, K., 1999. Rural development: Principles, policies and management. Sage.
5. Tripathy, S.N. ed., 2000. Rural Development. Discovery Publishing House.
6. Chambers, R., 2014. Rural development: Putting the last first. Routledge.
7. Azman, W.F.A.C. and Kasim, R.S.R., 2021. Bottom 40 Next Generation Model for Sustainability Entrepreneurship: Post COVID-19 Crisis. Nasrul Aiman Bin Abd Aziz Web designer.
8. Jha, M., 2022. DIGITAL MAPPING OF RURAL DEVELOPMENT WORKS: PURPOSE AND ADVANTAGE. Sustainable Development for Society, Industrial.

This course can be opted as an elective by the students of following subjects: **Open to all.**

Suggested Continuous Evaluation Methods: **Assignment/ Test/ Quiz (MCQ)/ Seminar/ Presentations** (any two methods)

Marks distribution of theory examination : **30 marks by Internal** assessment and **70 marks by external** assessment.

Note: The paper consists of four units. Two questions will be set from each unit. The candidate will be required to attempt four questions in all. Answer should be precise. All questions carry equal marks.

Head

Bachelor of Arts/ Science (B.A./B.SC.) IIIrd Year
Course- Vocational course/field visit/Entrepreneurship skills
(Theory/ Practical)

Programme/ Class: **Degree: B.A./B.SC.**	Year: **Third**	Semester: **Fifth/ Sixth**

Subject: **Geography**

Course Code: **UG/VC-007**	Course Title : **COMMUNITY HEALTH MANAGEMENT**

Course Objective: After completing the course, students will be able to-

1. Understand the concept of health, nutrition promotion, diseases and their prevention,
2. Understand the processes of community health management,
3. Participate in health management at the community level and during emergencies,

Course Learning Outcomes: Students will be able to understand-

1. *Will understand the history and development of Community healthcare initiatives in India*
2. *Understand the concepts of health, nutrition and able to draw the importance of individuals and families in promoting health of the Community.*
3. *Participate effectively in the management of health at community level.*
4. *Able to coordinate and collaborate with various agencies operating in the community by using inter sectoral and multi-disciplinary approach.*

*Credits : **4***	*Core Compulsory*
*Max. Marks: **30+70***	*Min. Passing Marks: **35***

*Total No. of Lectures- Tutorials - Practical (in hours per week): **L-T-4/W***

Unit	Topics
UNIT-I	Definition, nature and scope of Community health, Historical development of Community health planning in India, National Policies, plans and programmes- National health policy, National Population policy, Sustainable Developmental Goals (SDGs), National Health Mission, ABDHM.
UNIT-II	Health, nutrition and diseases: concepts, determinants, measurements, promotion and management of health, Health care delivery system in India: Urban and rural; Levels and hierarchical structure of health care system, IPHS guidelines
UNIT-III	Information, Education and Communication (IEC)-its importance, principles, strategies and guidelines, types and roles; Tele-medicine, Alternative systems of medicine; Health agencies: roles and functions;
UNIT-IV	Student Activities (anyone from the list as per convenience and context). ***Community Health Survey & report writing*** • Health education- campaign, exhibition, fold media, preparation of IEC materials (with the help from local health officials) on different issues like ANC visits, menstrual hygiene, child nutrition, STIs, • Identification and interaction with key persons of Village Health, Sanitation and Nutrition committee (VHSNC) under NHM, followed by brief report writing on health management processes • Drill for disaster/emergency preparedness (with the help from local health officials) • Report on the functioning of Anganwadi Centre (AWC) providing nutrition to child and women– Exercise on nutritional assessment • Estimation of vital health statistics using records, reports and registers maintained at SC/PHC/CHC • Field visits to Population Control Office, Office for National Health Mission, SHEB, Ayurveda Hospital, Homeopath Hospital

Suggested Readings:

1. World Health Organization (2001): Community Health Needs Assessment An introductory guide for the family health nurse in Europe, ISBN 92 890 1194 7

2. Neil Brecht (Eds.) (1999): Health promotion at the community level- New Advances (2nd Edition), Sage Publications, New Delhi
3. K Park (2023): Park's Textbook of Preventive and Social Medicine, 27th Edition, Bhanot Publication
4. James F. McKenzie, Robert R. Pinger, Jerome E. Kotecki (2005): An Introduction to Community Health-5th Edition, Jones and Bartlett Publishers
5. GOI-UNDP DRM Programme (2002-08): Guidelines for Hospital Emergency Preparedness Planning, National Disaster Management Division, GOI, MHFW, Retrieved at https://www.undp.org/sites/g/files/zskgke326/files/migration/in/guidelines_hospital_emergency.pdf
6. Indian Public Health Standards (2022): National Health Mission, https://nhm.gov.in/index1.php?lang=1&level=2&sublinkid=971&lid=154
7. IGNOU (2017): Information, education and communication, https://egyankosh.ac.in/bitstream/123456789/31761/1/Unit-3.pdf
8. Bhalwar, R, Rajesh Vaidya, Rina Tilak, Rajul Gupta, Renuka Kunte (Eds.) (2009): Text Book of Public Health and Community Medicine- 1st Editioon,Dept of Community Medicine, AFMC, Pune in collaboration with WHO, India, New Delhi
9. World Health Organization (2001): Information, Education and Communication -Lessons from the past; Perspective for the future, https://iris.who.int/bitstream/handle/10665/67127/WHO_RHR_01.22.pdf
10. MoSPI, GOI (2010): Manual on Vital statistics, Ministry of Statistics and Programme Implementation, Central Statistics Office retrieved from https://mospi.gov.in/sites/default/files/publication_reports/vital_statistics_2010_0.pdf
11. Journal of the Indian Institute of Science Vol 102, No 2 (2022): Public Health, ISSN: 0970-4140, Retrieved at https://journal.iisc.ac.in/index.php/iisc/issue/view/531
12. World Health Organization (2019): Health Emergency and Disaster Risk Management Framework, ISBN 978-92-4-151618-1
13. Directorate of Health Services Kashmir (2014): Disaster Management Manual Health Care Emergency Management,
14. https://www.dhskashmir.org/disaster/Disaster%20Management%20Manual-DHSK.pdf
15. Lahariya C, Roy B, Shukla A, Chatterjee M, De Graeve H, Jhalani M, Bekedam H. (2020): Community action for health in India: evolution, lessons learnt and ways forward to achieve universal health coverage. WHO South-East Asia J Public Health. ;9(1):82–91. doi:10.4103/2224-3151.283002.

This course can be opted as an elective by the students of following subjects: **Open to all.**

Suggested Continuous Evaluation Methods: **Assignment/ Test/ Quiz (MCQ)/ Seminar/ Presentations** (any two methods)

Marks distribution of theory examination : 30 marks by internal assessment and 70 marks by external assessment.
Note: The paper consists of four units. Two questions will be set from each unit. The candidate will be required to attempt four questions in all. Answer should be precise. All questions carry equal marks.

Major Economics

DCECO-501: Economic Development and Policy in India–I

Credits: 6

Course Objective:

This course critically reviews economic development and its determinants in India and places these against the backdrop of major policy debates in India in the post-independence period.

Course Learning outcomes:

The course will help learners to:

- Learn the concept of economic development and its various determinants, along with focusing on the Indian planning framework
- Understand the SDGs in the context of India

- Learn the major factors responsible for the process of development along with examination of their role
- Learn about the demographic profile of India and its impact and association with economic development
- Broaden their knowledge about employment structure in India

Critically analyse the Indian economic development in terms of various macroeconomic indicators.

UNIT I

Issues in Growth, Development and Sustainability

Meaning and measurement of economic development; development paradigm, dimensions and determinants of growth and development; goals and strategy of Indian planning. Sustainable development goals and India.

UNIT II

Factors in Development

Resources: Natural and Human resources; Environment in economic development; Capital formation (Physical and Human); Technology; Institutions; Foreign capital and economic development, foreign investment policy, FDI, FII.

UNIT III

Population and Economic Development

Demographic profile of India: decadal growth, age composition, literacy, gender composition, rural-urban distribution, migration, population and human resource policies, population and economic development.

UNIT IV

Employment

Labour force and workforce participation; Occupational structure in the organised and the unorganised sectors; trends of employment in public and private sectors; open and disguised unemployment (rural and urban); employment schemes and their impact.

