Syllabus for Four Year Integrated B.A.B.Ed (Compulsory Paper)

Babasaheb Bhimrao Ambedkar Bihar

University Muzaffarpur (Bihar)

(Based on NCTE Curriculum Framework for Four year Integrated B.Ed. Programme

Rationale and Objectives of Languages

At the Four Year Integrated B.A. B.Ed. Syllabus English and one MIL (Modern Indian Language) are focused as the core of language learning for the teacher students. Here the MIL includes Hindi, Bengali, Oriya and Alternative English. These above languages are also studied as Elective Subjects in the course. The study of languages aims at fulfilling the communicative, aesthetic and interactive needs of the learners.

COMPULSORY ENGLISH
SEMESTER-I
PAPER-I

GENERAL ENGLISH

Contact Hours: 4 per week
Exam Duration: :3 Hours
Maximum Marks: 100
Term End Exam : 75 Marks
Seasonal : 25 Marks

Objectives: This is essentially a language-based course. It aims at making students read English prose with a view to enlarging their comprehension of the language and encouraging them to develop reading habits. It also aims at giving them basic skills in grammar, widening their vocabulary and teaching them to write simple and correct English.

Scheme of Examination

1. Comprehension and Vocabulary

a. Questions based on content from the prescribed text 10 Marks
b. Questions based on a passage from the prescribed text to test the candidate's comprehension and vocabulary 20 Marks
c. Questions based on an unseen passage to test the candidate's comprehension and vocabulary 10 Marks
(There will be a text of essays and short stories between 100 and 200 pages in length.)

2. Composition

a. Letter/Application writing 10 Marks
b. Paragraph writing/Précis writing 10 Marks
c. Report Writing 10 Marks

3. Translation

The exercise will require candidates to render into English ten simple sentences in Hindi. At least 15 sentences will be set. 10 Marks

4. Grammar and Usage

The Questions in this exercise will be set with the purpose of testing thecandidate's knowledge of grammar and familiarity with correct usage.

A. Elements of sentence 2 Marks
B. Transformation of Sentences including Active and Passive Voice 2 ½ Marks

C. Modals	2 Marks
D. Tense Usage	2 ½ Marks
E. Determiners	2 ½ Marks
F. Common English Errors	2 ½ Marks
G. Phrasal Verbs	3 Marks
H. Idioms	3 Mark

Phrasal Verbs

Break Break away, break down, break off, break up
Bring Bring about, bring in, bring up, bring down
Come Come by, come across, come upon
Carry Carry out, carry on, carry off, carry over
Call Call on, call off, call at
Get Get along, get away with, get by, get through, get over
Give Give up, give away, give in
Hard Hard up, hard of hearing, hard nut to crack, hard to please
Look Look after, look into, look forward to, look up to
Put Put out, put off, put up, put up with
Run Run after, run down, run over, run out of
Take Take after, take up

Idioms

To be born with a silver spoon in one's mouth, to be at daggers drawn, to be at sea, to be in the dark, to be in hot water, to be on the run, to be out of the woods, to be under someone's thumb, to break the ice, to break fresh ground, to make a mountain out of a molehill, to put a spoke in someone's wheel, to put two and two together, to turn a deaf ear, to turn a new leaf, to turn the tables (on someone), to blow one's own trumpet, to burn the candle at both ends, to carry favour, to cut one's coat according to one's cloth, to fish in troubled waters, to hit the nail on the head, to kill two birds with one stone, to know where the shoe pinches, to let the cat out of the bag, to nip something in the bud, to smell a rat, to wash one's hands off something.

The following chapters are prescribed for study:

1. M.K.Gandhi : Training: Literary and Spiritual
2. Kamla Devi Chattopadhyay : Indian Women and the Salt Satyagraha
3. Robert Epstein : Unleash your Creativity
4. Uma Rao : A Special Child
5. Neelam Saran Gour : Personal Friend
6. Vandana Shiva : Women in the Food Chain
7. Boman Desai : Between the Mosque and the Temple

Recommended Books:

1. A.J.Thomson & A.V.Martinet : A Practical English Grammar (OP)
2. S.Pit Corder : Intermediate English Practice Book (O.L.)
3. Bhaskaran and Horsburgh : Strengthen your English (OUP 1973)
4. F.T. Wood : A Remedial English Grammar for Foreign Students (Macmillan 1965)
5. T.L.H.Smith- Pearse : The English Errors of Indian students. OUP

Book Prescribed

Dr. Jasbir Jain (Edt.): The Many Worlds of Literature, Macmillan India Ltd.

SEMESTER-II
ALTERNATIVE ENGLISH
PAPER-II
PROSE

Contact Hours: 5 days per week
Exam Duration: :3 Hours
Maximum Marks: 100
Term End Exam : 75 Marks
Sessional : 25 Marks

I. Prose (Non fiction)

Leh – Andrew Harvey
On Balance – Leila Seth
How are you different – Subroto Bagchi

II. Short stories

Panther's Moon - Ruskin Bond
How much land does a man need - Leo Tolstoy
The Crocodile's Lady – Manoj Das

III. Novel

Train to Pakistan - Khuswant Singh (Non detailed study)

IV. Speeches

Tryst with Destiny – Jawaharlal Nehru
I have a dream – Martin Luther King
A Tiny ripple of hope – John F. Kennedy

V. Appreciation of two unseen prose passages – Approximately 100 words each.

Reference

Train to Pakistan	:	Khuswant Singh
he Non fiction Collection Part-I	:	Penguin India

द्वितीय सेमेस्टर (IInd Semester)

आधुनिक भारतीय भाषा (हिंदी) MIL (HINDI)

संपर्क-घंटे : 4 प्रति सप्ताह
परीक्षा-अवधि : 3 घंटे
अधिकतम : 100 अंक
सत्र-अंत : 75 अंक
आंतरिक : 25 अंक

विस्तृत अध्ययन

Unit – I पाठ्य पुस्तक - श्रेष्ठ हिंदी निबंध - सं. डॉ. अजय कुमार पटनायक
शबनम पुस्तक महल, कटक -12

पाठ्य विषय

(क) हजारी प्रसाद द्विवेदी .... कुटज
(ख) रामधारी सिंह 'दिनकर' .... साहित्य और राजनीति
(ग) मोहन राकेश .... विज्ञापन युग

Unit – II पाठ्य पुस्तक - काव्य-सौरभ सं.पुरुषोतम दास मोदी, विश्वविद्यालय प्रकाशन, वाराणसी ।

पाठ्य विषय

(क) कबीर दास .... साखी (1 से 10)
(ख) सूरदास .... भ्रमरगीत (1 से 5)
(ग) तुलसीदास .... धनुर्भंग
(घ) सूर्यकांत त्रिपाठी 'निराला .... संध्या सुन्दरी
(ड) सुमित्रानंदन पंत .... मौन निमंत्रण

Unit - III

सामान्य अध्ययन

पाठ्य पुस्तक - प्रतिनिधि कहनियाँ सं. डॉ. बच्चन सिंह, अनुराग प्रकाशन, वाराणसी ।

(क) प्रेमचंद ..... कफन (ख) उषा प्रियंवदा ..... वापसी
(ग) ज्ञानरंजन .... पिता

Unit – IV शब्दज्ञान

(क) शब्द - शुद्धि (ग) विलोम शब्द

(ख) वाक्य - शुद्धि (घ) अनेक शब्दों के लिए एक शब्द

Unit –V निबंध - लेखन समसामयिक समस्याओं पर आधारित निबंध-लेखन (लगभग 300 शब्दों की सीमा)

अंक-विभाजन

1.	**दो व्याख्याएँ**	(यूनिट I और II से दो-दो व्याख्याएँ दी जाएंगी जिनमें से एक-एक को करना होगा)	2x10 = 20
2.	**दो आलोचनात्मक प्रश्न**	(यूनिट I और II से दो-दो प्रश्न पूछे जाएंगे जिनमें से एक-एक का उतर देना होगा)	2x6 = 12
3.	**एक आलोचनात्मक प्रश्न**	(यूनिट III के पाठ्यक्रम पर आधारित)	1x15 = 15
4.	**पाँच लघूत्तरी प्रश्न**	(यूनिट IV के पाठ्यक्रम पर आधारित)	3x6 = 18
5.	**पाँच विकल्पों में से किसी एक पर निबंध-लेखन**	(यूनिट V के पाठ्यक्रम पर आधारित)	1x15 = 15
			80

संदर्भ - ग्रंथ

1. हिंदी का ज्ञान - डॉ. हरदेव बाहरी, लोकभारती प्रकाशन, इलाहाबाद ।
2. शब्द-सामर्थ्य - डॉ. कैलाशचंद्र भाटिया, प्रभात प्रकाशन, नयी दिल्ली ।
3. आधुनिक हिंदी व्याकरण और रचना - डॉ. वासुदेव नंदन प्रसाद, भारती भवन, पटना ।
4. शुद्ध हिंदी कैसे सीखें ? - राजेन्द्र प्रसाद सिन्हा, भारती भवन, पटना ।

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Babasaheb Bhimrao Ambedkar Bihar University

Muzaffarpur (Bihar)

(Based on NCTE Curriculum Framework for Four year Intigrated B.Ed. Programme)

Semester-I
HEALTH AND WELL BEING

Contact Hours: 2 per week
Internal Assessment (Five point Grade)

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

- Develop skills to conduct medical check-up,
- Develop competency to participate and conduct competitions in physical activities,
- Verify their physical efficiency through tests of Physical Efficiency Tests,
- Develop physical, mental and emotional well being through yoga and games
- Develop social values

Transaction Mode: Oral, Demonstration, Imitation, Command, Dramatisation, part-by-part method and whole methods
Practical Area:
CONTENT
Unit 1 : Medical check-up

- Conducting of medical check-up and recording in the health register – Folow up with doctor wherever required
- First aid: Demonstration of first aid for fracture, cuts, sprain etc.

Unit 2: **Competitions:**

- Drawing of fixtures for conducting tournaments – Knock-out, League. Intramural competitions – Marking of courts on the field
- Lay out of Track and Field areas and participating in conducting Annual Athletic Meet

Unit 3 : Major Activities : Skills and fundamental rules

- Track and field events (Any two events other than the 1st year events opted) like 100M, 200M, 400M, 800M, 1500M, Long Jump, High Jump, Triple Jump, Shot put, Discuss, Javeline, Relay etc.
  Major Games : (Any one game other than the 1st year opted game) like
  Throw ball, Volley ball, Tennikoit, Chess, Table Tennis, Cricket, Football, Basket ball etc.
  - Yoga : Any two yogasanas other than the two opted during 1st year like, Padmasana, Vajrasana, Paschimottanasana, Halasana, Bhujangasana, Dhanurasana etc.
  - Physical Efficiency Test: Single star test or any other Physical Efficiency Test shall be conducted based on the availability of resources.

    Grading:
    A = Excellent
    B= Very Good
    C = Good
    D = Average
    E=Poor

Modes of Assessment:

Faculty should encourage student-teachers to participate in the above activities and keep track of their participation as part of their overall profile. A descriptive assessment should be made on the basis of overall level of participation for each year. The engagement of student teachers in the above set of experiences should be quantitatively and qualitatively evaluated, based on observations and submissions of projects and assignments and an overall grade should be assigned.

References

Butcher, C.A (1968).Foundations of Physical Education,(5th Edition),St.Loius ,The C.V.Mosby & Co Ltd
First Aid Manual: The St.John Ambulance Association and Brigade, The British Red cross Society
NCERT (2005).National Curriculum Framework-2005, New Delhi
Thirunarayanan,C &Sharma,HH(1959).Methods in Physical Education,Karaikudi , ,South Indian Press
Thirunarayanan, C &Sharma, HH.Track and Field, Karaikudi, South Indian Press
WHO (1991).Comprehensive School Health Curriculum, Regional Office foe South East Asia, New Delhi
Williams,J.F(1964).The Principles of Physical education ,Philadelphia and London,W.B.Saunders

Semester-I

BASICS IN EDUCATION

Contact hours: 4 hours per week
Total marks: 100(Internal-15, External,35)

Objectives of the Course

Education is a liberal process of knowing, examining knowledge, its realms of meaning, thus concerning itself with the episteme of learning. It is a socially contrived system influenced by various social, cultural and normative factors. Education draws its vision, aims and perspectives from different schools of thought for theorizing about various concerns that are epistemological, social and ontological in nature. The conceptual nature of education is an activity of analysis, clarification and criticism of concepts, principles, theories and assumptions that are unique to education itself.

The theoretical formulations derived through analysis and synthesis of different schools of thought and observed occurrences lend themselves into application that can be seen in the form of educational practice. Education in the form of schooling, being a social act, prioritizes, and legitimizes knowledge and values as well. When knowledge is processed and organized into school knowledge and transcribed into textbooks it assumes new forms, nature and authority. This process of organisation of knowledge creates 'gaps' between school knowledge and local knowledge; textual knowledge and contextual knowledge.

This course aims to make student teachers analyse and understand educational concepts, their premises and contexts that are unique to education. Through the process of inquiry, critical analysis and an intellectual discourse, it is hoped that the student teachers will be able to understand and appreciate the nature and the purpose of education, their practical ramifications in the school context.

This course is visualized essentially to lead to an understanding of some relevant concepts and themes in education (which will also be helpful in understanding the other courses). The course outline is presented in a different form with intent. That is, just to indicate the main aim of the course to provide opportunity for interactive and reflective modes of learning engagement. It purports to help student teachers to not only understand the concepts through self study but also 'reflect' on them. Therefore, instead of stating the concepts and ideas required for understanding the theme, certain questions are given as pointers while seeking sources of information. They are not 'sub-units' but mainly 'discussion triggers'. They are not separate fact finding questions.

Course Outline

Unit 1: Education - Nature and Purpose

Meaning and Nature of Education:

- What is Education?
- Whether education is a natural or social process? Intentional or unintentional?
- Does education occur only in educational institutions? Where else?

Processes and Modes of Education:

- Is education an activity/process?
- How education in schools is linked with outside school experiences?
- Why education, in the form of schooling, needs to be provided to all children?

Purpose of Education:

- Whether education is organized for:
  - Individual development or social transformation;
  - Providing knowledge or information;
- How worthwhile is education? Who decides it? For whom?
- Who is an educated person?

Unit 2: Knowledge and Knowing

Knowledge- meaning

- What is knowledge?
- What is knowing? Can doing, thinking and feeling be discerned separately in knowing?
- Differentiate between information, knowledge, belief and truth

Knowing Process:

- What are different ways of knowing?
- How knowledge can be constructed? What is involved in construction of knowledge?

- What are the relative roles of knower and the known in knowledge transmission and construction?

Facets of Knowledge:

- What are different facets of knowledge and their relationship such as:
  - …Local and universal?
  - …Concrete and abstract?
  - …Theoretical and practical?
  - …Contextual and textual?
  - … School and out of school?

  (With an emphasis on understanding special attributes of 'school knowledge')

Unit 3: Forms of Knowledge and its Organisation in Schools

- Can we categories knowledge? On what basis?
- What forms of knowledge are included in school education?
- On what basis are knowledge categories selected in school education?
- Who selects, legitimizes, and organizes categories of knowledge in schools? In what form?
- How does school knowledge get reflected in the form of curriculum, syllabus and textbooks?

Unit 4: Autonomy of Teacher and Learner

Autonomy of teacher

- What is autonomy? Is autonomy and freedom the same?
- What is Teacher's autonomy?
- What is freedom of a teacher? Freedom in what sense? Why?
- Do autonomy and accountability go together?
- What are the hindering factors that affect teacher's autonomy?

Autonomy of learner

- What is autonomy of learner?
- What are the restraints on learners in schools?
- Can learners be free from curriculum, textbooks, instruction, and discipline?
- Does learning take place if the learner is free from all constraints of the school?
- To what extent individual autonomy and collective responsibility go together for teacher and learner?

Unit 5: Education and Values

- What are values? Are they relative or absolute? Who creates values?
- What are the values prevalent in contemporary society?
- What does it mean when one says 'education is a normative Endeavour'? How does this relate to value formation?
- What kinds of values do education perpetuates?
- Do different school contexts have a differential impact on learners' value formation?
- Does education have the potential to contribute to transformation of values in society?

Modes of Learning Engagement:

The Course is visualized to be conducted through group discussion, self study and reflection. It does not envisage a lecture mode However, it would be important for the teacher educator to structure the study of themes in each unit through a range of activities such as: initiation of the dialogue within the group, organizing study groups, organizing a discussion in small groups, or planning fo short presentations.

The sub-themes organized as units of the course are those that can be discussed by student teachers without any specialized knowledge (using their own experiences and common-sense understanding, to begin with)

However, the questions given as 'discussion triggers' under each unit title will be helpful in providing some direction to studen teachers in seeking appropriate references. References are provided for each theme for meaningful focused study. Each theme needs to be studied through referencing, group sharing as well as reflection. The teacher-learners may be enabled to engage in multiple ways of study - i.e., independent study and/or group interaction. Self study provides the necessary basic understanding while interactive sessions will clarify any complex idea and help reflect on one's grasp. The interactive sessions also help clarify and overcome several inadequate or incorrect understandings that the student teachers may have.

Teacher educators will be present and participate in the plenary discussions as 'facilitators'.

Some activities envisaged in the modes of learning engagement are listed:

- Library readings for individual and/or group study; the list provided for each theme is suggestive and not complete. Any other material may be selected, as and when needed.

- Individual self-study of a text/article, with theme questions in mind
- Group study of a text/article on a given theme
- Observational studies and activities: it may be worthwhile to carry out observations in the field, record what is observed and use the information while discussing with either teacher educator or peers.
    - Observation of different contexts of knowing to reflect on knowledge transmission, construction, forms and ways of knowing and nature of knowing and knowledge;
    - Observation with a purpose to reflect on knowledge preservation, transmission/construction and generation in oral, written, and technological traditions.
    - Observations of schools, teachers, student activities in a school context
- Presentations by student teachers on selected themes- individually and collectively
- Group discussions on themes
- Documenting the discussions/dialogues.

Modes of Assessment

The student-teachers will maintain a portfolio of observations and notes on discussions; these will be submitted periodically to the faculty for appraisal and feedback.

Assessment will be done on the following heads:

- The depth and width of reading in each unit
- The level of participation in group study
- Quality of participation in discussion
- Note making and presentation of ideas
- Relevant field observations and linking these to the ideas discussed
- Written test on basic concepts introduced and discussed
- A term paper on a specific theme selected by the student-teacher

Appropriate criteria need to be worked out for each of the above.

Reference

- Agrawal, A (1995). *Dismantling the Divide Between Indigenous and Scientific Knowledge : Development and Change*, 26:41 - 39
- Ant Weiler, C. (1998). *Low Knowledge and Local Knowing: An Anthropological Analysis of Contested "Cultural Products" in the Context of Development*. Anthropos, 93:46-94.
- Butchvarov, P. (1970), *The Concept of Knowledge*, Evanston, Illinois: North Western University Press.
- Chomsky, N (1986). *Knowledge of Language*, Prager, New York.
- Datta, D.M. (1972). *Six ways of Knowing*. Calcultta University Press, Calcultta.
- Dewey John.'My Pedagogic Creed', in D.J. Flinders and S.J. Thorton(eds.) The Curriculum Studies Reader, Routledge: New York, 1997.
- Dewey, John(1997) *Experience and Education*, Touchstone, New York
- Dewey, John (1956). *The Child and the Curriculum and School and Society*, University of Chicago Press, Chicago, Illinois, U.S.A.
- Keddie, N.(1971) : *Classroom Knowledge*, in. M.F.D Young.
- Krishna Murthy, J. (1947) *On Education*, Orient Longman, New Delhi.
- Kumar Krishna (1996*). Learning From Conflict*, Orient Longman, New Delhi.
- Peters, R.S. *The Concept of Education*, Routledge, UK, 1967.
- Margaret, K.T. *The open Classroom*, Orient Longman: New Delhi, 1999.
- Prema Clarke (2001). *Teaching & Learning: The Culture of pedagogy*, Sage Publication, New Delhi.
- P.H. Phenix,(1964). *Realms of Meaning.* MacGraw-Hill, New York.
- Steven H. Cahn (1970). *The Philosophical Foundation of Education,* Harper & Row Publishers, New York.
- Sykes, Marjorie. *The Story of Nai Taleem*, Nai Taleem Samiti: Wardha, 1988
- Thapan. M. (1991). *Life at School: An Ethnographic Study*. Oxford University Press, Delhi.

Semester-I

ARTS AND AESTHETICS

Contact Time: 2 per week
Five point Grade (Internal)

The need to integrate arts education in the formal schooling of our students is to retain our unique cultural identity in all its diversity and richness and encourage young students and creative minds to do the arts. An understanding of the arts will give our youth the ability to appreciate the richness and variety of artistic traditions as well as make them liberal, creative thinkers and good citizens of the nation. Keeping in view some of these ideas the National Curriculum Framework-2005, introduced arts education **as a mainstream curricular area**, which must be taught in every school as a compulsory subject (up to class X) and facilities for the same may be provided in every school. Keeping this in view, it is all the more important that arts education is integrated in the school curriculum to provide an aesthetically viable atmosphere in schools encouraging creativity. For this, not only the art teachers but every teacher should be sensitive to appreciate this.