Teaching Learning Process: Lectures and tutorials

Suggested Readings:

1. Michael P Todaro and Stephen Smith. *Economic Development*, Pearson, 11th edition (2011)
2. Uma Kapila, *Indian Economy since Independence*, Academic Foundation, 19th edition (2009).
3. United Nations Development Programme, *Human Development Report* 2018 to 2021.
4. Government of India, *Economic Survey* (latest)
5. Government of India, 12th *Five-Year Plan* (latest)
6. Government of India, *Finance Commission Report* (latest)
7. World Bank, World Development Report, latest edition.
8. NITI Aayog.

Elective Course: Money & Banking or Environmental Economics

Credits: 6

Course Objective: The objective of the course is to help the learner understand the theory and functioning of the monetary and financial sectors of the economy, along with the domain and tools of monetary policy.

Course Learning Outcomes:

The course will help learners to:

- Understand the concept of money and the determination of the money supply
- Get knowledge of financial markets, institutions, and various issues faced in it due to a lack of information and other issues
- Understand the concept and theories of interest rate determination
- Learn the role of the central bank along with the working of the monetary policy.
- Get exposure to the current monetary policy in India

UNIT I

Money

Concepts, functions, measurement, and theories of money supply determination.

UNIT II

Financial Institutions, Markets, Instruments and Financial Innovations

a. Role of financial markets and institutions; problem of asymmetric information – adverse selection and moral hazard; financial crises.
b. Money and capital markets: organization, structure and reforms in India; role of financial derivatives and other innovations.

UNIT III

Interest Rates

Determination; sources of interest rate differentials; theories of term structure of interest rates; interest rates in India.

UNIT IV

Banking System

a. Balance sheet and portfolio management.
b. Indian banking system: Changing role and structure; banking sector reforms.

UNIT V

Central Banking and Monetary Policy

Functions, balance sheet; goals, targets, indicators and instruments of monetary control; monetary management in an open economy; current monetary policy of India.

Teaching Learning Process: Lectures and tutorials

Suggested Readings

1. F. S. Mishkin and S. G. Eakins, *Financial Markets and Institutions*, Pearson Education, 6th edition, 2009.

2. F. J. Fabozzi, F. Modigliani, F. J. Jones, M. G. Ferri, Foundations of Financial Markets and Institutions, Pearson Education, 3rd edition, 2009.
3. L. M. Bhole and J. Mahukud, Financial Institutions and Markets, Tata McGraw-Hill, 5th edition, 2011.
4. M. Y. Khan, Indian Financial System, Tata McGraw-Hill, 7th edition, 2011.
5. Various latest issues of R.B.I. Bulletins, Annual Reports, Reports on Currency and Finance and Reports of the Working Group, IMF Staff Papers.
6. S.B. Gupta, Monetary Economics: Institutions, Theory and Policy, S. Chand, New Delhi, 2016.

Elective Course: Environmental Economics

Credits: 6

Course Objective:

The course objective is to assist learners in methods and policy options for sustainably managing the environment through the use of economic tools.

Course Learning Outcomes:

The course will help learners to:

- To understand the interactions between the environment and economic activities.
- Understand the major environmental issues and adjust economic behaviour through economic institutions such as markets and incentives, as well as through regulation, etc.
- Understand the economic costs and benefits of climate change, along with the economic impact of actions aimed at limiting its effects.
- Study the environmental valuation methods along with understanding the cost-benefit analysis of environmental policies and regulations
- Learn the concept of sustainable development along with measurement to raise awareness among students about the sustainable use of resources so that scarce resources will be available for future generations.

Introduction

Key environmental issues and problems, economic way of thinking about these problems, basic concepts from economics, Pareto optimality and market failure in the presence of externalities, property rights and other approaches.

The Design and Implementation of Environmental Policy

Overview, Pigouvian taxes and effluent fees, tradable permits, implementation of environmental policies in India and international experience; transboundary environmental problems; economics of climate change.

Environmental Valuation Methods and Applications

Valuation of non-market goods and services--theory and practice; measurement methods; cost-benefit analysis of environmental policies and regulations.

Sustainable Development

Concepts, measurement, and perspectives from Indian experience

Teaching Learning Process: Lectures and tutorials

Suggested Readings

1. Roger Perman, Yue Ma, Michael Common, David Maddison and James McGilvray, "*Natural Resource and Environmental Economics"*, Pearson Education/Addison Wesley, 4th edition, 2011.
2. Charles Kolstad, "Intermediate Environmental Economics", Oxford University Press, 2nd edition, 2010.
3. Robert N. Stavins (ed.), "Economics of the Environment: Selected Readings", W.W. Norton, 6th edition, 2012.
4. Robert Solow, "An Almost Practical Step toward Sustainability," Resources for the Future 40th anniversary lecture,1992.
5. Kenneth Arrow et al., "Are We Consuming Too Much?" Journal of Economic Perspectives, 18(3): 147-172, 2004.
6. IPCC (Intergovernmental Panel on Climate Change), Fifth Assessment Report (forthcoming 2014).

Students will learn sociological research methods. It will provide the student with some elementary knowledge of the complexities and philosophical underpinnings of research.

DCFBECO-502: Field Visit/Vocational Course/Entrepreneurship Skills

Course Objective:

The main objective of the course is to deliver practical experience and exposure to the learner about the economic and entrepreneurial activities and to further motivate them towards entrepreneurship.

Course Learning Outcomes:

The course will help the student to:

• understand the real-world situation in a better way

• to get an opportunity to meet the entrepreneurs and main economic agents, to further interact with them, and learn from their experiences.

• The student will be able to access the working environment and problems faced by the producers/entrepreneurs.

Course module:

The student will be taken on a field visit to give them an exposure to meet entrepreneurs or to get an exposure to small, medium and large-scale industries. The student will be able to interact with entrepreneurs, workers, managers and other personnel of the industries. The student will have to prepare a field-based experience report at the end of the semester on the background, operations, marketing, inventory management, financial aspects, human resources, etc of the unit/enterprise/industry they have visited. The report will also include the experiences of the students and the things they have observed and learnt in their field visit.

Note: Student will have to bear the T.A. and D.A. on the field visits allocated to them by their supervisors.

Evaluation: The end-term field report will be evaluated by an external expert, along with an internal expert.

Teaching Learning Process: A Combination of lectures, tutorials and field visits.

Major Drawing & Painting

DCDRA-501: Brief History of European Painting-1 or Element of Technical Drawing -1 or Graph Credits: 2

DCDRA-501(P): Creative Composition or Tie and Die or Photography

Credits: 4

Course	Paper	Title of the Paper	Course Detail
Major Subject (Core Subject) (DSE)	Theory	Brief History of European Painting Part – 1 (Pre – Historic to Renaissance)	Primitive cave painting. Greek painting. Roman painting. Early Christian Art. Byzantine Art. Romanesque painting. Gothic painting. Renaissance painting.
	Practical	Creative Composition	A folio containing not less than 08 best classroom studies and finished creative compositions to be submitted one week before the commencement of End semester practical exam. 1. Size : Quarter Imperial 2. Duration of Time : 3 Hours 3. Medium : Water/Acrylic/Pastel 4. Submission of Sessional work : 08 Plates
			OR
	Theory	Elements of Technical Drawing – Part – 1	• Drawing Instruments and their Uses : • Introduction, Drawing Board, T-Squares, Set Squares, Drawing instruments Box – Scale, Protractor, French Curves, Drawing Paper, Drawing Pins, Eraser, Drawing Pencils, Sand Paper Block etc. • Lines and Lettering : Introduction • lines, line thickness, inked drawings, pencil drawings, Types of lines : Outlines, Marin lines, Dimension lines, Extension or projection lines, Construction lines, Hatching or section lines, Leader or pointer lines, Border lines, Short-break lines, Kong-break lines, Hidden or Dotted lines. • Lettering : Block Letters, Shaded Letters, Cursive Letters • Scales : • Introduction, Engineer's scale, Graphical scale, Representative fraction • Types of Scales: Plain scale, Diagonal scale, Comparative scale, Scale of chords, Vernier scale • Area : • Ellipse. Parabola, Hyperbola
	Practical	Tie & Die	10 best works to be submitted.
			OR
	Theory	Graphic Design	• Brief introduction : Meaning & Definition, Aims & Utility • Basic principle and elements : Balance, Proportion, Contrast, Eye movement, Unity and Varity • Design process : Layout, Visualization, Thumbnails, Rough layout, Comprehensive design, Mechanicals or Art work. • Design Reproduction : Traditional Process, Digital Process • Important Terms : meanings : Trade mark, Audience, Symbol, Monogram, Logotype, Poster, Hording, Banner, Kiosk
	Practical	Photography	Practice of natural, artificial light for still life and portraits, use of flush gun, enlarging and colouring. Copy to copy work, slide making and mounting of slides, group of photography and use of plate and field camera, trick photography, manual photography still and life, use of photography in audio visual aids, close-up. Submission : A collection of best 20 works produced during the session.