Objectives

The aim of teaching arts education in school may be perceived as a tool for development of aesthetic sensibility among learners to enable them to respond to the beauty in different forms. Thus, inclusion of the curricular area of arts in education in for student learners will contribute significantly in the overall development of their personality as well as make their teaching more effective. This may be achieved by learning different art forms as well as knowing about them and through student's own participation, community help and building up of certain core facilities. Thus, the broader objectives of learning should be able to make them;

- **express freely** their ideas and emotions about different aspects of life through different art forms.
- learn to **appreciate** different art forms and distinguish them.
- develop an **insight** towards sensibility and aesthetic appreciation and become more **creative and conscious** about the good and beautiful in their environment, including classroom, school, home and community through an integrated learning approach.
- integrate the **knowledge of art** with daily life through learning with different media and techniques by using creative expression and making objects of common use.
- make learners **conscious** of rich cultural heritage of their own region as well as that of the nation.
- get acquainted with the life and work of artists.

Course Components: This course as part of the two year B. Ed. programme should consist of theory, practical, project work and workshop. Also, the arts need to be applied in day to day life from designing classroom materials to notice board, cultural festivals, theme based celebrations, national days to festivals etc. where everyone will participate. These occasions will be a forum for students' activities where intra relation of all the art forms will manifest on a single occasion.

Theory

- Concepts and forms of arts and crafts- an introduction: what do we mean by arts and crafts, which contain visual and plastic art forms, performing art forms, and heritage crafts.
- Significance of art in education: why art forms are important for learning?
- Integrating arts and crafts in school curriculum as a pedagogical support/ resource: education through arts and crafts is an interesting method which may be integrated in regular learning that leads to skills, observation, analysis, synthesis, evaluation, and problem solving.
- Different ways/methods to integrate arts in education: during the curriculum transaction, different strategies can be adopted.
- Historical perspectives of arts in education: reflections on importance of arts education by thinkers and educators in 20th century.
- Current thinking and practices in arts education: various researches and NCF-2005.
- Knowing about local art and craft forms: the diversity of India's arts and crafts at the local/ regional level and its integration in the curriculum.

Practical

- Activities related to doing arts, including application of arts in the immediate environment. Small activities, which enhances the skills including the communication and presentation skills, brings in imagination, creativity and aesthetic sensibility among the student teachers.
- Application of aesthetic and design sensibility in the day to day life, in their profession and environment are some of the practical aspects, which needs to be taken care of. During the celebrations of festivals, functions, special days etc. this should be reflected.

Project:

The student teacher can take a theme-based project from any of the curricular areas covering its social, economic, cultural and scientific aspects integrating various art and craft forms. Also, they can do an analysis of textbooks - where they can find a scope either in the text or in the form of activities or exercises to integrate art forms. They can also document processes of an art or craft form from the pedagogical point of view; such as weaving or printing of textiles, making of musical instruments, folk performances in the community etc. - how the artists design their products, manage their resources including raw materials, market it, what problems do they face as all these aspects involve historical, social, economic, scientific and environmental concerns.

Modes of Learning Engagements:

- **Classroom** environment should be interactive and discussions should take place where student teachers can document each others' experiences as an artist and connoisseur both. How arts in education can be
- **Attending** exhibitions and performances, interacting with artists and craft persons, watching and listening art related films, audio and video materials available on different performers, regional/ folk art forms etc. may also be shown from time to time. These will not only create awareness but also an appreciation for arts forms and bring in aesthetic sensibility and related values among the student teachers.
- **Projects and assignments** may be given for individual learners as well as for group work.
- **Workshops** may be conducted at least once in each year where student teachers can get a first hand experience of working with artists, handle different materials and media, learn about different aspects of an art form on how it relates to the society and community and can be used as pedagogical tool to transact

Grading:

A = Excellent
B= Very Good
C = Good
D = Average
E=Poor

Modes of Assessment:

The engagement of teacher-learners in the above set of experiences should be quantitatively and qualitatively evaluated, based on observations and submissions of projects and assignments and an overall grade should be assigned that covers: a) submission of work b) participation c) creative potential displayed d) application of aesthetic and design sensibility in campus events or in other course work.

Semester II

CHILDHOOD AND GROWING UP

Contact Hours: 5 days per week
Exam Duration: :3 Hours
Maximum Marks: 100
Term End Exam : 75 Marks
Sessional : 25 Marks

COURSES OBJECTIVES

The student -teachers will be able to;

1. Develop an understanding of the notions of childhood and adolescence;

2. Develop an understanding about the impact/influence of socio cultural contextin shaping human development, especially with respect to the Indian context;

3. Develop an understanding of dimensions and stages of human development and developmental tasks ;

4. Understand the range of cognitive capacities among learner s;

5. Appreciate the critical role of learner differences and contexts in making meanings, and draw out implications for schools and teachers;

6. Understand socialization and its role in identity formation of a child;

7. Understand identity formation and its determinants;

COURSE CONTENTS

Unit 1: Understanding Childhood

- Understanding Childhood : Developmental Perspective
- Dimensions of Childhood : Social, Cultural, Political and Economic
- Key Factors during Childhood : Family, Neighborhood, Community and School
- Children and their Childhood: The Contextual Realities of Bihar
- General objectives of early childhood Education as related to national goals.
- Notion of joyful Childhood : Major discourse and educational implications
- Dimensions of individual development : physical, cognitive, language, social, and moral, their interrelationships and implications for teachers (with reference to Piaget, Erickson and Kohlberg)

Unit 2: Understanding Adolescence

- Adolescence : assumptions, stereotypes and need of a holistic understanding
- Major issues: growth and maturation, nature and nurture, continuity and discontinuity
- Learner as an adolescent : stages of development- developmental task with focus on process of growth and development across various stages from infancy to adolescence
- Factors affecting adolescence : social, cultural, political and economic
- Adolescence: activities, aspirations, conflicts and challenges of learner

• The contextual reality of adolescence in Bihar

• Dealing with adolescence ; discourse on the role of teacher, fam ily, community and state

Unit 3: Understanding Socialization and the Context of the Learner

• Understanding Socialization

• Socialization at home context: family as a social institution; parenting styles and their impact; transmission of parental expectations and values

• Socialization and the context of community: neighborhood, extended family,religious group and their socialization functions

• Socialization and the context of school : impact of entry to school, school as a social institution and its notions in Bihar, value formation in the context of schooling

• Schooling as a process of identity formation: ascribed, acquired and evolving

• Gender Identities and Socialization Practices in family, schools, other formal and informal organization; Schooling of Girls

• Ine qualities and resistances in society: issues of access, retention and exclusion

Unit 4: Understanding Differences in Learners

Difference in learners based on socio-cultural contexts : impact of home languages of learners' and language of instruction, impac t of differential 'cultural capital' of learners

• Differences between individual learners: multiple intelligence, learning style,self -concept, self-esteem, attitude, aptitude, skills and competencies, interest,values, locus of control and personality

• Und erstanding differently -abled learners: slow learners and dyslexic learners

• Methods of assessing individual differences: tests, observation, rating scales, self -reports

• Catering to individual differences: grouping, individualizing instruction, guidance and counseling, bridge courses, enrichment activities and clubs

Unit 5: Learner's Identity Development

• Understanding 'Identity Formation'; emergence of multiple identities in the formation of a person placed in various social and institutional contexts; the need for inner coherence; managing 'conflicting' identities

• Determinants of identity formation in individual and groups; social categories such as caste, class, gender, religion, language and age

• School as a site of identity formation in teacher and stude nts; school, culture and ethos, teaching -learning practices and teacher discourse in the classroom, evaluation practices; value system and 'hidden curriculum' in schools

• The influence of peer group , media, technology and globalization on identity formatio n

Practicum:

1. Critical analysis of classroom instruction in the light of the developed Understandings

2. Case study of a learner with behaviour problem/talented child/a LD child/a slow learner/a disadvantaged child

3. Observing children in their natural setting

4. Study of intelligence of at least 5 school children and relating it with achievement and other background factors

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17. Sarangapani M. Padma(2003.), Constructing School Knowledge :An Ethnography of learning in an Indian Village, Sage Publication

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Semester-II

CONTEMPORARY INDIA AND EDUCATION

Contact Hours: 5 days per week
Exam Duration: :3 Hours
Maximum Marks: 100
Term End Exam : 75 Marks
Seasonal : 25 Marks

COURSES OBJECTIVES

The student -teachers will be able to

- Understand the concept and aims of education
- Develop perspectives about vision of contemporary Indian educational reality,its concerns and issues.
- Understand the Constitutional values and their implications on education
- Understand the concept of philosophy, relationship between Philosophy and Education and implications of philosophy on education
- Understand the schools of Philosophy and their impact on education
- Understand the vision of education given by Indian& Western thinkers
- Understand the importance of universalization of secondary education and the constitutional provisions for realizing it
- Examine the issues and concerns related to universalization of secondary education
- Analyze the strategies used for realization UEE and the outcomes of their implementation.
- Realize the need and importance of equity and equality in education and theconstitutional provisions for it.
- Identi fy the various causes for inequality in schooling
- Realize the importance of Right to Education and the provisions made for realizing it.

COURSE CONTENTS

UNIT- I- UNDERSTANDING OF THE CONCEPT & AIMS OF EDUCATION

 Concept: Meaning and definitions of education, Processes of education- Schooling, Instruction, Training and Indoctrination. Modes of education - Formal, Informal and Non-Formal

 Aims: Meaning and functions of Aims, Classification of Aims of Education, Determinants of Aims of Education, Aims of education in relation to an individual, Aims of education in relation to a society / Nation, Philosophical contradictions between individualistic and socialistic aims and their synthesis

UNIT II: NORMATIVE VISION OF INDIAN EDUCATION

- Normative orientation of Indian education: A historical enquiry
- Constitutional provisions on education that reflect National ideals: Democracy, equality, liberty, secularism, and social justice
- India as an evolving Nation, State: Vision, Nature and Salient Features – Democratic and Secular polity, Federal structure: Implications for educational system
- Aims and purposes of education drawn from the normative vision
- Education for National development: Education Commission (1964 - 66)
- Emerging trends in the interface between

(i) Pol itical process and education;
(ii) Economic developments and education; and
(iii) Socio -cultural changes and education.

UNIT- I II - PHILOSOPH ICAL VISION OF EDUCATION AND THE PHILOSOPHICAL SYSTEMS

 Philosophy and Education: Meaning and definitions of philosophy, Branches of philosophy and their relationship with educational problems and issues.

 Philosophical systems: Schools of philosophy - Idealism, Naturalism, Pragmatism, Marxism,and Humanism with special reference to their concepts of reality, knowledge and values, and their educational implications for aims, curriculum, methods of teaching and discipline.

UNIT IV: PHILOSOPHICAL VISION OF EDUCATION: EDUCATIONAL THINKERS

An overview of salient features of the 'philosophy and practice' of education advocated by the following thinkers:

 Indian Thinkers: R.N. Tagore, M.K. Gandhi, Swami Vivekananda, Aurobindo Ghose, J iddu Krishnamurthi and Gijju Bhai Badheka

 Western Thinkers: Plato, Rousseau, Dewey, Froebel and Maria Montessori

UNIT V: CONTEMPORARY INDIAN SCHOOLING: CONCERNS AND ISSUES

• Universalization of School Education; Right to Education and Universal Access:

(i) Issues of a) Universal enrollment b) Universal retention c)
Universal success

(ii) Issues of quality and equity.

The above to be discussed with specific reference to physical, economic, social and cultural access, particularly to girl child and weaker sections as well as differently- abled children

• Equality of Educational Opportunity:

(i) Meaning of equality and constitutional provisions

(ii) Prevailing nature and forms of inequality, including dominant and minor groups and related issues

(iii) Inequality in schooling: Public -private schools, rural -urban schools, single teachers' schools and many other forms of inequalities in school systems and the processes leading to disparities

(iv) Differential quality in schooling: Variations in school quality

• Idea of 'common school' system

• Right to Education Bill and its provisions.

PRACTICUM

1. Readings on educational thinkers and presentation on the contribution of one of the thinkers (group work followed by discussion)
2. Project on the original work/s of a thinker
3. Seminar presentation on philosophical issues and report.
4. A brief study of some philosophical development of learners
5. Presentation on the reports and policies on USE
6. Conduct su rveys of various educational contexts (eg. Schools of different kinds) to identify various forms of inequality
7. A survey study of a school with reference to its aims, objectives, values and curriculum (Private School, Govt. School, Buniyadi Vidyalaya, Kasturba Gandhi Balika Vidyalaya, Schools run by Religious and Linguistic minorities)
8. Annotated Bibliography.

SUGGESTED READING

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Semester-III
LEARNING AND TEACHING

Contact Hours: 5 days per week
Exam Duration: :3 Hours
Maximum Marks: 100
Term End Exam : 75 Marks
Seasonal : 25 Marks

COURSES OBJECTIVES

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

- Understand Concept & Nature of Learning
- Understand and appreciate different perspectives of learning – Behavioral, Social, Cognitive and Humanistic.
- Know various types and strategies of learning
- Understand different conditions for learning and acquire the skills to facilitate them.
- Understand the approaches and strategies for managing learning
- Demonstrate his/her understanding of the role of a teacher in different phases of teaching.
- Identify various kinds of subject matter content in a textbook.
- Write instructional objectives for teaching of a topic.
- Demonstrate his/her understanding of different skills and their role in effective teaching.
- Use instructional skills effectively.
- Organize learning with active participation of learners – individually and in groups.

COURSE CONTENTS

Unit I: Learning: Its Nature, Types and Strategies

- Concept & Nature of Learning, Concept learning, skill learning, verbal learning, social learning, principle learning, problem solving
- Basic Assumptions and analysis of the relevance of Learning Theories – Behavioral, Social, Cognitive & Humanistic learning theories;
- Learning as a process of construction of knowledge - Constructivist Approach to learning
- Relationship of learning with school performance and ability of the learner

Unit II: Factors affecting Learning & Management of Learning

- Concept of Motivation; types, techniques of enhancing motivation,
- Health, sleep, difficulty of task, content and study habits as factors Influencing learning
- Influence of method of learning: part and whole learning; superficial and in-depth learning; Influence of prior learning on present learning; Strategies for transfer of learning
- Forgetting classroom learning – meaning and its causes; strategies for improving retention of learning
- Meaning of learning to learn skills; Ways of developing self- study

Unit III: Understanding Teacher and Teaching

- What is teaching?; Teaching as a planned activity – elements of planning.
- Assumptions underlying teaching and their influence on the planning for teaching. Proficiency in Teaching: Meaning and place of awareness, skills, competencies and commitment.
- Assumptions underlying effectiveness in teaching – Behaviouristic, Humanistic and Constructivist perspectives.
- An analysis of teacher's roles and functions, skills and competencies in the Pre -active phase – visualizing, decision-making on outcomes, preparing and organization; Interactive phase – facilitating and managing learning; Post -active phase – assessment of learning outcomes, reflecting on pre -active, interactive and post -active processes
- Characteristics associated with effective teachers; Teacher's professional identity – what does it entail?

Unit IV: Planning for Teaching

- Visualizing: The learner and learning readiness characteristics, the subject matter content and their inter -linkages, the learning resources, approaches/ strategies.
- Decision -making on outcomes: Establishing general instructional goals, specification of objectives and standards for learning, allocation of instructional time for various activities/ tasks – instructional time as a variable in learning.

- Decision -making on instructional approaches and strategies: Expository or Inquiry, Individualized or Small Group or Whole Class – skills required for learner engagement in the context of the strategy decided.
- Preparing for instruction: Identifying and selecting available learning resources or developing required learning resource.
- Preparation of a Plan: Unit Plan and Lesson Plan.

Unit V: Skills and Strategies of Teaching

- Introducing a lesson – need and various possibilities
- Motivating the learners and sustaining their attention – importance of stimulus variation and reinforcement as skills.
- Questioning, Illustration and explanation as teacher competencies influencing student-learning in the classroom;
- Strategy of Teaching – a) Expository Strategy as approach to teaching for understanding: Presentation – discussion – demonstration, the Advance Organizer Model; b) Inquiry Strategy as approach to teaching thinking skills and construction of knowledge : Concept attainment / Concept formation, Inductive thinking, Problem based learning/ Project Based Learning.
- Approaches to Individualized Instruction: Computer Managed Instruction, Programmed Instruction and Learning Activity Packages,
- Approaches to Small Group and Whole group Instruction: Cooperative and Collaborative approaches to learning, Brain storming, Role Play and Dramatization, Group Discussion, Simulation and Games, Debate, Quiz and seminar.

PRACTICUM

- Comparative study of syllabi of various subjects to identify content categories.
- Writing instructional objectives of a lesson under domains and levels.
- Practice on the skills of introducing, questioning, stimulus variation, illustrating and organizing learning activity.
- Design learning episodes / activities and organize them in the classroom.
- Analyze the type of strategies adopted by a classroom teacher in organizing learning.
- Prepare a plan of action for any one type of learning (concept learning, skill learning, attitudinal learning)

SUGGESTED READING

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2. B.Wilson, (1996) Constructivist Learning Environments, New Jersey : Educational Technology Publications.
3. Brown, J.S., Collins, A. and Duguid, S. (1989). Situated cognition and the culture of learning, Educational Researcher, 18(1), 32-42.
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Semester-III
LANGUAGE ACROSS THE CURRICULUM

Contact Hours: 3 days per week
Maximum Marks: 50
Term End Exam : 35 Marks
Sessional : 15 Marks

COURSES OBJECTIVES

After completion of Course the student will be able to

1. Have a conceptual understanding of language
2. Understand the different roles of language;
3. Understand the relation between literature and language;
4. Understand and appreciate different registers of language;
5. Understand the language background of students as first or second language users of the language used in teaching the subject;
6. Understand multilingualism in the classroom, school language and home language;
7. Develop sensitivity with respect to language diversity that exists in the classroom;
8. Und erstand the nature of classroom discourse
9. Analyse the Constitutional Provisions and recommendations of Commissions & Policies Of Language Education:

COURSE CONTENTS

Unit 1: Learner and their Language

- Meaning of Language; various forms, systems and properties
- Language capital of learners before school entry
- How children learn language with special reference to Skinner, Chomsky, Piaget and Vygotsky .
- Difference between acquiring language and learning language
- Social and cultural context of language; Language and Gender; Language and Identity; Language and Power; Language and Class (Society).
- Political context of language; Multilingual perspective of India and Bihar, Constitutional provisions related to languages in India

Unit 2. Language in School Cu rriculum :

- Home language and School language; Medium of understanding (child's own language);
- Centrality of language in learning;
- Language across the curriculum; Role and importance of language in the curriculum
- Language and construction of knowledge; Understanding the objectives of learning languages: imagination, creativity, sensitivity, skill development
- Difference between language as a school- subject and language as a means of learning and Communication;
- Critical review of Medium of Instruction; Different school subjects as registers;
- Multilingual classrooms; Multicultural awareness and language teaching.

Unit 3. Constitutional Provisions and Policies Of Language Education:

- Position of Languages in India; Articles 343-351, 350A;

- Recommendation of Kothari Commission (1964 -66); NPE-1986; POA-1992;
- National Curriculum Framework-2005 (language education).

PRACTICUM

- Prepare a report on the status of languages given in the Constitution of India and language policies given in Kothari Commission, NPE1986, and POA-1992.
- Visit five schools in the neighbourhood and prepare a report on the three language formula being implemented in the schools.
- Take a few passages from Science, Social Science and Math's textbooks of Classes VI to VII and analyze: (i) How the different registers of language have been introduced? (ii) Does the language clearly convey the meaning of the topic being discussed? (iii) Is the language learner -friendly? (iv) Is the language too technical? (v) Does it help in language learning? Now write an analysis based on the above issues

SUGGESTED READING

1. Akamajian,A, Demers, RA, Farmer, AK and Harnish, RH (2001), An Introduction to Language and Communication, Cambridge: Mass: MIT Press.
2. Becker, J.(1988) 'The success of parents' indirect techniques for teaching their pre-schoolers pragmatic skills', First Language, 8:173 -182.
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Semester-III

UNDERSTANDING DISCIPLINES AND SUBJECTS

Contact Hours: 3 days per week
Maximum Marks: 50
Term End Exam : 35 Marks
Sessional : 15 Marks

COURSES OBJECTIVES

The student -teachers will be able to

1. Understand the basic premises of subjects/disciplines
2. Understand the need for classification of human knowledge
3. Know required basic competencies for effective transaction of knowledge
4. Know how to enhance knowledge of the discipline
5. Importance of research for advancement of subject/discipline
6. Understand the concept of Interdisciplinarity in education

COURSE CONTENTS

Unit I: Basic Understanding of disciplines and Subjects

- What is a discipline?; History of the concept of discipline.
- What Are Academic Disciplines?Need/ Perspectives of the classification of Human knowledge into disciplines & Subjects; 1. The Philosophical Perspective: Unity and Plurality, 2. The Anthropological Perspective: Culture and Tribes, 3. The Sociological Perspective: Professiona lization and Division of Labour 4. The Historical Perspective: Evolution and Discontinuity, 5. The Management Perspective: Market and Organization, 6. The Educational Perspective: Teaching and Learning
- Difference between discipline and subject; Nature and scope of disciplines/subjects
- Strengths and weaknesses of disciplines
- Basic premises and philosophy of subject
- Aims of disciplines/subjects for learners development in the national context

Unit II: Competencies for and Advancement of the disciplines/subjects

- Mastery over the subject
- Communicating the subject
- Subject specific terms and their uses
- Projects/activities in the subject
- Research in subject/discipline; Methods of data collection in the subject, Drawing conclusion, generalization and theory development, Preparing reference, notes and bibliography

Unit III: Interdisciplinary learning and the related issues

- What is Interdisciplinary learning? Interdisciplinary learning – a dialectical process,
- What are interdisciplinary subjects?
- What are the generic objectives of interdisciplinary subjects?
- Do interdisciplinary subjects require disciplinary depth?
- How can you design and coordinate interdisciplinary subjects?
- How can you assess interdisciplinary learning?
- What criteria can be used for quality assurance of interdisciplinary subjects?

SUGGESTED READING

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2. Becher T (1989) Academic Tribes and Territories: Intellectual Enquiry and the Cultures of Disciplines. Milton Keynes: The Society for Research into Higher Education and Open University Press.
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11. Davies, M., & Devlin, M. (2007). Interdisciplinary Higher Education: Implications

for Teaching and Learning . Melbourne: Centre for the Study of Higher Education.

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24. Schwab, J. J. The concept of the structure of a discipline. Educ. Rec., 1 962, 43, 197 -205.
25. Whitley, Richard (2000), The Intellectual and Social Organization of the Sciences, Oxford: Oxford University Press.

Semester-IV
KNOWLEDGE AND CURRICULUM

Contact Hours: 5 days per week
Maximum Marks: 100
Term End Exam : 75 Marks
Sessional : 25 Marks

COURSES OBJECTIVES

After going through this course the student -teachers will be able to

• Understand the concepts of knowledge and knowing.

• Understand different ways of knowing, knowledge construction, the relative roles of kno wer and known in knowledge transmission and construction.

• Analyze the different facets of knowledge and their interrelationship.

• Comprehend the forms of knowledge and their organization in school education

• Understand the meaning of curriculum and its associated concepts

• Analyze the elements, organization, scope, various perspectives, needs, priorities, curriculum concerns, changes in the pedagogical approaches, sequence, evaluation schemes and other reforms in the documents of National curriculum frame work s

• Understand the influences of the knowledge categories, social, cultural, economic and the technological aspects in shaping the present school curriculum and the text books

• Understand the different approaches and process of curriculum development

COURSE CONTENTS

UNIT I: KNOWLEDGE AND KNOWING

• Concept of Knowledge

• What is knowledge?

• What is knowing? Can doing, thinking and feeling be discerned separately in knowing?

• Differentiation between information, knowledge, skill, belief and truth.

• Knowing Process

• What are different ways of knowing?

• How knowledge can be constructed? What is involved in construction of knowledge?

• What are the relative roles of knower and the known in knowledge transmission and construction?

• Facets of Knowledge

• What are th e different facets of knowledge and relationship, such as: local and universal, concrete and abstract, theoretical and practical, contextual and textual, school and out of school? (With an emphasis on understanding special attributes of 'school knowledge.)

• What is the role of culture in knowing?

• How is knowledge rendered into action? How to reflect on knowledge?

UNIT II: FORMS OF KNOWLEDGE AND ITS ORGANISATION IN SCHOOLS

• Can we categorize knowledge? On what basis?

• What forms of knowledge are included in school education?

• On what basis are knowledge categories selected in school education?

• Who selects, legitimizes, and organizes categories of knowledge in schools? In what form?

• How does school knowledge get reflected in the form of curriculum, syllabus and textbooks?

UNIT III: CONCEPT OF CURRICULUM

• Understanding the meaning and nature of curriculum: Need for curriculum in schools

• Differentiating curriculum framework, curriculum and syllabus; their significance in school education

• Notion of the textbook

• Fac ets of curriculum: Core curriculum— significance in Indian context

• Meaning and concerns of 'hidden' curriculum

• Curriculum visualized at different levels: National-level; state-level; school -level; class-level and related issues (Connection, relations and differences)

• Difference between curriculum framework, curriculum and syllabus

• Trends in the curriculum of school education at national and state levels (with reference to National curriculum frameworks)

UNIT IV: CURRICULUM DETERMINANTS AND CONSIDERATIONS

• Nature of learner and the Forms of knowledge; Nature of learner, needs and interests, and learning process; Forms of knowledge and disciplines, and their characterization in different school subjects.

• Determinants of curriculum at the nation or state-wide level; (i) social-political-cultural-geographical -economic diversity; (ii) socio-political aspirations, including ideologies and educational vision; (iii) economic necessities; (iv) technological possibilities; (v) cultural orientations; (vi) national priorities; (vii) system of governance and power relations; and (viii) International contexts.

• Inequality in educational standards, need for common goals and standards; issues related to common school curriculum National goals and priorities:

• Considerations in curriculum development at the level of the school: (i) Forms of knowledge and its characterization in different school subjects (ii) Relevance and specificity of educational objectives for concerned level (iii) Socio-cultural context of students – multi-cultural, multilingual aspects (iv) Learner characteristics (v) Teachers' experiences and concerns (vi) Critical issues: Environmental concerns, gender differences, inclusiveness, value concerns and issues, social sensitivity.

UNIT V: CURRICULUM DEVELOPMENT

• Understanding different approaches to curriculum development: Subject-centered; environmentalist (incorporating local concerns); behaviourist; competency -based (including 'minimum levels of learning'); learner -centered and constructivist.

• Process of curriculum making: (i) Formulating aims and objectives (based on overall curricular aims and syllabus) (ii) Criteria for selecting knowledge and representing knowledge in the form of thematic questions in different subjects (iii) Organizing fundamental concepts and themes vertically across levels and integrating themes within (and across) different subjects (iv) Selection and organization of learning situations (v) selecting learning experiences (vi) choice of resources (vii) planning assessments.

• Syllabus in different subject areas, time management, Text book as a tool for curriculum transaction, other learning resources such as 'on learning' and ICT, interactive videos, other technological resources.

• Planning and use of curricular materials – teachers hand book, source book, work book, manuals, and other learning materials

PRACTICUM

1. Assignment on concepts of knowledge in philosophical perspective.

2. Group work to analyze the curricular concepts.

3. Review of national curriculum frame works on school education and write a report fo r presentation and discussion.

4. School visits to study the factors required for implementing the curriculum in schools and write reflective experiences.

5. Analysis of teachers' handbooks, text books, workbooks, source books followed by Power point presentations and report submission.

6. Interviews with class room practitioners and students who are the stakeholders to know their perceptions about the curriculum and the text books in use.

7. Readings of certain curriculum reviews and articles bearing si gnificance to the course outlined and reflections on them.

SUGGESTED READING

1. Alka Kalra (1977) Efficient School Management and Role of Principals, APHPublishing, New Delhi.

2. Buch, M. B. Planning Education, Implementation and Development, NCERT, New Delhi. .

3. Curriculum Planning for better teaching and learning by J.G. Saylor and W Alexander (Holt, Rinehart and Winston)

4. Dewey, John (1959): The child and the Curriculum, Chicago, The University of Chicago Press

5. Giroux, Henry et.al (1981) : Curriculum and Instruction : Alternatives in Education by MC Cutchan Public corp, Printed in USA

6. Hilda T (1962): Curriculum Development- Theory and Practice; Harcourt, Brace and World, Inc.

7. Howson, Geoffrey (1978): Developing a New Curriculum, London: Heinmann

8. NCERT (1 988) National Curriculum For Elementary and Secondary Education: A framework

9. NCERT (2000) National Curriculum framework For school Education

10. NCERT (2005) National Curriculum framework

11. Olivia, P (2004): Developing the curriculum (6th ed). Allyn & Bacon, Inc. ISBN: 0205412599

12. Position paper: National Focus Group on 'Curriculum, Syllabus, Textbooks', NCERT

13. Schubert W (1986): Curriculum Perspectives, Paradigms and Possibilities, Newyork: Macmillan

14. Stuart Parker (1997). Reflective teaching in the post-modern world: A manifesto for education in postmodernity. Buckingham: Open University Press

15. Sue Roffey (2004). The new teacher's survival guide to behaviour. London: Paul Chapman.

16. T K D Nair (2004). School planning and management: A democratic approach, Delhi: Shipra.

17. Thomas J Lesley, et al. (2002), Instructional Models: strategies for teaching in a diverse society, Belmont: Wordsworth.

18. Yashpal Committee(1993): Learning without Burden , MHRD, India

19. Zias, R (1976): Curriculum Principles and Foundations; New york; Thomas Crow well

Semester-IV

CREATING AN INCLUSIVE SCHOOL

Contact Hours: 3 days per week
Maximum Marks: 50
Term End Exam : 35 Marks
Sessional : 15 Marks

COURSES OBJECTIVES

After going through this course the student teacher would be able to

- understand the meaning, scope and importance of inclusive education
- identify the children with diverse needs in the classroom
- understand the Concept of an inclusive school
- manage students in inclusive classroom by adapting appropriate strategies
- relate the use adaptation in assessment and evaluation strategies to ensure uniformity of the outcomes

COURSE CONTENTS

Unit I: Introduction to Inclusive Education

- Concept meaning scope and challenges of inclusive education
- Distinction between special education, integrated education and inclusive education and their merits and demerits
- Creating inclusive environment – physical, social and emotional (barrier free environment)
- Role of parents, head masters and teachers in ensuring equal educational opportunities for these students
- Facts and myths of inclusive education with particular reference to Indian context
- Factors influencing inclusive education

Unit II: Nature and needs of Students with Diverse Needs (SWDN)

- Definition, types and classification of SWDN (Visual Impairment, Hearing Impairment, Specific Learning Difficulties, Locomotor and Neuromuscular Disorders, Cerebral Palsy, Mental Retardation, Autism, Leprosy Cured Persons, Mental Illness and Multiple Disabilities, special health problems, gifted, creative, SC, ST, girl students, rural students, students from linguistic minority, street children, migrant workers children and orphans)
- Characteristics and educational needs of SWDN based on research evidence
- Concept of an inclusive school – infrastructure and accessibility, human resources, attitudes to disability, whole school approach, Community -based education.
- Supportive resources and services for children with SWDN in inclusive education

Unit III: Educational Strategies, M anagement and Assessment Techniques for SWDN

- Importance and need for adaptation (content and methodology for various subjects taught at secondary level for different categories of students coming under diverse needs)
- Guidelines for adapting teaching science, social studies, mathematics and languages at the secondary level
- Educational measures for effective implementation of inclusive education.
- Teachers' role in implementing reforms in assessment and evaluation in inclusive education; Type of adaptations / adjustment in assessment and evaluation strategies used for students with diverse needs; Importance of continuous and comprehensive evaluation
- Programmes & procedures used for Placement, grading, promotion, certification to bring uniformity in assessment

PRACTICUM

- Readings on PWD Act, RTE Act, IEDSS, SSA, RMSA and their implications for inclusive education
- Visit to special schools for observing the behaviours of students with VI, HI, MR, LH.
- Visit to AIISH to observe how to deal with assessment and for the students with diverse needs
- Discussion of the reports of the visits to schools / AIISH
- Lesson planning for inclusive classroom

SUGGESTED READING

Baker, E. T., Wang, M. C. & Walberg, H. J. (1998). 'The effect of inclusion on learning', in Nutbrown, C., & Clough, P. (2006) ' Inclusion in the Early Years', London, Sage

1. Biwako Millennium Framework for Action towards an Inclusive, Barrier -free and Rights -based Society for Persons with Disabilities in Asia and the Pacific (2002).
2. Internet Source, MHRD (2005b). 'Action Plan for Inclusive Education of Students and Youth with Disabilities',
3. Internet Source, SSA (2002). 'Basic features of SSA', Inclusive education in SSA, Retrieved from www.ssa.nic.in / inclusive_education / ssa_plan_manual
4. Jangira, N. K. (2002) Special educational needs of students and young adults: an unfinished agenda, in: M. Alur & S. Hegarty (Eds) Education and students with special needs: from segregation to inclusion New Delhi, Sage.
5. Jhulka, A. (2006) "Including students and youth with disabilities in education – a guide for practioners" NCERT, New Delhi
6. Hallahan, D.P., Kauffma, J.M., Pullen, P.C. (2009). Exceptional Learners – An Introduction to Education (11th Ed) Allyn & Bacon, Pearson Education, Inc. USA.
7. Kauffman, J. M. & Hallahan, D. P. (Eds): (1982). 'Handbook of Special Education', New York: Prentice Hall Inc.
8. King S. & Margaret. E. (1994). 'Curriculum based assessment in special education', California: Singular Publishing group Inc.
9. Luftig, L. R. (1989). 'Assessment of Learner with special needs' Boston, Allyn & Bacon.

10. Mani, M.N.G. (2000). Inclusive Education in Indian Context. International Human Resource Development Center (IHRDC) for the Disabled, Coimbatore: Ramakrishna Mission Vivekannanda University
11. Mangal, S.K. (2007). Educating Exceptional Students – An Introduction to Special Education. New Delhi: Prentice hall of India Pvt. Ltd.
12. Ministry of Human Resource Development (2005) Action plan for inclusion in education of students and youth with disabilities (New Delhi, Government of India).
13. Ministry of Social Justice and Empowerment (2006) National Policy for persons with disabilities (New Delhi, Government of India).
14. Narayan, J. (1997). Grade Level Achievement Devices, Secunderabad, NIMH.
15. Nutbrown, C. C. (2006). 'Inclusion in the early years', London: Sage Publications Ltd.
16. Oslon, J. L., and Platt, J. M. (1992). Teaching students and adolescents with special needs . McMillan publishing company limited, USA.
17. Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995
18. National Sample Survey Organisation (2003) Disabled persons in India, NSS 58th round (New Delhi, Government of India).
19. Right to Education Bill (2005 Draft, enacted 2009) Available online.
20. Rehabilitation Council of India (2005) Annual Report, 2003 –04, RehabilitationCouncil of India, New Delhi.
21. Salamanca Statement and Framework for Action on Special Needs Education (1994).
22. Smith, T .E. C., Polloway, E. A., Patton, J. R., & Dowdy, C. A. (2001) Teaching Students with Special needs in Inclusion Setting. (3 Ed). Allyn & Bacon.
23. Swarup, S. (2007). Inclusive Education, Sixth Survey Of Educational Research 1993 N.Delhi.: 2000. NCERT.
24. Wood, J. W., and Lazzari, A. M. (1997). Exceeding the boundaries: Understanding Exceptional Lives. Harcourt Brace and Company, USA.
25. Murphy, P.F and Gipps, C.V. (1996) Equity in the classroom: Towards effective Pedagogy for girls and boys (Ed) The Faluer Press, UNESCO Publishing
26. Abdelnoor, A. (1999) Presenting Exclusions. Heinemann Educational Publishers, Oxford
27. Ruhela S. P. (1996) India's struggle to universalize Elementary Education M D Publications Pvt. Ltd New Delhi
28. Burrello N. C., Lashley C, and Beatty E. E. (2001) Educating all students together. How school leaders create Unified System. Corwin Press, Inc., Sage Publication Company.
29. Hegarty S and Alur M (2002) Education and Children with special needs – from Segregation to Inclusion (Ed) Sage Publication
30. Thompson, S.J., Quenemoen R. F Thurlow M. L., Ysseldyke J. E (2001) Alternate Assessments For Students With Disabilities. Crowin Press, Inc and Council for Exceptional Children.

Semester-V
PEDAGOGY-I, ENGLISH LANGUAGE -1

Contact hours-4 per week
Marks-100(Internal-25,External,75

Course Description

Pedagogy courses aim at developing an understanding in the student teacher about the epistemology of language and language learning in general, its interaction and interface with history, economics society, etc. The course, besides familiarising the student teacher with the recent developments and emerging trends in language pedagogy, particularly English as a second language in Indian contexts, focus on enabling the learner to explore various ways and means to enrich language learning among learners in school contexts.

Objectives of the Course:

The Course will enable student-teachers

- To become aware of the nature and system of language, language acquisition and language learning, and develop a perspective on English (as second) language education in Indian contexts.
- To understand the dynamic nature of beliefs and assumptions about language learning, methodologies of language teaching and appreciate the aims of language teaching, particularly English Language teaching and its place and importance in learning-teaching other subject areas.
- To critically examine the English language curricula at school level (as prescribed by the boards) and appreciate philosophical and pragmatic understanding in them.
- To become a language teaching professional by continuous learning and exploring critically the existing theories and practices in language education.

Unit-1: Nature and system of Language

1 Language faculty in humans – Language as a rule governed system
2 Language as a system consisting of several subsystems – at the sound level, word level (lexis) and sentence level (syntax). Spoken and written language
3 Human Language and Animal communication

Unit-2: Language acquisitions and language learning

2.1 Objectives of language learning. First language acquisition, record language Acquisition
2.2 Behaviorist view of language learning, Cognitive view of language learning, Linguistic view of language learning, Constructivist view of language learning
2.3 Objectives of teaching English as a second language at the secondary level, position and role of English in India, Problems of teaching English in Indian schools

Unit-3: Methods of Language Teaching

3.1 A brief history of language teaching – Oral approach, situational language teaching, Grammar translation method, Direct Method
3.2 Audio-lingual method. The silent way, suggestopadia, Communicative language Teaching, Total physical Response (TPR)
3.3 Community Language learning, Natural Approach, Whole language approach
3.4 Constructivist approach to language teaching: Piagetian and Vygotskean perspective on social construction of knowledge

Unit-4 : Pedagogy of English as a second language-I

4.1 Integrating Language Skills
Listening, Speaking, Reading and Writing – receptive and productive skills
4.2 Kinds of listening sub skills of listening, Listening activities
4.3 Speaking sub skills of speaking and speaking activities

Unit-5: Pedagogy of Teaching English as Second Language-II

5.1 Reading – Kinds of reading, different reading skills early reading development, Different approaches to reading – Top down, Bottom up, genro approaches, Achuteres to promote reading
5.2 Importance of teaching writing, kinds of writing, mechanics of writing, product and Process approach, strategies to improve writing skills, correction of writing tasks, Vocabulary teaching – kinds of vocabulary, strategies for vocabulary teaching, Vocabulary test demo

Modes of Assessment

Suggested modes of assessment would include:

- Student teacher's interest in reading and self-study
- Initiative and participation in the discussion, group worked.
- Quality and ideas of Essay writing by student teachers
- Quality of materials (texts) and activities developed by student teachers.
- Self appraisal by teachers themselves about their learning performance.

Key Readings:

Agnihotri, R.K., Khanna, A.L. 1994. (Eds.) *Second Language Acquisition: Socio-cultural and linguistics Aspects of English in India (RAL 1),* New Delhi: Sage Publications.

Brown, J.D. 1996 *Testing in Language Programmes*. Upper Saddle River, NJ:Prentice Hall Regents.

Chomsky, N. 1986. *Knowledge of Language*. New York: Praeger

Chomsky, N. 1996. *Powers and prospects: Reflections on Human Nature and the Social Order.* Delhi: Madhyam Books.

Crystal, David. 1997. *Globalisation of English.* Cambridge: Cambridge University Press.

Cathy Spagnoli (Year not mentioned) *Telling Tales from Asia: a resource book for all who love telling stories.* Tulika. Chennai

Graddol, D. 1997. *The Future of English?* London: The British Council

Graddal, D. 2006. *English Next* London: The British Council

Ellis, R. 1992. *The Study of Second Acquisition.* Oxford: Oxford University Press.

Jesperson, O. 1922. *Language: Its Nature, Development and Origin*, New York: W.W. Nortorn.

Jhingaran, D. 2005. *Language Disadvantage: The Learning Challenges in Primary Education,* New Delhi APH Publishing Corporation.