DCDRA-502: Wall Painting in Rural Areas (Skill Course)

Credit: 4

Students should go to rural areas and do at least 02 wall paintings based on social awareness. A photograph and a certificate of completion of the work given by the Gram Pradhan, with a detailed report of the work to be submitted at least one week before the commencement of the end-of-semester practical exam.

Major Hindi

DCHIN-501: गढ़वाल लोक साहय एवं सं कत अथवा हद कायधारा म हमालय

(वैकल्पिक प्रश्नपत्र)

Credits: 6

1. लोक साहित्य की परिभाषा लोक वार्ता,

- लोक संस्कृति एवं लोक विज्ञान
- लोक साहित्य के संकलन की समस्याएँ
- गढ़वाली लोक साहित्य का स्वरूप

2. लोकगीतों का स्वरूप अथवा भावाभिव्यक्ति

- लोकगीत : वर्गीकरण एवं विशेषताएँ
- लोकगाथाएँ : वर्गीकरण एवं विशेषताएँ
- प्रमुख लोक गाथाएँ – जीतू बगड्वाल, तीलू रौतेली, माधो सिंह भंडारी की गाथा

3. लोक कथाएँ तथा लोक नाट्य विधा का सामान्य परिचय

- प्रमुख लोक कथाएँ एवं लोक नाट्य
- कथानक रूढ़ियाँ एवं अभिप्राय

4. मुहावरे, कहावतें, पहेलियाँ

- ढोलसागर, नंदाजात, औजी, बादी
- उत्तराखंड के प्रमुख लोक साहित्य के संकलनकर्ता और लोक साहित्य के क्षेत्र में उनका योगदान

नोट :– उक्त पाठ्यक्रम में से दीर्घ उत्तरीय, लघु उत्तरीय एवं अति लघु उत्तरीय प्रश्न पूछे जाएंगे।

संदर्भ ग्रंथ :–

1. लोक साहित्य विज्ञान – डॉ0 सत्येन्द्र
2. गढ़वाली लोकगीत एक सांस्कृतिक अध्ययन – डॉ0 गोविंद चातक
3. गढ़वाली भाषा और उसका साहित्य – हरिदत्त भट्ट शैलेश
4. गढ़वाल के लोकगीत एवं लोकनृत्य – डॉ0 शिवानंद नौटियाल
5. गढ़वाली लोक साहित्य का संदर्भ(मध्य हिमालय – डॉ0 गोविंद चातक
6. गढ़वाली लोक मानस – डॉ0 शिवानंद नौटियाल
7. गढ़वाल : इतिहास, संस्कृति, भाषा एवं साहित्य – डॉ0 सुरेश ममगांई, साहित्य सहकार प्रकाशन, दिल्ली।

8. गढ़वाली भाषा अर साहित्य की विकास यात्रा (चौदहवीं शताब्दी बरि अबारि), संदीप रावत, बिनसर पब्लिकेशन देहरादून।

हिंदी काव्यधारा में हिमालय

(वैकल्पिक प्रश्नपत्र)

क्रेडिट – 06

पाठ्यग्रंथ :– हिमालय – महादेवी वर्मा – लोकभारती प्रकाशन, इलाहाबाद

चंद्रकुँवर काव्य प्रसंग और काव्य संहिता – संपादक – श्रीकंठ, जयश्री ट्रस्ट – बसंत बिहार, देहरादून

पाठ्यांश :–

1. मैथिलीशरण गुप्त – (मातृभूमि)
2. जयशंकर प्रसाद – (हिमालय : आशा सर्ग)
3. सुमित्रानंदन पंत – (हिमाद्रि)
4. चंद्रकुँवर बर्त्वाल – (हिमालय/अब छाया में गुंजन होगा)
5. सुभद्राकुमारी चौहान – (वीरों का कैसा हो बसंत) 6.
6. रामधारी सिंह दिनकर – (हिमालय के प्रति)

नोट :– उक्त समस्त पाठ्यक्रम में से व्याख्या भाग, दीर्घ उत्तरीय, लघु उत्तरीय एवं अति लघु उत्तरीय प्रश्न पूछे जाएंगे।

संदर्भ ग्रंथ :–

1. हिमालय गाथा – जनजाति संस्कृति – सुदर्शन वशिष्ठ
2. हिमांचल दर्शन – डॉ0 शिवानंद नौटियाल
3. उत्तराखंड : संस्कृति, साहित्य और पर्यटन
4. हिमालय परिचय – राहुल सांकृत्यायन
5. चंद्रकुँवर – काव्य प्रसंग और काव्य संहिता – सं0 श्रीकंठ, देहरादून
6. हिमोत्कर्ष – डॉ0 शिवानंद नौटियाल
7. हिमालय – महादेवी वर्मा
8. कामायनी में काव्य संस्कृति और दर्शन –द्वारिका प्रसाद सक्सेना

DCFBHIN-502:

हिंदी एवं आधुनिक भारतीय भाषा-विभाग

बी.ए. हिंदी (NEP)

पंचम/षष्ठ सेमेस्टर (तृतीय वर्ष)

पाठ्यक्रम शीर्षक : व्यावसायिक पाठयक्रम/क्षेत्र भ्रमण/उद्यमिता कौशल

(Course Title : Vocational Course/Field Visit/Entrepreneurship Skills)

प्रश्नपत्र : साहित्यिक क्षेत्र भ्रमण

क्रेडिट – 04

अधिकतम अंक – 100

आंतरिक मूल्यांकन – 30 अंक

फील्ड रिपोर्ट – 50 अंक (बाह्य विशेषज्ञ द्वारा)

मौखिक परीक्षा – 20 अंक (बाह्य विशेषज्ञ द्वारा)

नोट –

1. बाह्य विशेषज्ञ को सक्षम अधिकारी द्वारा नामित किया जाएगा।
2. बाह्य विशेषज्ञ की अनुपलब्धता के मामले में आंतरिक परीक्षक को सक्षम अधिकारी द्वारा नामित किया जाएगा।

पाठ्यक्रम

निर्देश – छात्र को निम्नलिखित में से किसी एक विषय पर प्रस्तुति देनी होगी –

1. साहित्यिक पाण्डुलिपि संग्रहण।
2. भाषा–भूगोल (बोली संग्रहण)।
3. कवि, लेखकों, साहित्यकारों से जुड़े स्थानों का भ्रमण तथा उस पर वृत्त तैयार करना (जैसे– फीचर, डॉक्यूमैंट्री तैयार करना आदि)।
4. लोकगीतों का संग्रहण।

साहित्यिक भ्रमण पाठ्यक्रम का उद्देश्य

साहित्यिक भ्रमण पाठ्यक्रम का मुख्य उद्देश्य छात्रों को हिंदी साहित्य, लोक साहित्य की विविधता, समृद्धि और क्षेत्रीय साहित्यकारों के योगदान से परिचित कराना है। इस पाठयक्रम के तहत निम्नलिखित उद्देश्यों को पूरा किया जाता है–

1. हिंदी साहित्य, लोक साहित्य और साहित्यकारों का परिचय

i. छात्रों को हिंदी एवं लोक साहित्य की ऐतिहासिक और सांस्कृतिक पृष्ठभूमि से जोड़ना।
ii. विभिन्न क्षेत्रीय भाषाओं के प्रमुख साहित्यकारों और उनकी रचनाओं का अध्ययन करना।