Khubchandani, L.M. 1988. *Language in a plural Society*. Delhi: Motilal Banarasidass and Shimla IIAS.
Krashen, S. D. 1982. *The Input Hypothesis*. Oxford. Pergamon Press
Lewis, M 1993. *The Lexical Approach: The State of ELT and a Way Forward*. Hove: Language Teaching Publications. .
Lock, G. 1996 *Functional English Grammar*. Cambridge: Cambridge University Press
Marianne Celce – Murcia, Elite Olshtain 2000. *Discourse and Context in Language Teaching: A Guide for Language Teachers.* Cambridge University Press.
Mohanty, A.K.*Bilingualism in a Multilingual Society: Psycho-social and Pedagogical Implication.* Mysore: CIIL
NCERT. 2005. *National Curriculum Framework – 2005*. NCERT: New Delhi
NCERT. 2005. *Teaching of Indian Languages: Position Paper of National focus Group.* NCERT: New Delhi
NCERT. 2005. *Teaching of English: Position Paper of National focus Group*. NCERT: New Delhi
NCERT. 2005. *Gender Issues in Education: Position Paper of National focus Group*. NCERT: New Delhi
NCERT. 2005. *Problems of Scheduled Caste and Scheduled Tribe Children: Position Paper of National focus Group*. NCERT: New Delhi
NCERT 2008. *Reading for Meaning*. New Delhi: NCERT.
NCERT 2008 *Source Book on Assessment for Classes I – V*. NCERT: New Delhi
NCERT 2000 *Continuous and Comprehensive Evaluation*. NCERT: New Delhi.
NCERT 2005. *Examination Reforms: Position Paper of the National Focus Groups*. NCERT: New Delhi
Nunan, D. 1991. *Language Teaching Methodology*. London. Prentice Hall.
Pattanayak, D.P. 1981. *Study of Languages*. A Report (unpublished). New Delhi: NCERT.
Prabhu, N.S. 1987 *Second Language Pedagogy*. Oxford University Press.
Richards, J.C. and Rodgers, T.S. 1981. *Approaches and Methods in Language Teaching.* University of Hawaii, Manoa: Cambridge University Press.
Ronald Carter and David Nunan (eds.) 2001. *The Cambridge Guide to Teaching English to Speakers of Other Languages (Eds)*. Cambridge University Press
(This covers most of the aspects of English (as a second) language pedagogy and is very useful to develop a perspective among student teachers)
UNESCO. 2004. *Education in Multilingual World.* UNESCO Education Position Paper. Paris
UNESCO. 2007 *Advocacy Kit for Promoting Multilingual Education: Including the Excluded*. UNESCO Asia and Pacific Regional Bureau for Education, 920 Sukhumvit Road, Prakanong, Bangkok 10110. Thailand
UNESCO 2003. *The Use of Vernacular Language in Education*. Paris: UNESCO

Semester-V

PEDAGOGY-I MATHEMATICS 1

Contact hours: 4 hours per week

Total marks: 100(Internal25,External,75)

Objectives of the Course

After completion of course the students will be able to

- gain insight on the meaning, nature, scope and objective of mathematics education
- Appreciate mathematics as a tool to engage the mind of every student.
- Appreciate mathematics to strengthen the student's resource.
- Appreciate the process of developing a concept.
- Appreciate the role of mathematics in day-to-day life.
- Learn important mathematics: Mathematics is more than formulas and mechanical procedures.
- Channelize, evaluate, explain and reconstruct their thinking.
- See that mathematics as something to talk about, to communicate through, to discuss among them, to work together on.
- Pose and solve meaningful problems.
- Appreciate the importance of mathematics lab in learning mathematics.
- Construct appropriate assessment tools for evaluating mathematics learning.

Unit- I Nature of Mathematics

- Axiomatic Framework of Mathematics
- Axioms, Postulates, Undefined Terms, Defined Terms, Reasoning, Type of Reasoning, Proofs - Types of Proofs.
- Changing trends and goals of teaching mathematics with reference to NCF-2005

Learning Outcome in Mathematics

Inculcation of specific attitudes like Problem solving, Logical thinking, Drawing inferences, Handling abstraction, Visualising etc. in learner's personality.

Emphasis on use of mathematics in daily life situations.

Role of mathematics in other subject areas – Interdisciplinary approaches

Unit-II Problem posing / solving in Mathematics

Problem posing: Problem posing skill contextualized to recognition of pattern, Extension of pattern, Formulization of conjecture and generalizations through several illustrations drawn from learners immediate environment, Skill development of Process Questioning – that requires more than a simple factual response like yes or no only, can stimulate discussion of an idea, which lead to further exploration and use of oral language to explain and justify a thought.

Problem solving: Understanding of Problem, Splitting the Problem in known and unknown parts, Symbolization and mathematical formulation, Solving problem with multiplicity of approaches- **Probing questions** and **concrete analogies** can be used to initiate the exploration of alternative methods, Attitude build up of internal questioning – learn to ask themselves **key questions** before, during and after the solution process.

Unit-III Construction of concepts

Concept. Its meaning and characterstics,development of concepts

Analysis of concepts coherently in graded ways with s with varied examples, illustrations and activities.
Misconception and common errors about concepts. Methods and strategies for teaching mathematical concepts.

Unit-IV Integration of mathematical content with activities through Mathematics Laboratory

Identifying activity in several content areas conducive to the comprehension level of learner.

Inculcating skills in Designing, Demonstrating, Interpreting and drawing inference of activities/concrete models.

Unit-V Pedagogical Analysis of secondary school mathematics

Factonisation of polynomial, Linear equations, profit & loss, compound interest, congruence of triangle & Area of triangle quadrilaterals, Trigonometric ratio

Graphical representation of data

Modes of Assessment

- Presentation and communication skills in mathematics
- Posing conceptual questions from simple situations, interpretation and analysis
- Designing innovative learning situations
- Performance in group activity
- Laboratory experiences
- Reflective written assignment
- Written test on conceptual understanding of specific topics and its pedagogy

Reading Material

The Teaching of Mathematics- Roy Dubisch, John Wiley and Sons INC, New York and London, 1963
Teaching of Mathematics by Butler and Wren, Mc.Graw Hill Book Company, INC, New York and London, 1960
The Teaching of Secondary Mathematics by Claude H. Brown, Harper & Brothers, Publishers, New York (1953)
Teaching Mathematics in the Secondary School, Reinhart & Company INC, New York, 1954

Mathematical Discovery (Volume I and II) , George Polya, John Wiley & Sons, INC, New York and London, 1962 (I), 1965 (II)
Teaching Mathematics in Elementary School by C. G. Corle, The Ronalal Press Company, New York (1964)
Mathematics, Part I and II TEXTBOOK FOR CLASS XII, 2007, NCERT, New Delhi

Mathematics, Part I and II TEXTBOOK FOR CLASS XI, 2006, NCERT, New Delhi

National Curriculum Framework – 2005, NCERT.
Position Paper of NFG on Teaching of Mathematics – 2005, NCERT.
Position Paper of NFG on Habitat and Learning – 2005, NCERT.
Position Paper of NFG on Examination Reforms – 2005, NCERT.
Position Paper of NFG on Aims of Education – 2005, NCERT.
Position Paper of NFG on Gender Issues in Education – 2005, NCERT.
Position Paper of NFG on Education for Peace – 2005, NCERT.

Semester-V

PEDAGOGY-I BIO-SCIENCE 1

Contact hours-4 per week

Marks-100(Internal-25, External,75)

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

- Gain an understanding of the nature and scope and objectives of biological science
- Appreciate biological science as a dynamic body of knowledge understand about the pedagogy in biological sciences
- develop effectives plans for learning biological sciences
- Trace the changing trends in learning of biology
- Explore the possibility of developing scientific attitude values and skills through learning of biology
- Facilitate development of scientific attitudes in learners
- Construct appropriate assessment tools for evaluating science learning

Course Outline

Unit-I : Biological Science as a dynamic body of knowledge

- Nature of knowledge in Biological Science
- Historical and developmental perspectives of biological science
- Major scientific achievements in biological sciences
- Inter relationship of biology and other disciplines of science and their integration

Unit-II : The changing emphasis in learning biological science

- The changing trends in goals/objectives of learning biology
- Development of process skills in science through learning of biology
- Construct meaning and concepts related to biology through observation exploratory activities in the environment

Unit- III : Construction of knowledge Attitude, Skills and Values in Biological Sciences

- Constructivist approach in learning biological sciences
- Misconceptions in biological sciences and their remedies

- Concept mapping of themes related to biology
- Development of scientific attitudes, positive values and Identification and development of skills related to biological sciences
- Non formal channel for learning biological science :Arrangement of science exhibition/fairs including state and national exhibition, Conducting field trips and excursions children's science congress

Unit-IV: Pedagogy in biological sciences

- Pedagogical analysis : Identification of units, themes, concepts/learning point, generalizations and issues/problems
- Strategies of teaching biological sciences : inquiry problem based learning guided discovery, inductive method, co-operative learning and collaboration learning

Unit-V: Professional development of Biological Science Teachers

- Development of professional competencies of biology teacher
- Professional ethics of biology teachers
- Biological science and gender issues
- Biological science and ethical issues
- Impact of biological science on technology and society

Modes of Learning Engagement

Providing opportunities for group discussion on key themes and concepts.

Group/individual presentation

Lecture in interactive manner providing opportuninty for sharing ideas followed by group discussion.

Exposing to exemplar constructivist learning situations in science.

Designing and setting up activities / laboratory work.

Making filed notes /observation.

Visit to State/ National level science exhibition /science centre/ science museum.

Audio visual presentation followed by its analysis and discussion.

Reflective written assignments.

Case studies.

Modes of Assessment

Participation in group

Presentation and communication skills of science

Posing questions, interpretation and analysis of observation

Designing innovative learning situations

Laboratory experience

Field notes

Reading Material

NCERT, National Curriculum Framework – 2005.

NCERT, Position Paper of NFG on Teaching of Science – 2005.

NCERT, Position Paper of NFG on Habitat and Learning – 2005.

NCERT, Position Paper of NFG on Examination Reforms – 2005.

NCERT, Position Paper of NFG on Aims of Education – 2005.

NCERT, Position Paper of NFG on Gender Issues in Education – 2005.

NCERT, Position Paper of NFG on Education for Peace – 2005.

Vaidya, Science Teaching for 21st Century, Deep & Deep Publications (1999).

Dat Poly, Encyclopedia of Teaching Science, Sarup & Sons, New Delhi (2004).

Radha Mohan, Innovative Science Teaching for Physical Science Teachers, Prentice Hall of India Pvt. Ltd., New Delhi (2002)

Sutton, CR and Hayson JH, The Art of the Science Teacher, MC Graw Hill Book Company Ltd. (1974)

Their, DH, TeachingElementary School Science : A Laboratory Approach Sterling Publication Pvt. Ltd. (1973)

Science & Children (NSTA's peer reviewed journal for elementary teachers)

Science Teach (NSTA's per reviewed journal for secondary science teachers)

Journal of Research in Science Teaching (Wiley-Blackwell)

International Journal of Science Education

Misconceptions in chemistry, Addressing perceptions in Chemical Education, Barke, Hans Dieter, Al Yitbarek, Sileshi, Publication of Springer.

Turner Tony and Wendey Di Macro, Learning to Teach School Experience in secondary school teaching. Routledge, London and New York.

Taber K.S.: Chemical Misconceptions – Prevention, Diagnosis and cure volume 1 and 2, London 2002 (Royal Society of Chemistry)

Web Sites

http://www.tc.columbia.edu/mst/science ed/courses. asp. http://www.edu.uwo.cA

Semester-V

PEDAGOGY-II PHYSICAL SCIENCE -1

Contact Hours -4 per week

Marks-100(Internal-25, External,75)

Objectives

After completion of courser the students will be able to

- Gain insight on the meaning, nature, scope and objective of science education
- Appreciate that science is a dynamic body of knowledge
- Appreciate the fact that every child possesses curiosity about his natural surroundings
- Identify and relate everyday experiences with learning science
- Appreciate various approaches of teaching-learning of science
- Employ various techniques of transaction of science
- Use effectively different activities /demonstrations/laboratory /experiences for teaching-learning of science
- Facilitate development of scientific attitudes in learners
- Construct appropriate assessment tools for evaluating science learning

Course Outline

UNIT-I Nature of Physical Science

- **Learning experiences of physical science in context to life**
  Role of physical science in removing ignorance and superstition, bringing socio- economic changes concern to environment, (Poverty, health, equity, peace, environment, gender, concern to aims & objectives of teaching science).
- **Science as a domain of enquiry**
  Observation, process skills, steps in scientific method. Developing scientific attitude.
- **Science as a dynamic body of knowledge**

Historical and developmental perspective of science, major scientific achievements in the physical sciences: Impact on society, and futuristic views.

UNIT-II Content Specific Pedagogy

- **Pedagogy in physical Science**
  Nature of scientific disciplines. Constructivist approach in learning physical science at various levels of school education. Science as a discourse of interdisciplinary learning. Communication in science learning.
- **Pedagogy specific to disciplines: Constructivists learning situations**
  The theoretical basis of school science education: Thematic approach at elementary and secondary stages with subject specific examples such as Food and Nutrition Air, Energy Water – Natural resources, Habitat; disciplinary approach at higher secondary level with specific examples from physics / chemistry textbook class XI and XII; diffusing disciplinary boundaries (with specific examples like).

UNIT-IIIPhysical Science and learner's development

- Analysis of the organisation of relationships between concepts, laws and theories in physical science (biology/ chemistry/ physics).
- Erroneous concepts of scientific knowledge and remedies: learner's preconception, sources of misconception, language and misconception, effective remedies.
- **Activity / laboratory experiences in learning physics / chemistry**

Organising activity based class room, use of instructional material (learner participation in developing them), use of physical science laboratories, field experiences

UNIT-IV Resource utilisation:

- **Learning Resources**
  Identification of learning resources from immediate environment, formal and non-formal channels, collection of material (school specific – rural / urban, community), exploring alternative resources, handling hurdles in utilization of resources
- **Resources specific to the children with special need**
  Alternative resources for physically challenged learners; Ensuring partnership in classroom and other activities, socio-economic considerations.

UNIT-V Curricular components: Encouraging learner to non-formal channels such as debate/discussion project, exhibition, science and technology fair, children science congress; State and National Level Science Exhibition, nurturing creative talent at local level and exploring linkage with district / state / central agencies; community participation.

Modes of Assessment

- Participation in group
- Presentation and communication skills of science
- Posing questions, interpretation and analysis of observation
- Designing innovative learning situations
- Laboratory experience
- Field notesReading Material

Reading Material

- NCERT, National Curriculum Framework – 2005.
- NCERT, Position Paper of NFG on Teaching of Science – 2005.
- NCERT, Position Paper of NFG on Habitat and Learning – 2005.
- NCERT, Position Paper of NFG on Examination Reforms – 2005.
- NCERT, Position Paper of NFG on Aims of Education – 2005.
- NCERT, Position Paper of NFG on Gender Issues in Education – 2005.
- NCERT, Position Paper of NFG on Education for Peace – 2005.
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- Their, DH, TeachingElementary School Science : A Laboratory Approach Sterling Publication Pvt. Ltd. (1973)
- Science & Children (NSTA's peer reviewed journal for elementary teachers)
- Science Teach (NSTA's per reviewed journal for secondary science teachers)
- Journal of Research in Science Teaching (Wiley-Blackwell)
- International Journal of Science Education
- Misconceptions in chemistry, Addressing perceptions in Chemical Education, Barke, Hans Dieter, Al Yitbarek, Sileshi, Publication of Springer.
- Turner Tony and Wendey Di Macro, Learning to Teach School Experience in secondary school teaching. Routledge, London and New York.
- Taber K.S.: Chemical Misconceptions – Prevention, Diagnosis and cure volume 1 and 2, London 2002 (Royal Society of Chemistry)

Web Sites

1. http://www.tc.columbia.edu/mst/science ed/courses. asp.
2. http://www.edu.uwo.ca

Semester-V

LEARNING TO FUNCTION AS TEACHER-I
(Practice of Teaching Skills)
Micro Teaching

Marks: 50(Internal)

Objective-To develop in pupil teachers mastery in class room teaching skills

Transaction Mode: The theoretical input and practice of following classroom teaching skills will take place in the specified hours through discussion, demonstration and micro teaching session. At the closure of the practice of individual skills a lesson to be delivered

By linking all skills together (For obtaining feedback of each lesson tools will be provided)

- Introducing a lesson/topic: the importance of motivation in teaching, techniques of introducing a lesson to provide motivation, meeting the motivational needs of the disadvantaged learners, movement from familiar to unfamiliar, introduction of dramatic element, strategies for sustaining attention and interest.
- Questioning : its various forms : thought provoking, interpretative questions, questions to measure analytical ability, application ability, rephrasing, question to test judgment ability, synthesis ability, probing questions distribution and delivery of instruction, suggestions for handling pupil's questions and promoting pupil-pupil interaction in diverse context
- Explaining : Clarity, continuity, relevance to the content, using beginning and concluding statements, covering essential points Illustrating with Examples - simple, interesting and relevant to the points being explained
- Reinforcing : principles of reinforcement, varieties of reinforces and their uses-positive and negative, verbal and non-verbal : guidelines for use of reinforcement
- Stimulus Variation : Meaning, components-movement, gesture, change in voice, stress, focusing change in interaction pattern, pause, pupil participation and aural and visual aids

Use of Blackboard: techniques of using blackboard in different ways.

Evaluation-The performance in the skill will be observed and evaluated out of 10.The best five performances would be taken in to consideration to assign marks out of 50.

Semester-VI

PEDAGOGY-1

MATHEMEATICS-II

Contact Hours -4 Per week

Marks-100(Internal-25,External,75)

Objectives of the Course

After completion of course the students will be able to

- gain insight on the meaning, nature, scope and objective of mathematics education
- Appreciate mathematics as a tool to engage the mind of every student.
- Appreciate mathematics to strengthen the student's resource.
- Appreciate the process of developing a concept.
- Appreciate the role of mathematics in day-to-day life.
- Learn important mathematics: Mathematics is more than formulas and mechanical procedures.
- Channelize, evaluate, explain and reconstruct their thinking.
- See that mathematics as something to talk about, to communicate through, to discuss among them, to work together on.
- Pose and solve meaningful problems.
- Appreciate the importance of mathematics lab in learning mathematics.
- Construct appropriate assessment tools for evaluating mathematics

Unit-I Exploring learners

Cultivating learner's sensitivity like listening, encouraging learner for probing, raising queries, appreciating dialogue among peer group, promoting the student's confidence.

Place of Mathematics in secondary school curriculum

Unit-II Planning Classroom Strategies

Analysis of textual and supplementary print mataerials, connecting lab/field experiences and suitable planning for classroom interaction.

- Identifying desired outcome i.e., what level of understanding is desired, what essential questions will guide teaching/learning.
- Determining acceptable evidences that show students understanding.
- Integrating learning experiences and instructions – sequence of teaching/learning experiences that enable students to develop/demonstrate desired understanding.
- Developing skills and knowledge required to make appropriate use of technology, learner-teachers will be required to make pedagogical choices critically about when and where technology should be used.
- The role of cooperative learning in mathematics.

Unit-III Assessment and Evaluation

- **Informal creative Evaluation**
  Encouraging learner to examine a variety of methods of assessment in mathematics so as to assess creativity, problem solving and practical performance.

Appreciating evaluation through overall performance of the child.

Self and peer evaluation

- **Formal ways of Evaluation**
  Variety of assessment techniques and practices

  Assessing Product vs. Process, Knowing vs. Doing.

  In practice midterm/terminal examination, practicing continuous and comprehensive evaluation to test regular programs/achievement of learner.

Unit-IV Developing Blue print for designing question paper

Identifying and organizing components for developing frame work of question paper at different stages of learning. Framing questions based on concepts and sub concepts so as to encourage critical thinking, promote logical reasoning and to discourage mechanical manipulation and rote learning. Framing of open ended questions providing the scope to learners to give responses in their own words. Framing of conceptual questions from simple questions.