2. साहित्यिक स्थलों का अध्ययन

i. साहित्यकारों से जुड़े ऐतिहासिक, सांस्कृतिक और जन्म–स्थलों का भ्रमण कर उनकी प्रासंगिकता को समझना।
ii. साहित्यिक स्थलों के माध्यम से साहित्य और समाज के आपसी संबंधों को जानना।

3. दस्तावेजीकरण और प्रस्तुति कौशल

i. साहित्यिक स्थलों और साहित्यकारों से संबंधित जानकारी को वीडियो, फोटोग्राफ (2D/3D) और फिल्मों जैसे माध्यमों से दस्तावेजीकरण करना।
ii. छात्रों के रचनात्मक और तकनीकी कौशल का विकास करना।

4. लोक साहित्य की विविधता को समझना

i. क्षेत्रीय और भाषाई लोक साहित्य के विभिन्न रूपों और विषयों का विश्लेषण करना।
ii. समाज, संस्कृति, और परंपराओं को साहित्यिक दृष्टिकोण से समझना।

5. साहित्यिक अभिरुचि और चेतना का विकास

i. छात्रों में साहित्य के प्रति रुचि और संवेदनशीलता विकसित करना।
ii. साहित्यिक स्थलों और साहित्यकारों के योगदान को सराहने के लिए प्रेरित करना।

यह पाठ्यक्रम छात्रों को साहित्य और समाज के गहरे संबंधों को समझने और साहित्य की विविधता का अनुभव करने का एक प्रभावी माध्यम प्रदान करता है।

<u>साहित्यिक भ्रमण पाठ्यक्रम के परिणाम (Course Outcomes)</u>

पाठ्यक्रम को पूर्ण करने के बाद, छात्र निम्नलिखित कौशल और ज्ञान अर्जित कर सकेंगे–

1. साहित्यिक और सांस्कृतिक धरोहर की मूल अवधारणा को समझना।
2. साहित्यिक धरोहर का समाज में महत्व समझना।
3. साहित्यिक स्थलों का दस्तावेजीकरण।
4. साहित्यिक धरोहर के संरक्षण और पुनरुद्धार के सिद्धांत और प्रक्रियाओं की समझ विकसित करना।
5. साहित्यिक और सांस्कृतिक धरोहर में बदलाव की प्रक्रिया का अध्ययन करना।
6. साहित्यिक धरोहर संरक्षण में संगठनों और संस्थाओं की भूमिका का ज्ञान अर्जित करना।
7. हिंदी साहित्य और साहित्यकारों की गहन जानकारी प्राप्त करना।

यह पाठ्यक्रम छात्रों को साहित्य एवं सांस्कृतिक धरोहर की व्यापक समझ विकसित करने में सहायक होगा। साथ ही उन्हें साहित्यिक स्थलों और धरोहरों के संरक्षण और संवर्धन में सक्रिय भूमिका निभाने के लिए प्रेरित करेगा।

पाठ्यक्रम संरचना : साहित्यिक भ्रमण

कक्षा व्याख्यान (Classroom Lectures)

1. प्रति सप्ताह चार कक्षा व्याख्यान आयोजित किए जाएंगे।
2. इन व्याख्यानों में छात्रों को हिंदी साहित्य, लोक साहित्य के अंतर्गत संस्कृति और साहित्यिक धरोहर से संबंधित प्रमुख सिद्धांतों और व्यवहारिक पहलुओं को समझाने पर ध्यान दिया जाएगा।
3. साहित्यिक स्थलों, प्रमुख साहित्यकारों और उनके योगदान तथा क्षेत्रीय साहित्यकारों के ग्रामों के संरक्षण व संवर्धन के तरीकों पर चर्चा की जाएगी।

क्षेत्र भ्रमण (Field Visit)

1. कक्षा व्याख्यान समाप्त होने के बाद छात्रों को किसी साहित्यिक स्थल (जैसे, किसी प्रसिद्ध साहित्यकार का निवास, साहित्यिक गतिविधियों से जुड़ा ऐतिहासिक स्थान, या सांस्कृतिक धरोहर स्थल) का भ्रमण कराया जाएगा।
2. स्थल का चयन छात्रों और शिक्षकों द्वारा आपसी विचार–विमर्श से किया जाएगा।
3. क्षेत्र भ्रमण का उद्देश्य साहित्यिक धरोहर का प्रत्यक्ष अवलोकन करना और उसकी प्रासंगिकता को समझना होगा।

प्रस्तुति और रिपोर्ट (Presentation and Report)

1. क्षेत्र भ्रमण के बाद, छात्रों को अपने अनुभव और अवलोकन के आधार पर एक रिपोर्ट तैयार करनी होगी।
2. रिपोर्ट में साहित्यिक स्थल के महत्व, उसके संरक्षण की स्थिति और वहां से जुड़े साहित्यकारों व साहित्यिक धरोहर का विवरण शामिल होगा।
3. रिपोर्ट को विभाग में जमा करना होगा और छात्रों को अपनी रिपोर्ट पर आधारित एक प्रस्तुति देने का अवसर भी मिलेगा।

व्यावहारिक गतिविधियां (Practical Activities)

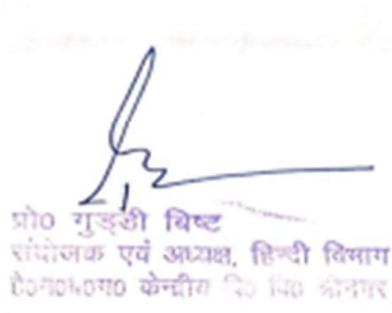
1. छात्रों को साहित्यिक स्थलों की फोटोग्राफी (2D/3D), वीडियो निर्माण या अन्य रचनात्मक माध्यमों से दस्तावेजीकरण का प्रशिक्षण दिया जाएगा।
2. इन गतिविधियों के माध्यम से छात्रों को धरोहर संरक्षण और उसके महत्व को समझने का व्यावहारिक अनुभव प्राप्त होगा।

रिपोर्ट प्रारूप (Report Format)

- Typed and Printed
- Font : Times New Roman / Hindi Krutidev 10
- Font Size : 14 (Title), 12 (Body Text)
- Line Spacing : 1.5
- Page : A4 (One Side)
- Number of Pages : Minimum 20 pages
- Photographs : Minimum 3 to 6 photographs of the field visit.

साहित्यिक क्षेत्र भ्रमण के लिए निर्देश

1. साहित्यिक स्थल पर जाने से पहले विषय-निर्देशक द्वारा दिए गए सभी दिशा-निर्देशों का पालन करें।
2. क्षेत्र भ्रमण के दौरान सभी छात्रों को फील्ड नोट्स बनाने के लिए एक डायरी साथ रखनी होगी।



Major English

DCENG-501: History of English Literature Part 1 or Literary Moments 1 or Twentieth Century British Poetry & Drama

(Any one of the following)

This course offers a choice to the students among

(a) History of English Literature Part I

(b) Literary Terms & Movements Part I and Twentieth Century British Poetry & Drama.

Credits: 6

It will help students to understand literature with a significant number of historical, geographical, and cultural contexts. It introduces students to specific terms used in literature in order to have a clear understanding of different literary texts. In addition to this, movements flourished in different time periods in literary oeuvres are also dealt with to bring a comprehensive study of works of literature. Literary movements establish a firm grip on social, political, geographical and historical aspects of the region from which the movements emerged.

DSE-1A) History of English Literature- Part I

UNIT I

Old English Period (Anglo-Saxon Period) 450-1066

UNIT II

Middle English Period 1066-1500

UNIT III

The Renaissance 1500-1600

UNIT IV

The Neoclassical Period 1600-1785

UNIT V

The Romantic Period 1785-1832

Suggested Reading:

1. Carter, Ronald, and John McRae. The Routledge History of Literature in English. 3rd ed., Routledge, 2021
2. Carter, Ronald, and John McRae. The Routledge History of Literature in English. 3rd ed., Routledge, 2021.
3. Daiches, David. A Critical History of English Literature Volume I and II (Combo Pack). Supernova Publishers, 2022
4. Evans, Benjamin Ifor. Short History of English Literature. 4th ed., Penguin UK, 1999
5. Lee-Browne, Patrick. The Renaissance. Evans Brothers Ltd, 2002.

6. Loewenstein, David, and Janel Mueller. *The Cambridge History of Early Modern English Literature (The New Cambridge History of English Literature)*. 1st ed., Cambridge University Press, 2006.
7. Stonyk, Margaret, and Norman Jeffares. *Nineteenth-Century English Literature (The History of Literature)*. 1983rd ed., Palgrave, 1983.

OR

DSE -1B) Literary Movements – I:

Unit I: Renaissance and Reformation

Unit II: The Metaphysical School of Poets

Unit III: English Neoclassicism

Unit IV: Pre- Romanticism

Unit V: Romanticism

Suggested Reading:

1. Cuddon, J., et al. *A Dictionary of Literary Terms and Literary Theory*. 5th ed., Wiley-Blackwell, 2013.
2. Hamilton, Donna. *A Concise Companion to English Renaissance Literature*. Wiley, 2006.
3. Hattaway, Michael. *Renaissance and Reformations: An Introduction to Early Modern English Literature*. Wiley-Blackwell, 2005.
4. Holmes, Michael Morgan. *Early Modern Metaphysical Literature: Nature, Custom and Strange Desires*. 2001st ed., Palgrave Macmillan, 2001.
5. Roe, Nicholas. *Romanticism: An Oxford Guide*. 1st ed., Oxford University Press, 2005.
6. Stevens, David. *Romanticism (Cambridge Contexts in Literature)*. Cambridge University Press, 2004.
7. Thompson, Stephen. *Literary Movements and Genres - Renaissance Literature (Paperback Edition)*. 1st ed., Greenhaven Press, 2000.

OR

DSE-1C) Twentieth Century British Poetry & Drama:

Unit I: Main Trends in Twentieth Century British Poetry

Unit II: Thomas Hardy: "The Darkling Thrush"

A.E. Houseman: "Loveliest of Tree"

W.B, Yeats: "Byzantium"

DH Lawrence: "Piano"

Unit III: Edith Sitwell: "Still Falls the Rain"

T.S. Eliot: "Journey of Magi"

W.H. Auden: "In Praise of Limestone"

Dylan Thomas: "The Force that through the green fuse drives the flower"

Unit IV: Main Trends in Twentieth Century Drama

Unit V: John Galsworthy: *Justice*

Suggested Reading:

1. Abrams, M. *A Glossary of Literary Terms*. 11th ed., Cengage, 2015.
2. Eliot, T. *The Poems of T. S. Eliot Volume I (Faber Poetry)*. Main, Faber and Faber, 2015.
3. Jain, Manju. *A Critical Reading of the Selected Poems of T.S. Eliot*. Oxford University Press, 2001.
4. Marks, Peter. *Literature of the 1990s: Endings and Beginnings (The Edinburgh History of Twentieth-Century Literature in Britain)*. 1st ed., Edinburgh University Press, 2018.
5. Pfister, Manfred, and John Halliday. *The Theory and Analysis of Drama (European Studies in English Literature)*. Reprint, Cambridge University Press, 1991.
6. Rabey, David Ian. *British and Irish Political Drama in the Twentieth Century: Implicating The Audience*. Palgrave MacMillan, 1990.
7. Smart, John, et al. *Twentieth Century British Drama (Cambridge Contexts in Literature)*. Cambridge University Press, 2002.

DCFBENG-502:

Credits: 04

Vocational Course

Documenting Oral Traditions of Uttarakhand (including Field Visit)

This paper aims to introduce the oral traditions of Uttarakhand Himalayas to the students and organize field trips to document such oral narrative practices abundant in the region.

THEORY - Introduction to the Oral Traditions of Uttarakhand Himalayas such as

Unit I: *Ramman* (listed in UNESCO World Heritage)

Unit II: *Paandav Leela* (Works of Claus Peter Zoller)

Unit III: *Jaagars* (works of PadmshriBasanti Devi)

Unit IV: Folk Songs, Folk Dances, *Ramleela* and Regional Festivals

Unit V: Field Visits

Suggested Readings:

1. Bhatt, Haridatta 'Shailesh'. *Garhwali Bhasha aur UskaShahitya*. TaxshilaPrakashan, 2007.
2. Chatak, Govind. *Bharatiya Lok Sanskriti Ka Sandarbha*. RK Books, 2014.

   ---.*GarhwaliLokgeet: Ek SanskritikAdhyan*. TaxshilaPrakashan, 2003.
3. Rawat, Ajay Singh. *Glimpses of Cultural History of Devbhumi Uttarakhand*: Stone Age to 1949. Ankit Prakashan.
4. Sharma, D.D. *Cultural History of Uttarakhand*. D.K. Print World Ltd.
5. "UNESCO- Ramman,religious festival and ritual theatre of the Garhwal Himalayas, India". Ich.unesco.org.

Major Sanskrit

DCSAN-501: वेद एवं उपनषद अथवा समास एवं छंदशा

Credits: 6

तृतीय वर्ष
पंचम सेमेस्टर
वेद एवम् उपनिषद (Elective 06 Credit)

(क) वेद –

(i) ऋग्वेद–अग्निसूक्त 1.1, अक्ष: 10.34, विष्णु 1.154, संज्ञान 10.191

(ii) यजुर्वेद–शिवसंकल्पसूक्त

(iii) अथर्ववेद–पृथिवीसूक्त (द्वादशकाण्ड, एक से बीस मंत्र)

(ख) कठोपनिषद् (प्रथम अध्याय)

(ग) वैदिकसाहित्य का इतिहास

पाठ्य पुस्तकें एवं सन्दर्भग्रन्थ :–

1. वैदिक–सूक्त सुधाकर, डॉ0 कृष्णकुमार, साहित्य भण्डार, शिक्षा साहित्य, रतिराम शास्त्री, सुभाष बाजार मेरठ
2. वैदिक सूक्तचयनिका, डॉ0किरण टण्डन एवं डॉ0 जयातिवारी, अंकित प्रकाशन, संस्करण–2001
3. ऋकसूक्तसंग्रह, डॉ0 हरिदत्त शास्त्री एवं डॉ0 कृष्णकुमार, साहित्य भण्डार, मेरठ
4. कठोपनिषद्, डॉ0 वासुदेव कृष्णचतुर्वेदी
5. 108 उपनिषद्–गीताप्रेस गोरखपुर
6. वैदिकसाहित्य का इतिहास, श्रीगजानन शास्त्री मुसलगाँवकर एवं पं0 राजेश्वर केशव शास्त्री मुसलगाँवकर, चौखम्बा संस्कृत संस्थान, वाराणसी।
7. वैदिकसाहित्य का इतिहास, डॉ0 कृष्णकुमार, साहित्य भण्डार, मेरठ

18

DCFBSAN-502: वेद एवं उपनषद अथवा समास एवं छंदशा

Credits: 4

स्थानीय तीर्थस्थलों का भ्रमण

क्षेत्रभ्रमण

ITEP Curriculum B.Com. B.Ed. Semester-V

S.N.	Code	Courses	Credit
1.	ESSCCPC-501-O	Content cum Pedagogy of Business Studies at Secondary Stage - Course (II)	2
2.	ESSCCPC-501-P	Content cum Pedagogy of Accountancy at Secondary Stage - Course (II)	2

ESSCCPC-501: Stage-Specific Content -cum-Pedagogy Courses
ESSCCPC-501-O: Content cum Pedagogy of Business Studies at Secondary Stage - Course (II)

Credits: 2

ESSCCPC-501-O.1 About the Course

This course focuses on teaching-learning resources, lesson planning, and ICT integration in Business Studies. Student teachers will explore a variety of traditional and digital resources and their use in the classroom. They will critically analyze textbooks and develop lesson plans aligned with learning outcomes. The course emphasises the pedagogical implications of NEP 2020 and contemporary practices like blended learning and project-based learning in Business Studies.

ESSCCPC-501-O.2 Learning Outcomes

After completing the course, student teachers will be able to:

- identify and develop teaching-learning resources for Business Studies,
- critically analyze Business Studies textbooks,
- prepare outcome-based and experiential lesson plans,
- integrate ICT tools in teaching Business Studies,
- use AI and digital platforms to enhance learning and assessment,
- plan business simulations and projects that reflect real-world scenarios.