Unit-V Pedagogical Analysis of secondary school mathematics

Quadratic equations, Arithmetic progression, scale of triangles, Distance between two points, Trigonometric identies, problems on Height & distance measures of central tendency

Modes of Learning Engagement

- Providing opportunities for group activities
- Group/individual presentation
- Providing opportunity for sharing ideas
- Exposing to exemplar constructivist learning situations in mathematics
- Designing and setting up models, teaching aids and activities/laboratory work
- Visit to district, state and national level science exhibition
- Audio visual presentation followed by its analysis and discussion
- Reflective written assignments
- Case studies

Modes of Assessment

1. Presentation and communication skills in mathematics
2. Posing conceptual questions from simple situations, interpretation and analysis
3. Design innovative learning situations
4. Performance in group activity
5. Laboratory experiences
6. Reflective written assignment
7. Written test on conceptual understanding of specific topics and its pedagogy

Reading Material

The Teaching of Mathematics-Roy Dubusch, John Wiley and Sons INC, New York and London, 1963

Teaching of Mathematics by Butler and Wren, McGraw Hill Book Company, INC, New York and London, 1960
The Teaching of Secondary Mathematics by Claude H.Brown, Harper & Brothers, Publishers, New York (1953)
Teaching Mathematics in the Secondary School, Reinhart & Company INC, New York, 1954
Mathematical Discovery (Volume I and II), George Polya, John Wiley & Sons, INC, New York and London, 1962 (I), 1965 (II)
Teaching Mathematics in Elementary School by C.G. Corle, The Ronalal Press Company, New York (1964)
Activity for Junior High School and Middle School Mathematics, Volume – II, NCTM, USA, 1999
Geometry – History, Culture and Techniques, J.L.Heilborn, OxfordUniversity Press,-2000

Mathematics, Part-I and II TEXYBOOK FOR CLASS XII, 2007, NCERT, New Delhi
Mathematics, Part-I and II TEXTBOOK FOR CLASS XI, 2006, NCERT. New Delhi
Mathematics, TEXTBOOK FOR CLASS X,2007, NCERT, New Delhi
Mathematics, TEXTBOOK FOR CLASS IX,2006, NCERT, New Delhi
Secondary School Curriculum, 2006, CBSE, New Delhi
Mathematics laboratory in schools – towards joyful learning, 2006, CBSE, New Delhi
Guidelines for mathematics laboratory in schools for class IX, 2006, CBSE, New Delhi
Guidelines for Mathematics laboratory in schools for class X, 2006, CBSE, New Delhi.
Mathematics, FOR CLASS VIII, 2008, NCERT, New Delhi
Mathematics, FOR CLASS VII, 2007, NCERT, New Delhi
Mathematics, FOR CLASS VI, 2006, NCERT, New Delhi
National Curriculum Framework – 2005, NCERT
Position Paper of NFG on Teaching of Mathematics – 2005, NCERT
Position Paper of NFG on Habitat and Learning – 2005, NCERT
Position Paper of NFG on Examination Reforms – 2005, NCERT
Position Paper of NFG on Aims of Education – 2005, NCERT
Position Paper of NFG on Gender Issues in Education – 2005, NCERT
Position Paper of NFG on Education for Peace – 2005, NCERT

Journals:

Teaching Children Mathematics (TCM), NCTM, USA
Mathematics Teaching in the Middle School (MTMS), NCTM, USA
Journal of Mathematics Teacher Education, Springer Netherlands

Web-sites:

1. Mathematical Thinking and Learning, Philadephia, USA
2. http://www.mathforum.org/dr.math
3. http://www.sakshat.ac.in
4. http://web.utk.edu
5. http://www.confluence.org
6. http://www.nationalmathtrail.org
7. http://www.gsh.org/lists/hilites.html
8. http://www.kn.pacbell.com./wired/bluewebn
9. http://www.gsn.org/pr
10. http://www.education-world.com
11. http://www.nctm.org
12. http://www.kn.pacbell.com/wired/bluewebn
13. http://www.ncert.nic.in

Semester-VI

PEDAGOGY-II PHYSICAL SCIENCE-II

Contact Hours-4 per week

Marks-100(Internal-25, External,75)

Objectives

After completion of courser the students will be able to :

- Gain insight on the meaning, nature, scope and objective of science education
- Appreciate that science is a dynamic body of knowledge
- Appreciate the fact that every child possesses curiosity about his natural surroundings
- Identify and relate everyday experiences with learning science
- Appreciate various approaches of teaching-learning of science

- Employ various techniques of transaction of science
- Use effectively different activities /demonstrations/laboratory /experiences for teaching-learning of science
- Facilitate development of scientific attitudes in learners
- Construct appropriate assessment tools for evaluating science learning

UNIT-I Learning process

Exploring learners

Cultivating in student-teacher the habit of listening child, motivating learner to bring her previous knowledge gained through class room / environment / parents and peer group; generating discussion, involving learner in teaching –learning process. Encouraging learner to raise questions, appreciating dialogue amongst peer group.

Evolving learning situation

Analysis of textual and supplementary print materials and suitable planning for connecting lab / field experiences in class room interaction. Identifying desired experience i.e. what level of understanding is desired, what essential questions will guide teaching – learning. Determining acceptable evidences that show students understand. Integrating learning experiences and instructions, steps in teaching – learning experiences that enable students to develop / demonstrate desired understanding. Use of ICT experiences in class room to enable learner to adopt new techniques in teaching – learning process.

UNIT-II Lab experiences

Encouraging learner to collect material to develop/fabricate suitable activity prior to the class(individual or group work) and teacher facilitated activities to generate discussion; experiences on layout, setting and organising laboratory. Developing content specific (biology/chemistry/physics) project work. Projects on planning and developing instructional materials.

UNIT-III Assessment and Evaluation-

Informal creative evaluation

Encouraging evaluation to assess creativity, problem solving, practical / technological skills. Appreciating evaluation through co-curricular channels. Exploring content areas not assessed in formal examination system through performance based assessment

UNIT-IVFormal ways to evaluate learner

Challenges to test understanding / concept development during in practice mid term / terminal examination, practicing continuous and comprehensive evaluation to test regular progress / achievement of learner, oral presentation, developing performance parameter for qualitative assessment, anecdotal records, rubric portfolio.

UNIT-V Developing Blue print and framing questions

Identifying and organizing components for developing frame work of question paper at different stages of learning. Percentile ranking, reporting performance of learners. Framing questions based on theory, experiments/activities to discourage rote learning and promoting analysis, critical thinking and reasoning. Open ended questions to evaluate creativity and expression of learner.

Modes of Learning Engagement

- Providing opportunities for group discussion on key themes and concepts.
- Group/individual presentation
- Lecture in interactive manner providing opportuninty for sharing ideas followed by group discussion.
- Exposing to exemplar constructivist learning situations in science.
- Designing and setting up activities / laboratory work.
- Making filed notes /observation.
- Visit to State/ National level science exhibition /science centre/ science museum.
- Audio visual presentation followed by its analysis and discussion.

- Reflective written assignments.
- Case studies.

Modes of Assessment

- Participation in group
- Presentation and communication skills of science
- Posing questions, interpretation and analysis of observation
- Designing innovative learning situations
- Laboratory experience
- Field notes Reading Material

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- NCERT, Position Paper of NFG on Gender Issues in Education – 2005.
- NCERT, Position Paper of NFG on Education for Peace – 2005.
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- Sutton, CR and Hayson JH, The Art of the Science Teacher, MC Graw Hill Book Company Ltd. (1974)
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- Journal of Research in Science Teaching (Wiley-Blackwell)
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- Misconceptions in chemistry, Addressing perceptions in Chemical Education, Barke, Hans Dieter, Al Yitbarek, Sileshi, Publication of Springer.
- Turner Tony and Wendey Di Macro, Learning to Teach School Experience in secondary school teaching. Routledge, London and New York.
- Taber K.S.: Chemical Misconceptions – Prevention, Diagnosis and cure volume 1 and 2, London 2002 (Royal Society of Chemistry)

Web Sites

http://www.tc.columbia.edu/mst/science ed/courses. asp.

http://www.edu.uwo.ca

Semester-VI

PEDAGOGY-II BIOSCIENCE-II

Contact Hours 4 per week

Marks-100(Internal-25,External,75)

Objectives

- Appreciate textbooks of biological science as source of leaving and explore other Resources available
- Explore the resources specific for the leaving of children with special needs
- Understand that evaluation of students can be done in formal and informal way

Unit-I: Planning for learning in Biological Sciences

- Writing learning objectives
- Steps and advantages of designing lessons (for different approaches of learning biology)
- Identification of learning experiences and organizing activities in the classroom use of field experience, laboratory and ICT
- Designing lessons for biology content

Unit-II : Biological Science laboratories and related activities

- Planning and organization of biology laboratory
- Planning and management of practical activities in biology laboratory
- Evaluation of students activities in biology laboratory
- Planning and organization of science club activities

Unit-III: Biological Science Curriculum

- Issues and concern of biological science curriculum
- Various interventions for reformulation of curriculum related to biological science at secondary level in India and abroad.
- Emphasis of NCF-2005 on transaction of curriculum: Going beyond biological science text book, Implementation critical pedagogy in biology classroom, Space for parents and community

Unit-IV: Text book and other learning resource

- Characteristics of a good text book and Evaluation of text book
- Effective use of text book for elaboration of concepts, activities, reflective thinking small group work etc.
- Identification of learning resources from immediate environment and preparation and use of learning materials, evaluation of learning resources ;Science parks, national parks, museum as resources sites for learning biological sciences
- Supplementary materials work sheets, self learning materials use of ICT in learning biology (web sides, interactive web sides, on line learning)
- Alternative resources for physically challenged learners

Unit-V : Formal Evaluation of learner

- Practicing continuous and comprehensive evaluation to test regular progress
- Developing blue print and framing different types of questions, diagnostic testing
- Developing performance parameter for qualitative assessment anecdotal record, portfolio etc.
- Reporting performance of learner

Modes of Learning Engagement

- Providing opportunities for group discussion on key themes and concepts.
- Group/individual presentation
- Lecture in interactive manner providing opportunity for sharing ideas followed by group discussion.
- Exposing to exemplar constructivist learning situations in science.
- Designing and setting up activities / laboratory work.
- Making filed notes /observation.
- Visit to State/ National level science exhibition /science centre/ science museum.
- Audio visual presentation followed by its analysis and discussion.
- Reflective written assignments.
- Case studies.

Modes of Assessment

- Participation in group
- Presentation and communication skills of science
- Posing questions, interpretation and analysis of observation
- Designing innovative learning situations
- Laboratory experience
- Field notes

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- Their, DH, TeachingElementary School Science : A Laboratory Approach Sterling Publication Pvt. Ltd. (1973)
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- Misconceptions in chemistry, Addressing perceptions in Chemical Education, Barke, Hans Dieter, Al Yitbarek, Sileshi, Publication of Springer.
- Turner Tony and Wendey Di Macro, Learning to Teach School Experience in secondary school teaching. Routledge, London and New York.
- Taber K.S.: Chemical Misconceptions – Prevention, Diagnosis and cure volume 1 and 2, London 2002 (Royal Society of Chemistry)

Web Sites

- http://www.tc.columbia.edu/mst/science ed/courses. asp.
  HTTP://WWW.EDU.UWO.CA

Semester-VI
ASSESSMENT FOR LEARNING

Contact Hours: 4 hours per week
Total Marks: 100(Internal-25, External,75)

Course: Assessment is integral to school education and more specifically to teaching-learning. Since education in schools presupposes certain aims and objectives, it is crucial for teachers to be aware of how the progress and growth of students is to be assessed. This in turn implies that teachers become cognizant of what dimensions of growth or learning are to be assessed, what means are available to them for this purpose, and what effects are likely to flow from various kinds of assessment.

This Course – as its title suggests - proposes that student-teachers become conscious of the distinction between assessment *for* learning and assessment *of* learning. Whereas both have their place in school education, a constructivist paradigm indicates a shift in emphasis towards the former. The course intends to enlarge current perspectives on assessment and evaluation, and enable student-teachers to view student learning along multiple dimensions. It brings a specific focus on assessment of subject-based learning, as well as processes of feedback and reporting, which are among the core competencies needed by teachers. A critical review of the examination system and the assessment practices that derive from this is also felt to be a necessary component of the course; so that student-teachers may learn to evolve more flexible and richer forms of assessment, even as they respond to current examination practices.

Objectives:

The Course will thus enable student-teachers to:

- Gain a critical understanding of issues in assessment and evaluation (from a constructivist paradigm)
- Become cognizant of key concepts such as formative and summative assessment, evaluation and measurement, test, examination
- Be exposed to different kinds and forms of assessment that aid student learning

- Become the use of a wide range of assessment tools, and learn to select and construct these appropriately
- Evolve realistic, comprehensive and dynamic assessment procedures that are able to keep the whole student in view.

Course Outline

Unit I: Overview of Assessment and Evaluation

- Perspective on assessment and evaluation of learning in a constructivist paradigm
- Clarifying the terms
  - assessment, evaluation, test, examination, measurement
  - formative and summative evaluation
  - continuous and comprehensive assessment
  - Grading
- Distinction between 'Assessment of learning' and 'assessment for learning'
- Purposes of assessment in a 'constructivist' paradigm:
  - engage with learners' minds in order to further learning in various dimensions
  - promote development in cognitive, social and emotional aspects
- Critical review of current evaluation practices and their assumptions about learning and development

Unit II: What is to be assessed?

Dimensions and levels of learning

- Retention/recall of facts and concepts; application of specific skills
- Applying tools and symbols; problem-solving; applying learning to diverse situations
- Meaning-making propensity; abstraction of ideas from experiences; seeing links and relationships; inference; analysis; reflection
- originality and initiative; collaborative participation; creativity; flexibility

- Contexts of assessment
  - subject-related ;person-related

Unit IIIAssessment of subject based learning

- Enlarging notions of 'subject-based learning' in a constructivist perspective
- Assessment tools

- kinds of tasks: projects, assignments, performances
- kinds of tests and their construction
- observation of learning processes by self, by peers, by teacher
- self-assessment and peer-assessment
- Constructing Portfolios

Unit-IV Context of Assessment and Evaluation

- Steps in pedagogical analysis of content matter
- Preparation of test item, development of blue print
- Checking of answer scripts-Subjective and objective
- Construction of achievement test-Teacher made and standardized
- Syllabus and textbook analysis

Unit V: Data Analysis and Feedback

Statistical tools- percentage, graphical representation , frequency distribution, central tendency, variation, normal distribution, percentile rank, correlation and their interpretation

- Feedback as an essential component of formative assessment
  - use of assessment for feedback; for taking pedagogic decisions
  - Types of teacher feedback (written comments, oral); peer feedback

Modes of Learning Engagement

Some suggested modes of learning are:

- Lecture-cum-discussion
- Readings and presentations
- Group discussions
- Analysis of a range of assessment tools
- Developing worksheets and other tasks for learning and assessment in one's specific subject area
- Maintaining a portfolio related to the course-work and devising rubrics for assessment
- Constructing a test or an examination paper in one's subject area; critical review of these
- Observing, interviewing and writing comprehensive profile of a student
- Simulated exercises in 'marking' and giving feedback to fellow student-teachers (on a written task); critical review of feedback
- Simulated exercise in marking an examination paper in one's subject area; critical review of marking

Modes of Assessment

Suggested modes of assessment are:

- Quality of participation in discussion
- Quality of presentation
- Rating of tasks taken up
- Rating of critical analysis of assessment tools
- Quality of assessment tools constructed
- Portfolio assessment according to the rubrics
- Written test

References

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- Black, P., Harrison, C., Lee, C., Marshall, B, & William, D. (2004). Working inside the black box: Assessment for learning in the classroom. Phi Delta Kappan, 86 (1), 8- 21.
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- Nitko, A.J. (2001). Educational assessment of students (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
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Semester-VI

LEARNING TO FUNCTION AS TEACHER-
SCHOOL EXPOSER PROGRAMME (MULTICULTURAL PLACEMENT)

School Obsarvation

Duration-2 weeks
Marks: 50(Internal)

Objectives

The pupil teachers would be exposed to different type of schools such as urban,rural,tribal with a view to

- Develop understanding about the school activities with different cultures
- Develop the process of engaging students in classrooms through observing the process adopted by regular teachers
- Develop understanding to manage a substitute(arrangement class)
- Experience of engaging classroom activities
- Conduct case studies

The institute will identify suitable number of cooperating urban schools, rural schools, and tribal schools, and students will be placed by rotation in all the three types of schools. All activities listed below are to be completed within two weeks during the placement of student teachers in three types of schools in rotation. Each pupil teacher performs the following activities under the guidance of supervisor and prepare reports on all the activities.The report will be evaluated as indicated below.

Activities

Sl.No	Activities	Marks
1	Observing 10 lessons 5 in each method delivered by regular teachers with the help of observation schedule	10
2	Observation of day-to-day school activities and preparation of comprehensive report highlighting working of the library, co-scholastic activities, games and sports, functioning of laboratory, school morning assembly	10
3	Availing atleast six substitute teaching opportunities in actual school situation	10
4	Developing two lessons in each method subject and use of learning materials/teaching aids	10
5	Undertaking a case study	10
	Total	50

Burke, K. (2005). How to assess authentic learning (4th Ed.). Thousand Oaks, CA: Corwin. Burke, K., Fogarty, R., & Belgrad, S (2002). The portfolio connection: Student work linked to standards (2nd Ed.) Thousand Oaks, CA: Corwin.

Carr, J.F., & Harris, D.E. (2001). Succeeding with standards: Linking curriculum, assessment, and action planning. Alexandria, VA: Association for Supervision and Curriculum Development.

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Semester-VI

LEARNING TO FUNCTION AS TEACHER-
SCHOOL EXPOSER PROGRAMME(MULTICULTURAL PLACEMENT)
School Observation

Duration-2 weeks
Marks: 50(Internal)

Objectives

The pupil teachers would be exposed to different type of schools such as urban,rural,tribal with a view to

- Develop understanding about the school activities with different cultures
- Develop the process of engaging students in classrooms through observing the process adopted by regular teachers
- Develop understanding to manage a substitute(arrangement class)
- Experience of engaging classroom activities
- Conduct case studies

The institute will identify suitable number of cooperating urban schools, rural schools, and tribal schools, and students will be placed by rotation in all the three types of schools. All activities listed below are to be completed within two weeks during the placement of student teachers in three types of schools in rotation. Each pupil teacher performs the following activities under the guidance of supervisor and prepare reports on all the activities.The report will be evaluated as indicated below.

Activities

Sl.No	Activities	Marks
1	Observing 10 lessons 5 in each method delivered by regular teachers with the help of observation schedule	10
2	Observation of day-to-day school activities and preparation of comprehensive report highlighting working of the library, co-scholastic activities, games and sports, functioning of laboratory, school morning assembly	10
3	Availing atleast six substitute teaching opportunities in actual school situation	10
4	Developing two lessons in each method subject and use of learning materials/teaching aids	10
5	Undertaking a case study	10
	Total	50

Semester-VII

LEARNING TO FUNCTION AS A TEACHER-II (INTERNSHIP)
School Internship

Full Marks-150(Internal)
Duration -5weeks

Objectives

On completion of the course the student teacher will be able to

- acquire the competence and skills required for multi level teaching,
- class management, evaluation of learning outcome, organization of co-curricular activities,
- develop professionalism and positive attitude to teaching
- understand the facilitating role of a teacher

Content

Unit-1 : Organisation: In order to facilitate staged entry of student-teachers in teaching, Internship in teaching will be organized in three phases viz. pre-internship, internship and post internship. The duration of Pre-internship (Preparation for teaching) programme will be of 1 month in first and second semester. The Internship will be of 5 weeks organized in selected cooperating schools. Necessary orientation programme for cooperating teachers and Head of the schools will be organized at the institute. An internship committee with representatives from the Departments of Education in Science & Mathematics, Department of Education and Department of Education in Social Sciences and Humanities will look after the academic and organizational aspects of the internship programme.

Unit-2 : Internship Activities: The details of Pre-internship have been elaborated earlier. The various activities to be performed during Internship and Post internship phases are as follows:

B. Internship

- Getting acquainted with various aspects of cooperating schools
- Planning and preparation for teaching in two school subjects and maintenance of records.The students are to deliver minimum of 20 lessons(16 with detailed lesson and 4 with lesson notes) in a method subject i.e(20 + 20 lessons) minimum in two subjects(Mathematics/BioScience and Physical Science for B.Sc.B.Ed and Language and Social Science for B.A.B.Ed students
- development of scheme of lessons and activities in schools
- administration of achievement tests, identification of learning difficulties and analysis of results
- conducting an action research
- preparation of instructional materials/teaching aids and exhibition of the aids/materials and exhibition of the aids/materials
- participation in school activities/organizations of activities and a reflective report on it.

School Attachment Programme

Each student teacher will prepare a report on the following

Suggested Activities

- conducting classroom teaching
- maintenance of classroom teaching records
- framing of time table
- development of scheme of lessons and activities
- observstion of peer lessons for self improvement
- attending and organizing morning assembly
- maintenance of school discipline
- organization/participation in literary and recreational activities debates/speech competition/quiz
- maintenance of school records
- conducting guidance and counseling
- conducting achievement tests
- organizing science fair, exhibition, science club, nature study clubs
- maintenance of school library
- maintenance of school laboratories
- organizing games and sports and participations

C. Post-Internship

- Discussion with the pupil-teachers in regard to :
- seeking reactions of students, cooperating teachers and headmasters and institute supervisors through inventory, interview and group discussion as feedback
- fellow-up, remedial and strengthening activities to be taken up by the institute
- exhibition of works done by students during internship
- suggestions for future

Unit – 3 : Evaluation and scheme of Assessment

Evaluation of performance, during internship will be done on the basis of assessment of institute supervisors, cooperating teachers, head of schools and students activities/assignments. The scheme of will be as follows in each year.

Area		**Marks Internal**
Teaching	Subject-I	35
	Subject-II	35
Lesson Planning (Record Maintenance)	Subject-I	10
	Subject-II	10
Development of scheme of lessons & activities		
Record on Observation of peer teaching	Subject-I	10
	Subject-II	10
Administration of Achievement tests and its analysis/identification of slow Learners/talented children		10
Record on school site and participation of School activities		10
Preparation of Instructional materials/Teaching aids exhibition		10

Assessment of Activities of Pupil-Teachers by Head of school	10

Total:	**150**

Semester-VII

ADDRESSING SPECIAL NEEDS AND GENDER ISSUES IN CLASSROOM

Contact Hours-2 per week
Full Marks -50(Internal-15, External-35)

Aims of the Course

The philosophy underlying this course is that many students face difficulties in learning at some stage of their school life and while traditionally these difficulties were considered to be a result of individual pathologies like a disability, today many of these are viewed more positively as created by the social environment involving interaction of complex range of factors . These factors include the nature of curriculum, school organization, teachers' attitudes and their inclination to respond to diversity of understanding, experiences and learning styles of the children in the classroom. The management of these difficulties, therefore, requires social action and is the responsibility of the school at large to make the necessary changes in the environment for the full participation of students in the school situation. Emphasizing on the wider cultural, social and political context in which their special needs occur, this course introduces student teachers to the difficulties a student with disability may experience while learning and participating in a regular classroom and help them to develop a rich understanding of theoretical and practical ideas of how to handle these difficulties.