UNIT – I
Teaching Learning Resources in Business Studies

- Types and role of teaching aids – print (textbooks, workbooks), visual (charts, business diagrams), and digital (videos, simulations, AR/VR, AI-based tools).
- Use of local resources and business environment for learning.
- Resource centers – business labs, library, financial literacy clubs.
- ICT tools – e-learning platforms, business software, stock market simulators.

UNIT – II
Content Analysis and Planning for Teaching

- Pedagogical analysis of Business Studies textbooks.
- Planning for inclusion and equity in learning activities.
- Unit and lesson planning – principles and models.
- Designing outcome-based and competency-driven lesson plans.

UNIT – III

ICT Integration and Applications in Business Studies

- Importance of ICT and AI in Business Studies education.
- Tools and applications for content delivery, assessment, and feedback.
- Integrating digital platforms for financial simulations, business planning, e-commerce.
- Developing TPCK-based digital lesson plans.

ESSCCPC-501-O.3 Suggestive Practicum (Any Three)

1. Develop an e-portfolio or website with business learning content.
2. Analyze Business Studies textbooks (Class 11–12) and identify gaps and strengths.
3. Design and develop business teaching-learning aids.
4. Prepare a lesson plan integrating AI tools or simulations.
5. Conduct a financial literacy workshop or peer-teaching session.
6. Plan a virtual field trip to a business establishment.
7. Any other project.

ESSCCPC-501-O.4 Suggestive Mode of Transaction

Lecture cum discussion, field visits, case study method, discovery learning, project-based learning, problem-solving, experiential learning, ICT-integrated learning.

ESSCCPC-501-O.5 Suggestive Mode of Assessment

Written tests, lesson plans, simulations, e-portfolios, project presentations, peer and self-assessments, classroom participation, sessional and terminal examinations (as per UGC norms).

ESSCCPC-501-O.6 Suggestive Reading Material

- NCERT Textbooks of Business Studies (Class XI and XII)
- National Education Policy 2020, MoE, Government of India
- National Curriculum Frameworks (NCF-SE 2023)
- CBSE Business Studies Curriculum and Teachers' Manuals
- Research articles on Business Education and Pedagogy
- Online platforms and resources: Investopedia, NSE Academy, SEBI Educational Portal

ESSCCPC-501-P: Content cum Pedagogy of Accountancy at Secondary Stage - Course (II)

Credits: 2

ESSCCPC-501-P.1 About the Course

This course introduces student teachers to teaching-learning materials, planning techniques, and resource management in Accountancy. It emphasizes the identification, development, and use of print and digital teaching aids and integration of ICT. It also includes pedagogical content analysis of textbooks, lesson and unit planning based on experiential and outcome-based learning. Special attention is given to local and community-based resources and the NEP 2020 framework.

ESSCCPC-501-P.2 Learning Outcomes

After completion of this course, student teachers will be able to:

- identify and categorize teaching aids for Accountancy,
- develop and use effective teaching-learning resources,
- analyze textbook content and curriculum,
- plan lesson and unit plans based on learning outcomes and competencies,
- integrate ICT tools and platforms into Accountancy teaching.

UNIT – I

Teaching Learning Resources

- Role and significance of teaching-learning aids in Accountancy
- Types: textbooks, workbooks, visuals, simulation tools, financial calculators, digital ledgers, spreadsheets, videos, e-content, OERs
- Identifying learning resources from the local environment (e.g., banks, local businesses)
- Resource rooms, Accountancy labs (simulation), financial literacy clubs, exhibitions, excursions

UNIT – II

Content Analysis and Planning

- Pedagogical analysis of textbook topics (e.g., journal, ledger, trial balance)
- Developing unit and lesson plans based on learning outcomes
- Inclusive and experiential learning activities in Accountancy classrooms
- Reflective teaching and adaptive planning

UNIT – III

ICT Integration and Applications

- Importance of ICT in Accountancy teaching-learning
- Tools: Tally, MS Excel, accounting software, simulations, YouTube lectures, AI-driven tools
- Digital lesson planning using TPACK framework
- Developing and evaluating ICT-integrated lessons for online/offline classrooms

ESSCCPC-501-P.3 Suggestive Practicum (Any Three)

1. Analyze NCERT/State Board Accountancy textbooks
2. Develop teaching aids (charts, models, simulations) for accounting topics
3. Design experiential learning-based lesson plans
4. Create e-content or video tutorials for Accountancy concepts
5. Identify local learning resources for Accountancy
6. Develop a project integrating Accountancy with Economics/ICT
7. Any other relevant task

ESSCCPC-501-P.4 Suggestive Mode of Transaction

Lecture cum discussion, field visits, case study method, discovery learning, project-based learning, problem-solving, experiential learning, ICT-integrated learning.

ESSCCPC-501-P.5 Suggestive Mode of Assessment

Written tests, lesson plans, simulations, e-portfolios, project presentations, peer and self-assessments, classroom participation, sessional and terminal examinations (as per UGC norms).

ESSCCPC-501-P.6 Suggestive Reading Material

- NCERT Accountancy Textbooks

CBSE/State Syllabus Guidelines

- NEP 2020
- NCFSE Draft 2023
- Teacher Manuals
- ICAI Educational Resources
- Digital tools like MS Excel, Tally, Zoho Books

B.Com. B.Ed. Semester-V

	Subject	Course	Credits
19.	**501: Business Studies Major**	**Management Accounting**	6
20.	**502: Skill course**	**Field Training**	4

DCMJ-501: Disciplinary
Major Management Accounting

Credit:06

Course Objective:

The course aims to enable students to acquire knowledge of concepts, methods and techniques of Management Accounting for the purpose of managerial planning, control and decision-making.

Course Outcomes:

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

i. Examine thoroughly the conceptual framework of Management Accounting; identification of differences between different forms of accounting—Financial, Cost and Management; distinction between cost control and cost reduction,

ii. Analyse budgetary control system as a tool of managerial planning and control; prepare various types of budgets and explore the standard costing system as a tool of managerial control; calculation of variances in respect of each element of cost and sales; control ratios.

iii. Recognise the concept of marginal cost and marginal costing; preparation of income statements using absorption and variable costing; learning of cost-volume-profit analysis and break-even analysis through statements, mathematical and graphical approaches,

iv. Infer the concept of relevant cost and make decisions related to different business situations using marginal costing and differential costing techniques

v. Facilitate basic understanding of different contemporary issues involved in management accounting, like Responsibility Accounting, Divisional Performance Measurement.

UNIT I
Introduction to Management Accounting

Meaning, objectives, nature and scope of management accounting; Difference between different forms of accounting: Cost, Financial and Management accounting; Cost control and Cost reduction.

UNIT II

Budgetary Control and Standard Costing Systems

A. Budgeting and Budgetary Control: Concept, objectives, merits and limitations of budget, budgeting and budgetary control; Functional Budgets; Fixed and Flexible budgeting; An overview of different approaches to budgeting: Zero base budgeting, Performance budgeting and Programme budgeting.

B. Standard Costing and Variance Analysis: Meaning, advantages, limitations and applications of standard cost and standard costing; Variance Analysis: material, labour, overheads and sales variances; Control ratios.

UNIT III

Marginal Costing

Concept of marginal cost and marginal costing; Absorption versus Marginal Costing: Distinctive features and income determination; Cost-volume-profit analysis; Break-even Analysis: mathematical and graphical approaches; Profit-volume ratio, angle of incidence, margin of safety, key factor, determination of cost indifference point.

UNIT IV

Decision Making

Steps in Decision making process; Concept of relevant costs; solving various short -term decision making problems using marginal costing and differential costing techniques: Profitable product mix, Acceptance or rejection of special/ export offers, Make or buy, Addition or elimination of a product line, sell or process further, operate or shut down and Pricing decisions

UNIT V

Responsibility Accounting and Ratio Analysis

Responsibility Accounting: Concept, Significance, Different Responsibility Centres; Divisional Performance Measurement: Financial and Non-Financial measures;

Analysis of Financial Statement through Ratio Analysis: Computation of various ratios relating to liquidity, solvency, profitability, activity and ratios for investors.

Suggested Readings:

- Khan, M. Y., & Jain, P.K. Management Accounting. Tata McGraw Hill Publishing Co., New Delhi.
- Kishore, R. M. Management Accounting. Taxmann Publication, New Delhi.
- Arora, M. N. Management Accounting. Himalaya Publishing House, New Delhi.
- Jain, S. P., & Narang, K. L. Cost and Management accounting. Kalyani Publishers, New Delhi.
- Maheshwari, S. N., & Mittal, S. N. Management Accounting. Shree Mahavir Book Depot (Publishers), New Delhi.
- Pillai, R. S. N., & Bagavathi. Management Accounting. S. Chand Publishing, New Delhi.
- Singh, S. Management Accounting. PHI Learning Pvt. Limited, New Delhi.
- Singh, S. K., & Gupta, L. Management Accounting: Theory and Practice. A.K. Publications, New Delhi.
- Tulsian, P. C., & Tulsian, B. Advanced Management Accounting. S. Chand, New Delhi.
- Drury, C. Management and Cost Accounting. Thomson Learning.

- Horngren, C. T., George, F., & Srikant M. D. Cost Accounting: A Managerial Emphasis. Prentice Hall of India Ltd., New Delhi.

Note: Learners are advised to use the latest edition of readings.

502: Skill Course

Credit: 4- **Field Training**

Summer Internship and Project Report

Course Objective:

The Summer Internship and project report aim to provide students with practical experience in the firm, industry and organisation to develop specific skills and knowledge relevant to their field of study. Students are expected to develop analytical ability and skills.

Course Outcomes:

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

1. Gain experience in their field of study, enabling them to develop practical skills and knowledge relevant to their chosen industry/service sector.
2. Apply their academic learning to real-world scenarios and develop the ability to work effectively within an organisation and analyse their problems.
3. Valuable exposure to industry-specific practices, develop a deeper understanding of their chosen field, and enhance their career readiness by participating in the industrial training program
4. Will be able of have a clear understanding of the expectations and requirements for their industrial training program, and will be better equipped to make the most of the experience and develop a meaningful project file that captures the learning outcomes achieved.

Course Details:

Students are advised to follow the detailed guidelines as mentioned below:

1. Duration of Sumer Internship and Project Report: All students will also undergo Summer Internship in a firm, industry, or organisation for a minimum period of 21 days during the 5th semester in any of the reputed industry/ service sector, Government/ private sector, research & development organisation. A certificate is required to be taken from the organisation where training has been completed. Each student enrolled shall be assigned a Mentor (faculty member) who will be in continuous touch with the student and the business organisation providing summer training/field work. After completion of training, the student will procure a certificate of training from the organisation
2. Assessment Criteria: Students will be assessed based on their level of engagement and initiative during the training, as well as the quality of work produced. The assessment will also take into account the level of learning outcomes achieved as demonstrated in the project file. The students will have to submit a project report of the Summer training/Research internship to the department. That report should contain the entire experience of training and the knowledge gained during the continuation of training. Training offers students practical exposure to real-world environments related to their academic discipline. It also helps in understanding the real-world problems faced by businesses in running their business. Training or research-based internship can be performed in the following areas: The list is indicative only.

1. Trade and Agriculture Area,

2. Economy & Banking, Financial Services, and Insurance Area,
3. Logistics, Automotive & Capital Goods Area,
4. Fast Moving Consumer Goods & Retail Area,
5. Information Technology/Information Technology-enabled Services & Electronics Area, 6. Handcraft, Art, Design & Music Area,
7. Healthcare & Life Science Area
8. Sports, Wellness and Physical Education Area,
9. Tourism & Hospitality Area,
10. Digitisation & Emerging Technologies (Internet of 85 Things/Artificial Intelligence/Machine Learning/Deep Learning/Augmented Reality/Virtual Reality, etc.) Area,
11. Humanitarian, Public Policy and Legal Service Area,
12. Communication Area, 13. Education Area,
14. Sustainable development Area,
15. Environment Area,
16. Commerce, Medium and Small-Scale Industries Area.

Format and Content of the Project File:
Students will be required to prepare a project file documenting their training/ research experience. The project file should include a description of the organisation, the student's role and responsibilities, skills and knowledge gained, and reflections on the experience. A copy of the certificate taken from the authorised person of the organisation, where the summer training/ internship was performed, should be annexed to the project file as evidence. A project file is required to be made based on the internship under the guidance of a supervisor.

NOTE: 1. Internal assessment for 30 marks will be done by the faculty member (Mentor) of the Department. The remaining 70 marks will be assessed by the external expert appointed by the University based on the evaluation of the project file and Viva-Voce related to the experience and learning gained in the Summer Internship.
UGC guidelines for internship for undergraduate students can be referred to by faculty members and students. Link is given below 0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf 86

B.Sc. B.Ed., B.A. B.Ed. & B.Com. B.Ed.			
S.N.	**Code**	**Courses**	**Credit**
1.	ESEC-502	Pre-internship Practice	2
2.	RM-503	Introduction to Research	4
3.	RM-504	Interdisciplinary Research	2

ESEC-502: SCHOOL EXPERIENCE

Pre-internship Practice: Orientation and preparation in the Institute

Credits: 2

Field engagement is an integral part of a teacher education programme. In the field engagement of a pre-service teacher education programme, the student teachers are engaged in different kinds of

practical tasks or activities relating to the teaching profession in a supervised condition. Through field engagement, the student teachers understand school processes, participate in activities, and internalise school-related ethics, values, and norms. School experience is integral to the Integrated Teacher Education Programme (ITEP); it allows student teachers to experience the school environment and apply theoretical learning.

Objectives

The School Experience will help the student teachers:

1. To understand on the roles of different personnel associated with the academics, resources, and the school system's management.
2. To be conscious of their duties as teachers concerning students, school, community, and other stakeholders.
3. To reflect on diverse school contexts and to appreciate the role of school teachers.
4. To understand and participate in different curricular activities like school assemblies, games and sports, cultural activities, and other events.
5. To participate in different programmes of school like parental engagement, motivating the students from the socio-economically disadvantaged group, and promoting inclusion and equity.
6. To develop skills associated with the profession - adaptation, collaboration, problem-solving, and participative decision-making.
7. To develop contextual learning competencies, skills, and attitudes for becoming effective teachers.
8. To develop ICT and research skills.

502.1 About the Course

Pre-Internship is a vital component of the Teacher Education Programme. It is a prerequisite for student teachers to experience a simulated classroom environment to prepare them for real-life situations. Student teachers get exposure in a conducive, guided environment to manage a classroom and learn pedagogic and classroom management skills and get an opportunity to have hands-on experience.

502.2 Learning Objectives:

After completion of the course, student teachers will be able to:

- acquainted with various pedagogic practices, classroom management skills, assessment tools and learning standards,
- get experience of conducting classes by observing lessons transacted by teacher educators (demonstration lessons),
- develop lesson plans to teach them using appropriate pedagogies and learning resources,
- develop and practice teaching skills in a guided environment to be an effective teacher,
- be prepared for the school internship.

502.3 Suggestive Mode of Transaction

- Demonstration lesson (minimum 1 in each pedagogical subject)
- Peer Group teaching and peer observation (minimum 5 in each pedagogical subject)
- Observation of lessons by teacher educators during peer group teaching
- Reflective group discussions/workshops/seminars

- Preparation and presentation of the video content illustrating best classroom practices.

502.4 Content

The pre-internship will include activities relating to the stage-specific pedagogy courses, ability enhancement and value-added courses and foundation courses transacted during previous semesters. It will also include knowledge of pedagogy, formats of lesson plans, different ICT tools, schooling systems in India, principles of classroom management, assessment, and other relevant content.