National Curriculum Framework (NCF) 2005 that focuses on equality, social justice and respect for diversity as well as dignity and right of children from different social backgrounds. It attempts to treat gender as a human issue and not as a women's issue The approach followed in the course is based on the position paper on *Gender Issues in Education* wherein it is stated that gender should not be treated as an add on approach but as a cross cutting edge in all disciplinary areas. The course will also enable students to understand key concepts related to gender and how they operate in reality through various institutions. As has rightly been pointed out in the position paper pedagogical and curricular changes cannot be realized without the teacher who is at the forefront of the teaching learning process. This course will provide an opportunity for pupil teachers to reflect at their own socialization processes and will enable them to integrate their experiences with the content of different disciplines. The broad course outline would promote self-esteem and self confidence, stimulate critical thinking and develop in learners the abilities to question power relations., enable them to access resources, especially to an expanding framework of information and knowledge, ability to analyse options available in making informed choices, challenge relations of power and enable girls to take control of their lives and assert their rights as independent human.

Objectives

This course will enable the students to:

- Develop basic understanding and familiarity with key concepts – inclusion,gender equality etc
- Developing an understanding of special needs of students in terms of the curriculum and changing perspectives in the area of education of children with disabilities.
- Familiarizing teachers with literature on Policy and legislative frameworks, and activities taken up by the governmental and voluntary organizations for education of children with disabilities
- Developing skills and practices that respond to special needs of students and facilitate learning of all students in the classroom
- Creating awareness about the range of attitudes towards students with disabilities and to help in developing ways of replacing negative attitudes with positive attitudes.

Course Outline

Unit 1: From Segregation to Inclusion: Changing Paradigms

Historical overview of education of children with disabilities- from welfare to rights

- Defining Special Needs : Ways of looking at Educational difficulties-individual deficit view vs. curriculum view
- Shifting Approaches of viewing Disability: the charity model, the bio centric model, the functional model and the human rights model
- Difference between special, integrated and inclusive education
- Philosophy of inclusive education

Unit II: Moving towards Inclusion: Policy ,Rights and Legislations and Efeective Classroom Climate

- National Policy and Legislative Frameworks –Education of students with disabilities in the National Policy on Education, 1968, 1986, Education of Special focus groups under the Sarva Shiksha Abhiyan, Educational Provisions of Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) *Act*, 1995, Goals and Strategies in the Comprehensive Action Plan for Including Children and Youth with Disabilities in Education, MHRD, 2005,
- Special Role of Institutions for the Education of Children with Disabilities- Rehabilitation Council of India, National Institutes of different Disabilities.
- Addressing social climate of the classroom
- Parents as Partners- Developing positive relationships between school and home;Involving Community Resources as source of support to teachers

UNIT III Gender Issues in Curriculum

- Gender Bias, Gender Stereotyping and Empowerment
- Gender, Culture and Institution: Intersection of class, caste and religion
- Curriculum and the Gender Question
- Construction of Gender in Curriculum Framework since independence: An Analysis
- Gender and the hidden curriculum
- Gender in Text and Context(textbooks inter-sectionality with other disciplines, classroom processes including pedagogy)

Modes of Learning Engagement

- Presentation of examples help to strengthen what is being presented to the trainees
- It is important to engage the participants in a lot of cooperative group work so that they start valuing alternative points of view and significance of collaboration
- The student trainees can also be asked to write their reflections on various topics.
- Presentation of case studies and discussion on those is a good medium to crystallize individual view points on various issues. This method can easily used in the classrooms. The case studies from all over India can be collected before hand.
- Interaction with children with disabilities studying in schools and spending quality time with them is of great help in changing attitudes and developing empathy. This can be used as a mode of learning engagement.
- Projects on various topics can help the students to achieve some in depth knowledge on different topics.
- Audio- Visual Demonstrations including Videos and slides can help in demonstrating various practices

Modes of Assessment

- Reflective written assignments
- Conducting Seminar on chosen topics
- Group reports
- Field visit reports/project report
- Participation in discussions
- Written tests

Suggested Readings

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Srivastava, Gouri, The Role of Begums of Bhopal in Girls' Education, 2006. NCERT N. Delhi
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Semester-VII

EDUCATION FOR PEACE

Contact Hours-2 per week
Full Marks -50(Internal-15,External-35)

Aim of the Course

Education is preparation for participation in the democratic processes of society as an ethical and compassionate adult. It should enable students to develop a vision of peace as a dynamic social reality at micro (personal, home and family) and macro levels, (society, national, global) marked by conflicts arising out of the diverse needs and aspirations of the individuals and diverse groups-regional, religious, linguistic, marginalized etc. which need to be maintained by reconciled with dignity and justice for all. Peace education is about developing awareness in the education system particularly teachers, of the issues and challenges to peace which result in direct violence, as well as, indirect forms of violence as neglect, humiliation, denial of freedom and rights to individuals or groups or societies. It aims at building attitudes, values, skills and competencies and, developing commitment for conflict resolution. Foundations of peace in the society lie on respect for values of peace-compassion, caring, and cooperation, which complement Constitutional values of freedom justice, equality, intercultural harmony, secularism, human rights, social responsibilities ecological balance. The starting point for this change are transformed and empowered teachers who having identified challenges to peace in their own conflicts, biases and stereotypes and, the conflicts inherent in the structure and processes of school and society, could work for a change.

This course aims at broadening notions of trainee teachers about peace and peace education, their relevance and connection to inner harmony as well as harmony in social relationships across individuals and groups based on constitutional values. The course also proposes to enable teachers for reflection on the attitudes that generate conflicts at personal and social levels and learning skills and strategies of resolving these conflicts. The contents also focus on strengthening self by continual reflection leading to reduction in stereotypes, and transcending barrier of identity and socialization. Thus transformed trainee teachers will be enabled

to orient curricular and educational processes, find creative alternatives which nurture and promote peace building capabilities among students and counter the negative influence of media and the local community to weed out negative effects by influencing parents, families, and local community.

The course transaction must include activities for experiential awareness of peace as a reality at personal and school levels modeled by teacher educators. It should enable them to develop attitudes and skills for resolving conflicts in creative manner and reflect on school, curricula, textbooks and pedagogical processes from peace perspective. The teacher educators must involve prospective teachers in understanding role of media and local community on them. Peaceful solutions to the real issues facing trainee teachers may be discussed.

Objectives: To enable teacher trainees to acquire knowledge, attitudes, values, skills and competencies to:

- Become aware of role of education in building peace as dynamic social reality.
- Understand and resolve conflicts within, and mediate others'.
- Empower themselves and transcend barriers of identity.
- Use pedagogical skills and strategies in and out of classroom for promoting peace at school level.
- Act as agency to promote peace in the local community influencing school.

Course Outline

Unit 1: Understanding peace as a dynamic social reality

Peace contexts; underlying assumptions, processes and imperatives.

Peace is a dynamic reality.

Peace values vis-à-vis constitutional values: Importance of the attitudes, beliefs and values of peace viz., compassion, cooperation, love, etc. that foster inner peace and Constitutional values of justice, equality, freedom, respect for differences and ecological resources that ensure peace in society.

Approaches to peace education

Unit 2: Understanding conflicts, underlying personal – social processes and mediation, and transformation of conflict `

Nature of conflict-Incompatibility of needs, aspirations; desires and resulting conflicts at different levels in society: intrapersonal, interpersonal, organizational, interstate, global.

- Understanding the role of social conditions and processes that sustain conflict: limited resources, poverty, political, economic, socio-cultural and ecological conditions, environmental resources viz., water, forests, energy etc.

Unit 3: Orienting education for peace building

Critical reflection on the curricular processes

Awareness of opportunities inherent in curriculum for introducing

Healthy discipline practices in and outside classroom, for their fairness to different gender, caste and cultural groups, child rights/human rights, and ameliorative approach to discipline rather than punitive.

Critical pedagogy of Peace Education

Awareness of pedagogical skills and strategies for removing tensions, examination fear, stress, corporal punishment, violence and conflicts at school level.

- Becoming peace teacher- acquisition of relevant knowledge, attitudes, values and skills
  - Development of listening skills for dialogue- listening to verbal and non-verbal content of messages, developing awareness of feelings and expressions in massages,; skills of questioning, paraphrasing and providing feedback that is, non judgmental, sensitivity to socio-economic, cultural, gender, caste differences.
- Pedagogical skills for orientation of subject content and teaching-learning experience in classroom for promoting peace.

Practical activities to be taken

- Experiential learning sessions on yoga, meditation, communication skills, conflicts their resolution, media influence, cooperative competitive strategies, use of meditation, art, drama, nature to experience harmony.
- Reflective journal to record experiences of the day and reflections thereon during the training programme, sharing and discussing self expression of change during the training.
- Visits to organizations connected with peace and intercultural harmony, and aesthetic appreciation to experience peace as reality submission of reports on experiences.

- Assignments on topics which require deep understanding, and generating creative/alternative ideas to deal with issues and challenges to peace few suggested topics and sharing in groups. Few suggested topics for assignments:
  - Conflicts experienced at home/in family/ in society/ in school etc.
  - Experiences of handling conflicts in a creative manner.
  - Exploring possible strategies of resolving commonly experienced conflicts.
  - Healthy discipline among school children.
  - Identifying challenges of peace in school and dealing with one such challenge.
  - Strategies of promoting healthy relationships on the job.
- Approaches to peace education-case studies of local and international.
- Role plays to enact situations involving conflict, corporal punishment, discrimination, and domestic violence in day-to-day life.
- Films clips displaying, concerns of peace, good intercultural relationships, environmental presentation and other key ideas and discussions thereon, like –Doha Debates, Sadako etc.
- Preparation of collages from newspapers etc. to highlight issues and challenges to peace or positive response to them
- Developing an action plan for peace in school and local community.
- Visiting websites on peace education to become familiar with national and international initiatives, approaches and strategies of peace, case studies of conflict in the region.

Modes of Learning Engagement

The course material should be transacted in experiential manner drawing from a number of resources print, films, exercises, visits, reading of selected papers, write ups etc. It should be made available to teacher trainees with instructions to read material before hand for participation in the discussion in class. The sources could be relevant portions of textbooks with chapters on peace education, and non-violence, selected portions from *Gandhian* literature on *Buniyaadi shiksha* books on self and identity development, communication skills, chapters from psychology texts. A number of materials may not be available locally; the conflicts stories, issues and resolution related articles, editorials/ news and special columns in newspapers could also be used.

A few selections from work and films on prominent philosophers and educators of peace like *Gandhi. Krishanamurthy, Aurobindo, Vivekananda, Rabindranath Tagore, Gopabandhu Dash, the Dalai Lama* could be used to initiate discussion and dialogues followed by assignment on one or two.

Modes of Assessment

Involvement and initiative in self learning, and joining discussions on lectures, films, experiential sessions

- Submission of assignments with the rigour and reflection.
- Reflection journal maintenance and change in beliefs, all attitudes, and vales temperament, cooperation and discipline relevant to peace acquired and exhibited during the training programme.

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Semester-VIII
VISION OF EDUCATION IN INDIA: ISSUES AND CONCERNS

Contact hours: 4 per week
Total marks: 100(Internal-25, External, 75)

Objectives of the course:

Education is essentially a normative endeavour, hence is intentional. It intends, rather deliberately, to socialize children into a value frame or normative structure. That is why history reveals that every education system, at different historical periods, had been guided by certain value concerns. In contemporary times, the education system in India derives its values from the Constitution of India. While socializing children education has to negotiate within the frame of Constitutional values. Indian Constitution envisioned a humane society based on freedom, equality and justice, and this led to evolving many institutions to realize the vision. In this regard, education has been considered as an agency of social transformation and classroom as the shaper of the envisioned destiny. Since teachers ought to play crucial role in realizing the vision, they are to be informed the Constitutional vision so as to develop normative perspectives regarding education and thereby emerging concerns and issues. This normative perspective a teacher holds in turn guides his/her actions and acquires a meaning to action.

Education being an operational area, every citizen perceives several issues related to it through personal experience. The student-teachers need to understand the main issues that touch their functioning as also situate themselves in context. Such an understanding on at least a few issues and concerns will equip student teachers to be ready for dealing with other issues and concerns in the field. This is very relevant as it may not be possible to bring under scrutiny all issues and concerns.

Since, concerns and issues cannot and should not be 'informed' like 'ready to cook facts', the course is designed in such a fashion that prospective teachers would be encouraged to come to terms with concerns and issues that would emerge out of their reasoned engagement with contemporary educational reality in the light of professed humanistic values.

The course is intended to enable the development of perspectives about vision of contemporary educational reality, its concerns and issues Therefore, this course is called 'Seminar Course' which will be provided through deliberations, discussions, dialogues, reflections, library reading and presentations, instead of the usual classroom lectures.

Course Outline

Unit 1: Normative Vision of Indian Education

- Normative orientation of Indian Education: A historical enquiry
- Constitutional provisions on education that reflect national ideals: Democracy, Equality, Liberty, Secularism, and Social Justice.
- India as an evolving Nation State: Vision, Nature and Salient Features- Democratic and Secular polity, federal structure: Implications for Educational system
- Aims and purposes of education drawn from the normative vision

Unit 2: Vision of Education: Four Indian Thinkers

An overview of salient features of the 'philosophy and practice' of education advocated by these thinkers

- Rabindranath Tagore: Liberationist pedagogy
- M.K.Gandhi: Basic education OR Education for self sufficiency
- J. Krishnamurthy: Education for individual and social transformation
- Gopabandhu Das:Satyabadi Bana Vidyalaya

Unit 3: Contemporary Indian Schooling: concerns and issues

- Universalization of School Education
  - Right to Education and Universal access:
    i. Issues of a) Universal enrollment b) Universal retention c) Universal success:
    ii. Issues of quality and equity

  (The above to be discussed with specific reference to physical, economic, social and cultural access particularly to girl child and weaker sections as well as differently abled children)

Unit 4: Contemporary Indian Schooling: concerns and issues

- Equality of Educational Opportunity:

Meaning of Equality and Constitutional Provisions
- Prevailing nature and forms of Inequality including Dominant and Minor groups and the related issues
- Inequality in Schooling**:** Public- private schools, Rural-urban schools, single teachers' schools and many other forms of inequalities in school systems; and the processes leading to disparities
- Differential quality in Schooling: variations in school quality

- Idea of 'common school' system
- Right to Education Bill and its provisions

Unit 5: Education and Development- an Interface

- Education for National Development: Education Commission (1964-66)
- Emerging trends in the interface between:
  - Political process and education
  - Economic developments and education
  - Socio-Cultural changes and education

Modes of Learning Engagement

This is intended to be a seminar course, where students engage with diverse activities around the themes, issues and concerns highlighted in the course. They would engage in a range of self-study and discussion activities.

Suggested modes of learning engagement are:

- Sourcing and studying relevant portions of documents relevant to the themes
- Presentations based on readings (including original writing of at least one educational thinker)
- Conduct surveys of various educational contexts (eg. Schools of different kinds) and make interpretative presentations based on these
- Study writings on analysis of education-development interface and make presentations
- Group discussions, debates and dialogue on the themes
- Individual or group projects to visualize feasible school-based strategies for contributing to 'peace' and 'environmental conservation'

The suggested modes of assessment are:

- Level of initiative, and participation in group work
- Quality of conducting surveys and presentations based on these
- Originality of interpretation of field studies and experiences in terms of the course themes
- Comprehension of ideas of thinkers and presentation of these
- Extent of innovative ideas and sensitivity in visualizing project on 'peace' or 'environmental concerns'
- Individual term paper on a selected theme

Appropriate criteria need to be worked out for each of the above.

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- Varghese, N.V. (1995). *School Effects on Achievement: A Study of Government and Private Aided Schools in Kerala.* In Kuldip Kumar (Ed.) School effectiveness and learning achievement at primary stage: International perspectives. NCERT. New Delhi.
- World Bank, (2004). *Reaching The Child: An Integrated Approach to Child Development*. Oxford University Press, Delhi

Semester-VIII
MANAGEMENT OF SCHOOL

Contact hours: 2 per week
Total marks: 50(Internal-15, External-35)

Aim of the Course

The student teacher should be aware about how the job of the teacher has changed immensely in last decade. The teacher as the head of the school or class teacher has to perform many managerial functions in relation to the management of human and material resources. A professionally trained teacher is expected to have know-how of managing instructional and other school services. The core paper "Management of School" is intended to enable the development of skill how to manage school. The paper will be taught through deliberations, discussion, reflection, school visit, library reading and presentations.

Objectives

Through this Course the student teachers will then be able to:

- Develop understanding of school management
- Undertake management of teaching learning activities in school plant
- Develop action plan for institutional planning
- Understand the importance of management of different resources in school system

Unit-1 School Management: Concept, Process and Importance

- Concept of management and administration, School Management
- Process of school management:Planning,organization,control ,decision making and evaluation; Teacher as a manager
- Problems of school management
- Characteristics of effective school management

Unit-2 Management of Resources in School

- Management of material resources: General class room equipments ;school building,library,laboratory ,assembly hall play ground and surroundings of school
- Management of human resources: organizational climate in school, Professional development of teachers-Self learning, reflective practices,orientation,seminars and colloquium
- School Head/Principal-Personal characteristics and skills, leadership roles and styles, leadership for innovation and change
- School community relationship; Utilizing community resources for school development, Measures to improve the relation between school and community- Parent Teacher Association

Unit-3 Management of Teaching Learning activities

- Class room management:factors of class room management; Managing Cultural diversity in classroom
- Time management: School Calender,Preparation of school time table, factors affecting preparation of time table
- Management of co-scholastic activities in school-cultural, physical, social and creative and recreational activities, School assembly
- Management of Examinations: Continuous and comprehensive evaluation, Preparation of cumulative record card

Modes of Learning Engagement

Modes of learning engagement may include:

- Reflective Written Assignments – comments and grade
- Lecture-cum-discussion, for presentation of overviews

- Study of selected readings and discussions around these
- Anecdotes, experiential and reflective writings.
- Audio-visual clips of learning situations and interactions, analysis and discussion in small groups (as well as large group)
- Making an organizational plan for proper management of resources in school building
- Planning for different type of co-scholastic activities
- Preparation of time table for different type of school
- Preparation of plan for effective management of library/laboratory
- Group presentations of key themes and concepts
- Assignments based on the above

References

Sidhu.K.S (1992).School organization and administration, Sterling Publisher, New Delhi
Khan, M.S (1990).Educational Administration, Asia Publishing House, New Delhi
Mohanty, J (2000) School management, Administration and Suprevision, Deep and Deep, New Delhi
Kochhar, S.K(1994)Secondary School Administration, Sterling Publisher New Delhi

Semester-VIII
FIELD WORK WITH COMMUNITY

Grading in a five point Scale

Objectives: The fieldwork with community programme will enable the pupil teachers :

- to acquaint with the factors working within the society, community i.e. knowledge of social realities
- to develop the dignity of labour among student – teachers
- to arouse their interest in the social and economic reconstruction of the country
- to make the student-teacher aware with the educational problems and needs of the society
- to enable them for preparing youth for sustainable development
- to develop the personality of the student-teacher through community service

The students will spend 8 (Eight) days at a stretch during every academic year in the identified village. Separate activities may be planned every year.

Transaction Mode

Discussion, Rally, Competitions (Debates) Posters and Banner displays Working in community setting, Mass movement, *Nukkad* Performances, Local action group formation, surveys, interviews, action research, case study, dissemination of success stories etc**.**

Content:

Unit – 1 : School community symbiosis – concept, bipolar relationship. Contribution of school in improving the community, Process of involvement of community members to improve the school conditions and practices.

Unit – 2 : Methodology of organizing school-community relationship

Suggested Activities

- micro planning of a school community relationship
- study of the nature of community participation in a secondary school
- survey of community resources for participation in scholastic and co-scholastic activities of a school
- educational survey of a slum area
- report on social customs, traditions and superstition
- survey of a village/town with at least 20 households in order to study the socio-economic andeducational status of the villager
- study of wastage and stagnation in local primary schools
- study of an area in regard to consumption of electricity and water and suggest remedialmeasures
- study of food habits of 10 houses, 5 each of urban and rural area and suggest balanced food
- tree plantation programme in the campus/nearby village
- survey of parent's attitude towards education of their children
- organization of non-formal education centers for dropouts and out of school children in alocality
- organization of campus beautification programme
- survey of the level of value degradation in the community
- identification of problems of parents with respect to education of their children
- survey of value degradation of students as perceived by parents
- implementation of the Lab-Area concept in adopted community

- conducting awareness programmes in the community – like Environment conservation, tree
- Plantation, watershed management, health programmes, like vaccination, polio drop etc.
- AIDS awareness, electoral awareness, road safety, human rights, women rights etc.
- literacy programmes in the community
- cleanliness drives in the community and awareness about its needs
- character building programmes
- developing healthy food habits among the community members
- training of community in some simple vocations for self-employment
- establishing and maintaining library in a community
- remedial teaching work for poor and needy in the community
- action research on local problems in consultation with the community
- micro – planning exercises for assessing the educational status of the community
- establishment of cooperatives in the community
- establishment of Peace-committees and making them functional effectively
- critical review of Adult Education Programmes
- assistance and working with local community in actual relief work whenever needed
- training of community in First Aid
- exploiting the community resources and finding means and ways of using them for school
- helping the children with special needs

Many more such exercises could be conceived. Any such activities could be planned at the institutional level and executed. It is suggested that these activities may be conducted individually or collectively etc. under the supervision of teacher educator.