502.5 Activities to be conducted:

- Observation of lessons transacted by teacher educators to identify pedagogic skills.
- Exposure to various types of lesson plans through workshops.
- Development of relevant Teaching Learning Materials (TLMs).
- Participation in screening and discussion of educational videos on pedagogy and assessment.
- Learning about inclusiveness in school education
- Orientation for Action Research/case study

502.5 Secondary Stage

- Orientation of student teachers to different pedagogic approaches like storytelling, art-integrated, sports-integrated, project-based, and ICT-integrated for developing critical thinking, attention to life aspirations, and greater flexibility and classroom management skills.
- Observation of the lesson is demonstrated by teacher educators/experts in the institute.
- Designing guided activities, including a laboratory for each class/subject based on learning outcomes.
- Study Secondary Stage Learning Standards in the NCF
- Content analysis and development of the unit plan, concept map and lesson plan.
- Discussion on unit plan and lesson plan with teacher educators/experts
- Preparation of a Portfolio (for self-work) that the student-teacher will use to keep all her/his work.
- Participate in discussions/reflective sessions for conceptualising teaching-learning practices.
- Exploring available learning resources and educational videos
- Developing local, low-cost, and innovative TLMs.
- Reading and reflecting on inspiring books on pedagogic practices

502.6 Assessment

Competence/Artefact	Method of assessment	Assessed By	Credits
Classroom teaching skills and assessment tools (including learning standards)	Simulated Presentation	Teacher-Educator	1
Reflective group discussions/workshop	Observations	Teacher-Educator	0.5
Artefacts (Lesson Plans, TLM, Curated Videos) and action research procedures.	Evaluation	Teacher-Educator	0.5

502.7 Outcomes

After completion of the course, student teachers will be able to:

1. describe the prerequisites of the internship.
2. demonstrate knowledge of pedagogic practices, classroom management skills, assessment tools and learning standards,
3. develop lesson plans and relevant Teaching Learning Materials (TLMs),
4. develop readiness to take up an internship programme.

RM-503: Introduction to Research

Credit: 4

503.1 About the Course

The "Introduction to Research" course prepares students at the undergraduate level to develop the basic foundational skills needed to inquire into different areas systematically. It provides an all-inclusive overview of the steps involved in research, including constructing research questions, performing a literature review, designing a study, collecting and analysing data, and upholding ethical standards. Students tackle both qualitative and quantitative approaches and learn to choose appropriate methods for different scenarios. Emphasis is placed on the mastery of research communication skills, critical thinking, and advanced analysis. Students utilise practical methods and projects to gain firsthand experience in designing and executing research studies. This positions them for further academic study and professional research positions. At the conclusion of the course, students will understand the complete process involved in research, from conceptualisation to dissemination, and appreciate the significance of research for advancing knowledge and contributing towards societal development.

503.2 Learning Outcomes

After completion of this course, student teachers will be able to:

- Discuss the core principles, classifications, and aims of research in theoretical as well as practical contexts.
- Articulate and precisely define research issues, goals, and questions or hypotheses.
- Undertake a simple literature review utilising scholarly search engines and cite the references utilising accepted citation formats such as APA style.
- Determine suitable research strategies, sample selection procedures, and tools for gathering information to answer various research questions.
- Use simple statistical computations and methods to describe and analyze qualitative and quantitative information.
- Observe ethical norms of conduct and academic honesty in all stages of proposing, implementing, and reporting the research.
- Formulate and defend a complete research proposal or prepare a mini-project report using generally accepted academic standards and structures.

UNIT – I: Introduction to Research

A. Meaning, purpose, and importance of research
B. Research in academic and professional contexts
C. Types of research: Basic, Applied, and action research. Quantitative, Qualitative, Mixed Methods

D. Characteristics and limitations of scientific research. Nature of Interdisciplinary research.

UNIT – II: Literature Review

A. Purpose and techniques of reviewing literature
B. Sources of knowledge: Primary and secondary
C. Tools: Google Scholar, Research Gate, databases (JSTOR, Scopus, etc.)
D. Finding and writing the research gap.

UNIT – III: Research Design

A. Types of research design: Exploratory, descriptive, experimental, randomised.
B. Research problem identification and formulation
C. Objectives: Formulation of objectives.
D. Hypotheses: Meaning, types and importance.

UNIT- IV: Research Process

A. Steps in the research process.
B. Population and sample. Qualities of a good sample.
C. Sampling techniques: Probability and non-probability, Sample size determination
D. Data collection methods: Surveys, interviews, observations, experiments. Design of questionnaires and interview schedules.

UNIT- V: Data Analysis and Interpretation

A. Types of data: Qualitative vs Quantitative
B. Coding and tabulation, data analysis, and interpretation.
C. Introduction to statistical techniques: mean, median, mode, SD, ANOVA and correlation.
D. Using software: Excel/SPSS/R (introductory)

503.4 Suggestive Mode of Transaction

Lectures, hands-on activities, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, collaborative & co-operative approach, experiential learning, art integrated learning, sport integrated learning.

503.5 Suggestive Mode of Assessment

Assessment and examinations will be conducted as per the criteria of HNBGU.

503.6 Suggestive Reading Material

1. American Psychological Association (APA) Style Guide (7th ed.). APA Style
2. Best, J. W., & Kahn, J. V. (2014). *Research in Education* (10th ed.). Pearson Education.
3. Binkerhoff, C. (2019). *Doing Research: A Student's Guide to Finding & Using the Best Sources*. Kwantlen Polytechnic University.
4. Creswell, J. W. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE Publications.
5. Kothari, C. R., & Garg, G. (2019). *Research Methodology: Methods and Techniques* (4th ed.). New Age International Publishers.
6. Kumar, R. (2019). *Research Methodology: A Step-by-Step Guide for Beginners* (5th ed.). SAGE Publications.

7. Modern Language Association (MLA) Handbook (9th ed.). MLA Style Centre.
8. Sheppard, V. (2020). *Research Methods for the Social Sciences: An Introduction*. BC campus.
9. Walliman, N. (2011). *Your Research Project: Designing and Planning Your Work* (3rd ed.). SAGE Publications.

RM-504: Interdisciplinary Research

Credit: 2

504.1 About the Course

The "Interdisciplinary Research" course prepares students at the undergraduate level to develop the basic foundational skills needed to inquire into different areas systematically. It is an approach that integrates knowledge, methods, and perspectives from two or more disciplines to address complex questions, problems, or issues that cannot be effectively solved within the boundaries of a single field. It encourages collaboration among scholars and professionals, fostering innovation through the combination of diverse ideas and methodologies. This course provides insight into the meaning, scope, and importance of interdisciplinary research. The student teachers will develop the skill to apply suitable methodologies for interdisciplinary research work and collaborative research skills. They will understand the difference between multidisciplinary, cross-disciplinary, transdisciplinary, and interdisciplinary research. They will learn the concept of open science and describe the ethical issues in interdisciplinary research.

504.2 Learning Outcomes

After completion of this course, student teachers will be able to:

A. understand the meaning, scope, and importance of interdisciplinary research.
B. identify connections across different disciplines.
C. apply suitable methodologies for interdisciplinary research work
D. develop collaborative research skills
E. quantitative, Qualitative, Mixed Methods

UNIT-I

Introduction to Interdisciplinary Research

A. Meaning and scope of interdisciplinary research.
B. Nature of interdisciplinary research.
C. Difference between multidisciplinary, cross-disciplinary, transdisciplinary, and interdisciplinary.
D. Importance of interdisciplinary research in view of NEP 2020.

UNIT-II

Research Design in Interdisciplinary Studies

A. Qualitative, quantitative, and mixed methods.
B. Framing research questions across disciplines.
C. Integrating concepts and methods from different disciplines.
D. Selecting mixed methods and combined approaches.

UNIT-III
Collaboration in Research

A. Building effective interdisciplinary teams and managing conflicts.
B. Communication across disciplines.
C. Philosophy of knowledge integration.
D. Ethical issues in interdisciplinary research.

503.3 Suggestive Practicum (Any three)

- Identify an interdisciplinary research topic.
- Based on the selected problem, draft specific research objectives and formulate testable hypotheses (if applicable).
- Conduct a mini literature review using Google Scholar, JSTOR, or other databases and compile a bibliography using APA or MLA format.
- Search for any interdisciplinary case study and prepare a report.
- Any task suggested by the teacher.

504.4 Suggestive Mode of Transaction

Lectures, hands-on activities, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, collaborative & co-operative approach, experiential learning, art integrated learning, sport integrated learning.

504.5 Suggestive Mode of Assessment

Assessment and examinations will be conducted as per the criteria of HNBGU.

504.6 Suggestive Reading Material

- Julie Thompson Klein – *Interdisciplinarity: History, Theory, and Practice*
- Repko, Szostak & Buchberger – *Introduction to Interdisciplinary Studies*
- Frodeman, Klein, & Mitcham (eds.) – *The Oxford Handbook of Interdisciplinarity*
- Selected research articles from Nature, Science, and interdisciplinary journals

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