Evaluation: Grading on Five Point Scale

A – Excellent
B – Very Good
C - Good
D - Average
E - Poor

Syllabus for Four Year Integrated B.Sc.B.Ed. (Subject Specialisation)

SCHEME OF EXAMINATION IN PHYSICS (HONOURS)

Babasaheb Bhimrao Ambedkar Bihar University Muzaffarpur (Bihar)

(Based on NCTE Curriculum Framework for Four year Intigrated B.Ed. Programme)

SCHEME OF EXAMINATION IN PHYSICS (HONOURS)

B.Sc.B.Ed.

Semester-I	**Examination**	
Paper 1.1:	Vector Analysis, Gravitational Interaction, and	
	Properties of Matter(Terminal-60, Sessional-15)	75 marks
Paper 1.2:	Practical	25 marks
Semester-II	**Examination**	
Paper 2.1:	Mechanics, Oscillations, and Waves(Terminal-60, Sessional-15)	75 marks
Paper 2.2:	Practical	25 marks
Semester-III	**Examination**	
Paper 3.1:	Thermal Physicsand Classical Statistical Mechanics	
	(Terminal-60, Sessional-15)	75 marks
Paper 3.2:	Practical	25 marks
Semester-IV	**Examination**	
Paper 4.1:	Electricity, Magnetism,and Electronics (I)	
	(Terminal-60, Sessional-15)	75 marks
Paper 4.2:	Practical	25 marks
Semester-V	**Examination**	
Paper 5.1:	Optics(Terminal-60, Sessional-15)	75 marks
Paper 5.2:	Practical	25 marks
Semester-VI	**Examination**	
Paper 6.1:	Special Theory of Relativity, Atomic Physics,	
	Nuclear Physics (I, II), and Particle Physics	
	(Terminal-60, Sessional-15)	75 marks

Paper 6.2:	Practical	25 marks
Semester-VII	**Examination**	
Paper 7.1:	Quantum Physics, SolidState (I), Laser, Fibre Optics, and Astrophysics (I) (Terminal-60, Sessional-15)	75 marks
Paper 7.2:	Practical	25 marks
Paper 7.3:	(Honours): Quantum Statistics, SolidState (II, III), Properties of Materials, and Astrophysics (II) (Terminal-60, Sessional-15)	75 marks
Paper 7.4:	(Honours): Seminar and Project	25 marks
Semester-VIII	**Examination**	
Paper 8.1:	Electronics (II), and Detectors and Accelerators (Terminal-60, Sessional-15)	75 marks
Paper 8.2:	Practical	25 marks
Paper 8.3:	(Honours): Mathematical Methods and Quantum Physics (III, IV, V) (Terminal-60, Sessional-15)	75 marks
Paper 8.4:	(Honours): Practical	25 marks
	Total	**1000 Marks**

* Paper 4(b) Physics for CBZ 50 marks

SEMESTER I

Physics Paper 1.1: Vector Analysis, Gravitational Interaction, and Properties of Matter

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course the students will be able to

- apply vector analysis to different relevant problems,
- distinguish between different coordinate systems,
- solve second order differential equations and related problems,
- calculate gravitational fields and potential for different bodies,
- Improve understanding of different properties of matter like elasticity, surface tension and viscosity.

Unit 1: Vector Analysis - I

Scalar product and vector product of vectors. Triple scalar product. Vector triple product. Differentiation of vectors with respect to scalars. Expressions for position, velocity and acceleration vectors of a particle. Gradient, divergence, curl: definitions, physical meaning and operations. Laplacian of a scalar.

Unit II: Vector Analysis - II

Ideas of line, surface and volume integrals. Gauss's, Stokes' and Green's theorems. Length element, area element and volume element in different coordinate systems. Curvilinear coordinate systems. Expressions for gradient, divergence and curl in Cartesian, spherical and cylindrical coordinates.

Unit III:Second Order Differential Equations

Second order differential equations with variable coefficients. Linear independence of solutions. Series solution of linear oscillator. Legendre differential equation and its series solution. Legendre polynomial and recurrence relations. Bessel equation, its solution and recurrence relations.

Unit IV: Gravitational Interaction

Gravitation as a fundamental force of nature. Inertial mass and gravitational mass. Gravitational field and potential due to (i) a spherical shell, and (ii) a solid sphere. Variation of acceleration due to gravity owing to rotational motion of the earth. The principle of equivalence. Earth's satellites: characteristic velocity, energy relations in launching a satellite. Global positioning system (GPS).

Unit V: Properties of Matter

Derivation of relations among elastic constants. Torsion of a right circular cylinder. Bending of beams. Vibration of loaded cantilever. Surface tension: pressure difference across curved surfaces and pressure inside a liquid drop and bubble. Poiseuille's formula for steady flow of a viscous liquid: derivation and significance

References:

1. Vector Analysis – M. R. Spiegel (Schaum Series, McGraw Hill)
2. Mathematical Methods for Physicists – G. B. Arfken (Academic Press)
3. Mathematics for Physicists and Engineers – H. A. Pipes (Tata McGraw Hill)
4. Mathematical Physics – B. S. Rajput (Pragati Prakashan)
5. Mathematical Physics – Satyaprakash (Sultan Chand)
6. Essential of Mathematical Physics – P. C. Naik (Kalyani Publishers)
7. Mechanics and Properties of Matter – F. Tyler (Edward Arnold)
8. Classical Mechanics and General Properties of Matter – S. N. Maiti and D. P. Raichaudhury (New Age International)
9. Classical Mechanics of Particles and Rigid Bodies – K. C. Gupta (New Age International)
10. The Feynman Lectures on Physics, Vol. I (Narosa Publishing House)
11. Properties of Matter – F. H. Newman and V. H. L. Searle (Orient Longman)
12. Properties of Matter – D. S. Mathur (S. C. Trust)
13. Physics, International student edition – Marcelo Alonso, Edward J. Finn, (Addison Wesley-1999)

Physics Paper 1.2: Practical

Contact Hours per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25(Expt-18, Viva-4, Record-3)

Objectives:

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

- develop the skill of doing experiments related to properties of matter,
- handle apparatus for doing different experiments in Physics,
- develop the skill of observation and measurement.

List of Experiments:

1. To determine modulus of rigidity of the given rod by Barton's apparatus
2. To measure viscosity of water by capillary flow method
3. To determine Poisson's ratio of rubber
4. To determine Young's modulus by Searle's apparatus
5. To determine Young's modulus of the material of a rectangular bar by bending
6. To measure surface tension of water

7. To determine Young's modulus of wood (a wooden metre scale) by vibration of cantilever
8. To determine viscosity of castor oil by Stokes' method
9. To determine modulus of rigidity, Young's modulus and Poisson's ratio of the material of a flat spiral spring
10. To determine the coefficient of volume expansion of air using constant pressure air thermometer

SEMESTER II

Physics Paper 2.1: Mechanics, Oscillations, and Waves

Contact Hours per Week : 4
Examination Duration : 3 Hours
Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course the students will be able to

- improve understanding of mechanics of a system of particles,
- apply Lagrangian formulation to different relevant problems,
- distinguish between different types of oscillatory motion like harmonic motion, damped harmonic motion and forced harmonic motion,
- use the principle of superposition of different types of waves,
- describe different applications of ultrasonics.

Unit I: Mechanics - I

Rotating frame of reference. Inertial and Coriolis forces. Mechanics of a system of particles. Conservation of linear momentum, angular momentum and energy. Constraints: holonomic and non-holonomic. Degrees of freedom. Generalized coordinates and velocities

Unit II: Mechanics - II

Principle of virtual work. D' Alembert's principle and derivation of Euler-Lagrange's equation. Cyclic coordinates and conservation theorems. Simple applications of the Lagrangian formulation (simple pendulum, Atwood machine).

Unit III: Mechanics - III

Central force and its characteristics. Two-body central force problem and reduction to the equivalent one-body problem. Inverse square law potential and different forms of orbit. Deduction of Kepler's laws of planetary motion and Rutherford scattering cross-section.

Unit IV: Oscillations

Oscillatory motion of a free compound pendulum. Length of equivalent simple pendulum. Damped harmonic oscillator: cases of over-damping, critical damping and under-damping. Logarithmic decrement. Lightly damped system. Forced harmonic oscillation of a lightly damped system. Resonance. Q-factor.

Unit V: Waves

Linearity and superposition principles. System with two degrees of freedom (coupled oscillator). Normal coordinates and modes. Energy transfer. N coupled oscillators. Plucked and struck strings. Wave equation. Traveling waves. Plane and spherical waves. Superposition of two orthogonal harmonic waves with: (i) equal frequencies, (ii) frequencies in the ratio of 1:2. Ultrasonics: properties, production and applications

References:

1. Classical Mechanics – H. Goldstein (Narosa Publishing House)
2. Mechanics – K. R. Symon (Addison Wesely)
3. Theory and Problems of Theoretical Mechanics – M. R. Spiegel (Scaum Series, McGraw Hill)
4. Classical Mechanics – N. C. Rana and P. S. Joag (Tata McGraw Hill)
5. Introduction to Classical Mechanics – R. G. Takwale and P. S. Puranik (Tata McGraw Hill)
6. Mechanics – D. S. Mathur (S. Chand)
7. Waves and Oscillations: Berkley Physics Course, Vol. 3 – F. S. Crawford, Jr. (McGraw Hill)
8. The Physics of Waves and Oscillations – N. K. Baja (Tata McGraw Hill)
9. Waves and Oscillations – N. Subrahmanyam and Brij Lal (Vikash)
10. Sound – M. Ghosh (S. Chand)
11. A Textbook of Sound – N. Subrahmanyam and Brij Lal (Vikash)
12. Oscillations and waves – S.Garg, C.K.Ghosh, S .Gupta, PHI Learning (2009)

Physics Paper 2.2: Practical

Contact Hours per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25(Expt-18, Viva-4, Record-3)

Objectives:

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

- develop the skill of assembling an electrical circuit,
- apply superposition principle to do related experiments.

List of Experiments:

1. To measure 'g' by bar pendulum
2. To measure 'g' by Kater's pendulum
3. To study variation of resistance with temperature
4. To determine ratio of emf's by potentiometer
5. To determine moment of inertia of flywheel
6. To determine modulus of rigidity of a wire by Maxwell needle
7. To measure frequency of an electrically maintained tuning fork by Melde's method
8. To verify the laws of vibration of a string by Sonometer

SEMESTER III

Physics Paper 3.1: Thermal Physics and Classical Statistical Mechanics

Contact Hours per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives:

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

- apply the second law of thermodynamics,
- draw the temperature- entropy diagram,
- distinguish between different thermodynamic potentials,

- establish Maxwell's thermodynamic relations,
- establish different radiation formule like Wien's law, Rayleigh –Jean's law and Plank's law,
- explain the phenomenon of thermoelectricity,
- describe and explain the basics of classical statistical mechanics.

Unit I: Thermodynamics: I

Axiomatic statements of the first and second laws of thermodynamics. Concepts of internal energy and entropy. Conversion of heat into work. Classius inequality. Entropy changes for reversible and irreversible processes. Temperature-entropy diagram.

Unit II: Thermodynamics: II

Exact differentials and state functions. Thermodynamic potentials. Enthalpy. Gibb's and Helmholtz's functions. Maxwell's relations. T dS equation. Change of phase. Condition for equilibrium between phases. Phase diagram. First order phase transition. Classius-Clayperon equation. Chemical potential. Gibbs phase rule and its derivation.

Unit III: Heat Conduction

Thermal conductivity. Differential equation of heat flow in one dimension and its solution. Ingen-Hausz method of determining thermal conductivity. Lee's disc method of determining thermal conductivity of a bad conductor. Radial flow of heat in an isotropic medium.

Unit IV: Radiation and Thermoelectricity

Blackbody radiation. Emissive and absorptive power. Kirchhoff's law. Stefan-Boltzmann law. Energy distribution in blackbody spectrum. Wien's law. Ralyleigh-Jean's law. Planck's law. Thermoelectricity. Seeback and Peltier effects. Thomson effect. Thermodynamics of thermocouple

Unit V: Classical Statistical Mechanics

Macroscopic and microscopic descriptions of a system. Ensembles: microcanonical, canonical and grand canonical. Phase space. Thermodynamic probability. Fundamental postulates of statistical mechanics. Probabilistic interpretation of entropy. Statistical equilibrium. Maxwell-Boltzmann distribution law. Energy and velocity distribution laws for an ideal gas.

References:

1. Treatise on Heat – M. N. Saha and B. N. Srivastava (The Indian Press)
2. Heat and Thermodynamics – M. W. Zemansky and R. H. Ditman (McGraw Hill)
3. Heat and Thermodynamics – D. S. Mathur (Sultan Chand)
4. Heat and Thermodynamics – A. B. Gupta and H. Ray (New Central)
5. Heat and Thermodynamics – Brij Lal and N. Subrahmanyam (Vikash)
6. Advanced Textbook of Heat – P. K. Chakrabarty (Hindustan)
7. Thermodynamics – M. M. Abbott and H. C. Van Ness (Schaum Outline Series)
8. Statistical Thermodynamics – M. C. Gupta (Wiley Eastern)
9. Statistical Mechanics – K. Huang (Wiley Eastern)
10. Statistical Mechanics – B. K. Agarwal and M. Eisner

Physics Paper 3.2: Practical

Contact Hours per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25 (Expt-18, Viva-4, Record-3)

Objectives:

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

- develop the skill of observation and measurement,
- apply the principle of heat and thermodynamics to different experiments.

List of Experiments:

1. To determine the conductivity of a solution using conductivity cell
2. To determine the coefficient of conductivity of a bad conductor by Lee's disc method
3. To determine melting point of wax using Joly's constant volume air thermometer
4. To determine thermal conductivity of copper using Searle's conductivity apparatus
5. To determine mechanical equivalent of heat by Callender and Barne's constant flow method
6. To determine specific heat of a liquid by the method of cooling
7. To calibrate a thermocouple
8. To verify Stefan's law of radiation using tungsten filament lamp

SEMESTER IV

Physics Paper 4.1: Electricity, Magnetism, and Electronics (I)

Contact Hours per Week : 4
Examination Duration : 3 Hours
Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course the students will be able to

- explain the principles of electrostatics,
- derive expression for Q-factor and bandwidth,
- use galvanometer in different experiments,
- describe the working of BJT, FET and MOSFET,
- distinguish different filters,
- describe the principles of different amplifiers and oscillators.

Unit I: Electrostatics

Electric field and potential due to an arbitrary charge distribution: multipole expansion. Force on a dipole placed in a non-uniform electric field. Poisson's and Laplace's equations for potential. Solution of Laplace's equation in spherical coordinates. Electrostatic energy of a system of charges and a uniformly charged sphere.

Dielectric polarization. Field inside a dielectric. Linear dielectric. Susceptibility. Permittivity. Dielectric constant. Molecular field in a dielectric. Clausius-Mossotti relation.

Unit II: Current Electricity

Transients in LCR circuits. Complex quantity formalism of series and parallel resonant circuits. Q-factor and bandwidth. Kirchhoff's law for AC bridges. Anderson's and Owen's bridges for self-inductance measurements. Maxwell's bridge for mutual inductance measurement. de Sauty's bridge for comparison of capacitances. Ballistic galvanometer (moving coil type). Use of ballistic galvanometer to measure high resistance by leakage and magnetic field by search coil.

Unit III: Magnetism and Electromagnetic Induction

Magnetic induction **B**. Vector potential. Ampere's circuital law. Curl and divergence of **B**. Magnetic flux. Electromagnetic induction in a conducting a loop moving through a non-uniform field. Universal law of induction ($\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$). Mutual induction. Reciprocity theorem ($M_{12} = M_{21}$). Self-induction. Energy stored in a magnetic field.

Unit IV: Circuit Analysis and Semiconductor Devices

Circuit elements. Current source – voltage source transformation. Thevenin and Norton theorems. Maximum power transfer. Superposition and reciprocity theorems. Impedance matching.

Transport of charge carriers in semiconductors. Action of BJT, FET and MOSFET with their characteristics.

Half-wave and full-wave rectifiers and their performance. Filter circuits: shunt capacitor, series inductor, L-section and π-section filters. Ripple factor. Zener regulator.

Unit V: Electronic Circuits

Classification of amplifiers. h-parameter equivalent circuit of BJT. CE amplifier. CB amplifier. CC amplifier. Operating point and bias stability of an amplifier. Small signal amplifier. Large signal amplifier. RF amplifier. Concept of feedback. Negative feedback and its effect on amplifier performance. Positive feedback amplifier as an oscillator. LC oscillator. Hartley and Colpit oscillators. Wein bridge oscillator.

References:

1. Classical Electrodynamics – J. D. Jackson
2. Electricity and Magnetism – A. F. Kip

3. Introduction to Electrodynamics – D. I. Griffith (Prentice-Hall India)
4. Electromagnetism – I. S Grant and W. R. Phillips (Wiley)
5. Field and Wave Electromagnetics – D. K. Cheng (Pearson Education)
6. Foundations of Electromagnetic Theory – Reitz and Milford
7. The Feynman Lectures on Physics, Vol. II (Narosa Publishing House)
8. Electricity and Magnetism – C. J. Smith
9. Electricity and Magnetism – D. C. Tayal (Himalayan Publication)
10. Electronic Fundamentals and Applications – J. D. Ryder (Prentice-Hall India)
11. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit
12. Principles of Electronics – V. K. Mehta
13. Principles of Electronics – B.V. N. Rao
14. Handbook of Electronics – Gupta and Kumar
15. Textbook of Electronics – B. B. Swain (Kitab Mahal)

Physics Paper 4.2: Practical

Contact Hours per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25(Expt-18, Viva-4, Record-3)

Objectives:

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

- develop the skill of doing experiments related to electricity and magnetism.
- Recognize different measuring instruments,
- Apply the principle of wheatston bridge to different electrical circuits.

List of Experiments:

1. To compare capacitances by De Sauty's bridge
2. To measure low resistance by Carey-Foster's bridge
3. To determine the frequency of AC mains using a sonometer and an electromagnet
4. To measure horizontal component of earth's magnetic field using a deflection and a vibration magnetometer
5. To study the variation of magnetic field with distance along the axis of a circular coil carrying current
6. To measure internal resistance of a Leclanche cell by Mance's method using P. O. Box
7. To study the variation of filament resistance of a bulb with temperature
8. To determine high resistance by the method of leakage
9. To study induced emf as a function of velocity of a magnet
10. To study growth and decay of current in a LR circuit using a magnetic core inductor
11. To determine quality factor and band width of a series resonant circuit
12. To study resonance in a parallel LCR circuit
13. To determine mutual inductance by Carey Foster's method using AC source and a detector

SEMESTER V

Physics Paper 5.1: Optics

Contact Hours per Week : 4
Examination Duration : 3 Hours
Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course the students will be able to

- explain the basic principles of geometrical optics,
- distinguish between interference, diffraction and polarization,
- describe plane, circular and elliptical polarization,
- state the use of zone plate,
- distinguish between optical processes involving single slit, double slits, and grating,
- derive different laws related to interference, diffraction and polarization.

Unit I: Geometrical Optics

Fermat's principle. Laws of reflection and refraction of light at plane interfaces. Laws of refraction at a spherical surface.

Aberrations of a lens. Longitudinal chromatic aberration. Condition of achromatism for a system of coaxial thin lenses. Spherical aberration. Minimizing spherical aberration.

Unit II:Electromagnetic Theory

Maxwell's equations. Displacement current. Vector and scalar potentials. Gauge transformation. Coulomb gauge and Lorentz gauge. Boundary conditions at interfaces between different media. Wave equation. Plane electromagnetic waves in dielectric media. Poynting theorem and Poynting vector. Polarization of electromagnetic waves. Descriptions of plane, circular and elliptical polarizations.

Unit III: Interference

Two beam interference: Division of wave front. Biprism. Division of amplitude: Michelson interferometer. Circular and straight fringes. Visibility curve. Determination of wavelength and wavelength difference.

Multiple beam interference: Interference in uniformly thick and wedge shaped thin films. Colour of thin films. Newton's rings. Fabry-Perot interferometer and determination of wavelength of light.

Unit IV: Diffraction

Fraunhofer diffraction: Diffraction at a single slit and two parallel slits. Plane diffraction grating. Rayleigh's criterion of resolution. Resolving power of grating, telescope and microscope.

Fresnel diffraction: Division of wave front into half period zones. Rectilinear propagation. Zone plate. Diffraction at a straight edge.

Unit V: Polarization

Polarized and unpolarized light. Plane, circular and elliptic polarizations. Polarization by reflection, refraction and scattering. Brewster's law. Malus law. Light propagation in uniaxial crystal. Double refraction. Nicol prism. Production of circularly and elliptically polarized light. Babinet compensator. Half wave and quarter wave plates.

References:

1. Optics – A. K. Ghatak
2. Textbook of Optics – B. K. Mathur
3. Fundamentals of Optics – F. A. Jenkins and H. E. White
4. Geometrical and Physical Optics – R. S. Longhurst
5. Geometrical and Physical Optics – P. K. Chakraverty
6. A Textbook of Optics – Brij Lal and N. Subrahmanyam
7. Optics and Atomic Physics – Satyaprakash

Physics Paper 5.2: Practical

Contact Hours per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25(Expt-18, Viva-4, Record-3)

Objectives:

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

verify the principles of geometrical optics,

develop the skill of setting experiments related to optics,

develop the skill of using spectrometer and optical bench.

List of Experiments:

1. To determine wavelength of light using Fresenel's biprism
2. To determine refractive index of prism using spectrometer
3. To determine dispersive power of a prism using spectrometer
4. To determine magnifying power of a telescope
5. To measure diameter of a narrow wire by diffraction method
6. To determine wavelength of light using a diffraction grating
7. To determine grating element of a diffraction grating
8. To determine wavelength of light using Newton's rings
9. To measure thickness of a thin plate by interference of light in an air wedge
10. To determine Cauchy's constants using spectrometer

11. To determine principal refractive indices for O-ray and E-ray using calcite and quartz prisms
12. To determine specific rotation of sugar by polarimeter
13. To determine the resolving power of a grating and compare it with its theoretical value

SEMESTER VI

Physics Paper 6.1: Special Theory of Relativity, Atomic Physics, Nuclear Physics (I, II), and Particle Physics

Contact Hours per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives:

On completion of the course, the students will be able to

- describe and justify the postulates of special theory of relativity,
- describe Michelson Morley experiment,
- explain the principles underlying length contraction and time dilation,
- derive mass-energy relation,
- explain the significance of the four-vector space.

Unit I: Special Theory of Relativity

Galilean transformation. Newtonian relativity. Michelson-Morley experiment and its outcome. Postulates of special theory of relativity. Lorentz transformation. Length contraction. Simultaneity. Time dilation. Transformation of velocity. Velocity dependence of mass. Equivalence of mass and energy. Relativistic Doppler effect. Concept of four-vector: position-time, velocity, energy-momentum.

Unit II: Atomic Physics

Bohr-Sommerfeld model of atom. Elliptic orbits and relativistic mass correction. Space quantization. Electron spin. Vector model of atom. Quantum numbers. Selection rules. Intensity rules. Spectral terms and their notations. Spin-orbit coupling. and fine structure effects. Sodium D lines. Bohr magneton and Stern-Gerlach experiment. Anomalous and normal Zeeman effects. Pauli's exclusion principle. Bohr-Stoner scheme. L-S and J-J couplings. Explanation of the periodic table of elements.

Unit III: Nuclear Physics (I)

Basic properties of atomic nucleus: constituents, charge, mass, size, spin, magnetic dipole moment, qudrupole moment. Nuclear force and its characteristics. Yukawa potential and its interpretation. Liquid drop model. Semi-empirical mass formula. Nuclear fission.

Unit IV: Nuclear Physics (II)

Elementary ideas of shell model. Magic numbers. Elementary ideas on α decay (Gamow's theory), β decay (neutrino hypothesis) and gamma decay. Nuclear fusion reaction. Source of stellar energy: carbon-carbon cycle and proton-proton cycle

Unit V: Fundamental Interactions and Particles

Basic forces of nature, their relative strength and range. Quantum numbers and classification of elementary particles: hadrons, leptons, mesons, and baryons. Quark structure of hadrons. Quantum numbers of quarks. Generations of leptons and quarks. Elementary ideas of unification of forces: electro-weak unification, grand unification, and super unification (No derivations required).

References:

1. Introduction to Special Relativity – R. Resnick (Wiley Eastern)
2. Atomic Physics – J. B. Rajam
3. Atomic Spectra – H. E. White
4. Concepts of Modern Physics – A. Baiser (Tata McGraw-Hill)
5. Modern Physics – J. Bernstein, P. M. Fishbane and S. Gasiorowicz (Pearson Education)
6. Physics of Atoms and Molecules – B. H. Bransden and C. J. Joachain (Pearson Education)
7. Introduction to Modern Physics – H. S. Mani and G. K. Mehta
8. Modern Physics – B. V. N. Rao (Wiley Eastern)
9. A Textbook of Modern Physics – K. C. Lal and S. I. Ahmad
10. Modern Physics – R. Murugeshan (S. Chand)
11. Atomic and Nuclear Physics – A. B. Gupta and Dipak Ghosh
12. Concepts of Nuclear Physics – B. L. Cohen
13. Nuclear Physics – Kaplan
14. Nuclear Physics – D. C. Tayal (Himalaya)

Physics Paper 6.2: Practical

Contact Hours per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25(Expt-18, Viva-4, Record-3)

Objectives:

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

- develop skill to use different instruments like CRO in different electronic circuits,
- develop the skill of drawing graphs,
- interpret the graphs.

List of experiments:

1. To determine self-inductance by Anderson's bridge
2. To determine self-inductance by Owen's bridge
3. To study characteristics of a vacuum diode
4. To study characteristics of a vacuum triode
5. To study characteristics of semi conductor diode and Zener diode
6. To study transistor characteristics in common base configuration
7. To study transistor characteristics in common emitter configuration
8. To determine e/m for electron by helical method
9. To determine e/m for electron by Thomson's method
10. To study waveform of a given oscillator using a CRO and hence determine its frequency
11. To compare frequencies of oscillations due to two audio oscillators using Lissajous figures

SEMESTER VII

Physics Paper 7.1: Quantum Physics, SolidState (I), Laser, Fibre Optics, and Astrophysics (I)

Contact Hours per Week : 4
Examination Duration : 3 Hours
Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course the students will be able to

- describe the emergence of quantum mechanics,
- explain operator formalism and its significance,
- calculate the packing fraction of different crystal structures,
- derive Bragg diffraction condition,
- describe the uses of laser and optical fibre
- describe and explain the various aspects of astrophysics.

Unit I: Quantum Physics (I)

Inadequacy of classical mechanics: Energy distribution in the spectrum of blackbody radiation, Planck's law; Photoelectric effect. Compton effect. Matter-wave representation of a free particle and Schrödinger's velocity paradox. Superposition of matter waves and wave packet representation. Phase velocity and group velocity. Heisenberg's uncertainty principle and its application to the ground state energy of harmonic oscillator.

Unit II: Quantum Physics (II)

Time-dependent Schrödinger's equation for a free particle and particle in a force field. Born's physical interpretation of wave function. Normalization of wave function. Operator representations of co-ordinate, momentum and energy. Equation of continuity. Probability density and probability current density.
Time-independent Schrödinger's equation. Stationary states. Application of time-independent Schrödinger's equation in one-dimension: (a) Particle in a box; (b) Potential step.

Unit III: SolidState-I: Crystal Structure and X-Ray Diffraction

Amorphous and crystalline solids. Crystal lattice. Basis. Lattice translation vectors. Unit cell. Prmimitive cell, Wigner Seitz cell. Bravais lattices. Cubic lattices. Packing fraction of sc, bcc, fcc and hcp structures. Miller indices. Interplanar spacing, Simple crystal structures like NaCl, CsCl and diamond.

Determination of crystal structure by x-ray diffraction. Bragg's law. Reciprocal lattice. Brillouin zones. Derivation of scattered wave amplitude, Diffraction condition, Laue conditions.

Unit IV: Coherence, Laser and Fibre Optics

Coherence: Purity of spectral line. Coherence length and coherence time. Spatial and temporal coherence. Partial coherence.

Laser as a coherent source of radiation. Spontaneous and stimulated emission of radiation. Einstein's coefficients. Condition for laser action. Population inversion. Pumping mechanism. Optical feedback. Resonators. Properties and uses of laser. Examples of laser: ruby laser, gas laser, semiconductor laser.

Structure of optical fibre. Principle of propagation of electromagnetic waves through optical fibre. Classification of optical fibre. Fibre optic communication system

Unit V: Astrophysics (I)

Ways of observing stellar bodies through visible, radio and infrared radiations. Apparent and absolute magnitude of stars. The Harvard classification of stars. Hertzspurg-Russel diagram. Determination of velocity and distance of a heavenly body. Hubble's law. Doppler shift. Cosmic microwave background radiation.

References:

1. Quantum Mechanics – L. I. Schiff
2. Quantum Mechanics – J. L. Powell and B. Craseman (Narosa)
3. Quantum Physics – S. Gasiorowicz
4. Quantum Mechanics – B. H. Bransden and C. J. Joachain (Pearson Education)
5. Modern Quantum Mechanics – J. J. Sakurai (Pearson Education)
6. Quantum Mechanics – V. K. Thankappan (New Age International)
7. Quantum Mechanics – S. L. Gupta, V. Kumar, H. V. Sharma and R. C. Sharma (Jai Prakash Nath)
8. Laser and Nonlinear Optics – B. B. Laud (John Wiley)
9. An Introduction to Lasers – M. N. Avadhanulu (S. Chand)
10. Communication Through Optical Fibre – A. Ghatak (Tata McGraw-Hill)
11. References: Introduction to SolidState Physics – C. Kittel (Wiley Eastern)
12. Elements of SolidState Physics – J. P. Srivastava (Prentice-Hall India)
13. SolidState Physics – S. O. Pillai (New Age International
14. Discovering the Universe – Bernard and Joyce Lovell (ELBS)
15. A History of Astronomy – A. Pannekoek (Interscience)
16. Astrophysics – W. K. Rose (Holt, Rinehart and Winston)
17. Planets, Stars and Galaxies – S. J. Inglis (John Wiley and Sons)
18. The Universe in a Nutshell – S. Hawking (Bantam Press)
19. Discovering the Universe – Bernard and Joyce Lovell (ELBS)
20. A History of Astronomy – A. Pannekoek (Interscience)

Physics Paper 7.2: Practical

Contact Hours per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25(Expt-18, Viva-4, Record-3)

Objectives:

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

- understand the skill of oscillator circuit,
- apply the principle of LASER to different experiments.

List of Experiments:

1. To determine band gap energy of a thermistor
2. To study of WienBridge oscillator
3. To determine frequency of Hartley and Colpitt's oscillator
4. To study rectifiers with filters and measurement of ripple factors
5. To verify Thevenin's, Norton's and superposition theorems
6. (a) To test monochromaticity of the given laser
   (b) To measure the divergence of the given laser beam (with and without a lens)
7. To verify laws of reflection and the laws of refraction using the given laser
8. To study double slit interference due to He-Ne laser
9. To determine thermionic work function of tungsten using a directly heated diode
10. To measure peak, average and rms values of a signal using an electronic voltmeter
11. To study the effect of variation in the dc load resistance on dc bias condition and voltage gain of CE amplifier
12. To determine the bandwidth and the mid-frequency open-circuit voltage gain of a single stage RC-coupled CE amplifier

Physics Paper 7.3: (Honours): Quantum Statistics, SolidState (II, III), Materials Science, and Astrophysics (II)

Contact Hours per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	75(Terminal-60, Sessional-15)

Objectives

On completion of the course, the students will be able to

- describe and explain the basic principles of quantum statistics,
- derive Wiedman-Franz law,
- explain the band theory of solids,
- differentiate between different magnetic materials,
- distinguish between different superconducting materials.
- describe the applications of nano-materials,
- describe the formation and evolution of stars and galaxies,
- distinguish between different types of stars.

Unit I: Quantum Statistics

Fermi-Dirac distribution: derivation and significance. Free electron gas model of metals. Specific heat of metals. Electrical conductivity and Ohm's law. Thermal conductivity in metals. Wiedman-Franz law. Bose-Einstein distribution: derivation and significance. Bose-Einstein condensate.

Unit II: Solid State-II: Magnetic Properties of Solids

Classification of magnetic materials: Dia, para, ferri and ferromagnetic materials. Langevin's theory of dia and paramagnetism. Gyromagnetic ratio. Quantum theory of paramagnetism. Ferromagnetism. Curie-Weiss law. Hysteresis. Energy loss due to hysteresis. Antiferromagnetism. Ferrimagnetism and ferrites.

Unit III: Solid State-III : Band Theory of Solids

Nearly free electron model. Origin of energy gap. Bloch function. Bloch theorem. Kronig-Penney model. Effective mass of electron. Concept of hole. Band gaps. Difference between conductors, semiconductors and insulators. Intrinsic and extrinsic semiconductors. p-type and n-type semiconductors. Conductivity in semiconductors. Hall effect in semiconductors (qualitative).

Unit IV: Materials Science

Superconducting materials. Meissner effect. Characteristics of a superconductor. Types of superconductor. Thermodynamic properties of superconductors. London equation. BCS theory of superconductivity (simple ideas only). Applications of high-T_c superconductors and metallic superconductors. Nano-materials and their characteristics. Applications of different nano-materials in medicine, industry, agriculture. CMR and GMR materials and their characteristics. Applications of CMR and GMR materials.

Unit V: Astrophysics-II

Formation and evolution of stars and galaxies. First generation stars. White dwarf. Chandrasekhar limit. Red giants. Neutron stars. Black holes. Dark matter. Second generation stars. Our galaxy and the sun. The expanding universe. Origin of the universe: the big bang theory, the steady state theory, the oscillating universe theory. Future of the universe.

References:

1. Statistical Thermodynamics – M. C. Gupta (Wiley Eastern)
2. Statistical Mechanics – K. Huang
3. Statistical Mechanics – B. K. Agarwal amnd M. Eisner
4. Quantum Mechanics, Statistical mechanics and Solid State Physics: An Introduction – D. Chattopadhyay and P. C. Rakshit (S. Chand)
5. Introduction to SolidState Physics – C. Kittel (Wiley Eastern)
6. Elements of SolidState Physics – J. P. Srivastava (Prentice-Hall India)
7. SolidState Physics – A. J. Dekker (Mc Millan)
8. Introduction to Superconductivity – A. C. Rose-Innes and E. H. Rhoderick (Pergamon Press)
9. Superconductivity – E. A. Lynton (Methuen)
10. Science of Engineering Materials – C. M. Srivastava and C. Srinivasan (New Age International)
11. Astrophysics – W. K. Rose (Holt, Rinehart and Winston)
12. Planets, Stars and Galaxies – S. J. Inglis (John Wiley and Sons)
13. The Universe in a Nutshell – S. Hawking (Bantam Press)
14. Discovering the Universe – Bernard and Joyce Lovell (ELBS)
15. A History of Astronomy – A. Pannekoek (Interscience)
16. Modern Physics – G. Aruldhas and P. Rajagopal (PHI)

Physics (Honours) Paper 7.4: Seminar and Project

Contact Hours per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25

Objectives:

Oncompletion of the course, the students will be able to:

- investigate various principles of physics,
- develop the power of analysis,
- develop the skill of oral presentation using ICT.

1. Project : 15 marks

2. Seminar : 10 marks

SEMESTER VIII

Physics Paper 8.1: Electronics (II), Detectors, and Accelerators

Contact Hours per Week : 4
Examination Duration : 3 Hours
Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives

On completion of the course, the students will be able to

- explain the principles underlying switching circuits,
- distinguish between adder, subtractor, differentiation and integrator,
- explain the process of radio transmission,
- describe the working of detectors and accelerators.

Unit I: Switching Circuit

Comparison between mechanical, electromechanical and electronic switches. Switching transistor. Multivibrators: free running, one-shot, flip-flop multivibrators. Wave shaping circuits. Integrating circuits. Clipping circuits. Clamping circuits.

Unit II : Operational Amplifier (Op-amp)

Equivalent circuit of op-amp. Power supplies for op-amp. Differential amplifier and its operational analysis. Parameters of op-amp. Open-loop op-amp configurations. Closed-loop op-amp configurations. Op-amp as adder, subtractor, differentiator and integrator.

Unit III: Digital Electronics

Difference between analog and digital circuits. Logic gates: AND, OR, NOT, NAND, NOR, and exclusive OR. NAND and NOR gates as universal gates. AND and OR gates using diodes. NOT gate using transistors. NOR and NAND gates using diode-transistor logic (DTL). Laws and rules of Boolean algebra. Boolean expressions and truth tables. De-Morgan theorems and applications. Combinational logic using NAND and NOR gates. Standard forms of Boolean expressions, SOP form and POS form.

Unit IV: Radio Wave Transmission

Modulation: significance and types. AM. Modulation index. Side bands. AM transmitter. FM. FM transmitter. Comparison between AM and FM. Demodulation. AM detection. Linear diode detector with capacitor filter. FM detection.

Unit V: Detectors and Accelerators

Principle of detection of radiation and particles. Classification of detectors. Ionization chamber. Geiger-Muller counter. Scintillation counter. Cloud chamber. Principle of acceleration of particles. Linear accelerator (Drift tube type). Cyclotron. Betatron.

References:

1. Functional Electronics – K. V. Ramanan (Tata McGraw-Hill)
2. Electronic Principles – A. P. Malvino (Tata McGraw-Hill)
3. Electronic Devices and Circuits – G. K. Mittal (Khanna)
4. Modern Electronic Circuit Design – D. J. Comer (Addison-Wesely)
5. Electronics – E. J. Angelo (McGraw-Hill)
6. Electronic Devices and Circuits – Allen Mottershed (Prentice-Hall India)
7. Operational Amplifiers and Linear Integrated Circuits – (Prentice-Hall)
8. Digital Electronics – A. Kapoor

Physics Paper 8.2: Practical

Contact Hours per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25(Expt-18, Viva-4, Record-3)

Objectives:

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

- verify the basic principles of digital electronics,
- develop the skill of handling instruments like Michelson and Fabry-Perot interferometer,
- determine various characteristics using OPAM.

List of experiments:

1. To study the characteristics of FET
2. To study voltage doubler circuit
3. To construct OR, AND, NOT and NAND gates using discrete circuit components and to verify their truth tables

4. To verify truth tables for OR, AND and NOT gates, verify De Morgan's theorem and establish NAND/NOR gates as universal gates
5. To study a WienBridge oscillator
6. To study differentiating and integrating circuits
7. To study the characteristics of a photo-voltaic cell (solar cell)
8. To verify the inverse square law of radiation using a photo-voltaic cell
9. To determine an unknown wavelength of light by Michelson's interferometer
10. To determine an unknown wavelength of light by Fabry Perot interferometer
11. To determine the transfer characteristics of inverting type and non-inverting type comparators using OPAMP with reference voltage $V_R > 0$ and $V_R < 0$
12. To study the characteristics of LDR

Physics (Honours) Paper 8.3: Mathematical Methods, and Quantum Physics (III, IV and V)

Contact Hours per Week	:	4
Examination Duration	:	3 Hours
Maximum Marks	:	75 (Terminal-60, Sessional-15)

Objectives

On completion of the course, the students will be able to solve problems related to Fourier series, Fourier transform, beta and gamma functions, and functions of complex variable, use operator formalism, solve problems using Schrödinger equation, explain and use the properties of orbital angular movement of operator.

Unit I: Fourier Series, Fourier Transform,Beta and Gamma Functions

Fourier series. Dirichlet conditions (statement only). Sine and cosine series and their orthogonality and completeness. Distinctive features of Fourier expansion. Fourier transform. Beta and gamma functions. Relations between beta and gamma functions. Evaluation of simple integrals using beta and gamma functions.

Unit II: Functions of Complex Variables

Complex variables. Analytic functions. Cauchy-Riemann condition. Cauchy's theorem. Cauch's integral formula. Taylor and Laurent's series. Singularities. Simple poles. Residues. Cauchy's residue theorem. Evaluation of simple integrals.

Unit III:Quantum Physics - III

Physical observables as operators. Linear operators. Adjoint operators. Hermitian and unitary operators. Commutator algebra for operators. Non-commutative operators and derivation of uncertainty relation. Gaussian packet as a minimum uncertainty wave packet. Spreading of a Gaussian packet. Time-dependence of expectation values. Ehrenfest's theorem. Quantum virial theorem..

Unit IV:Quantum Physics - IV

Eigenvalues and eigenfunctions of Hermitian operators. Simultaneous eigenfunctions. Degenerate eigenfunctions. Ortho-normality. Linear independence of eigenfunctions. Schmidt's orhogonalization procedure. Eigenfunction expansion of an arbitrary wave function. Closure property. Time-independent Schrodinger's eqation in one dimension: Rectangular potential barrier, reflection and transmission coefficients, barrier penetration and penetration probability; Bound state solutions for rectangular potential well and one-dimensional harmonic oscillator. Parity operator and symmetry properties of wave functions under parity operation.

Unit V:Quantum Physics - V

Orbital angular momentum operator $\mathbf{L} = \mathbf{r} \times \mathbf{p}$. $\mathbf{L_x}$, $\mathbf{L_y}$, and $\mathbf{L_z}$ in Cartesian system. $\mathbf{L_x}$, $\mathbf{L_y}$, $\mathbf{L_z}$ and $\mathbf{L^2}$in spherical polar coordinates. Commutator algebra for $\mathbf{L_x}$, $\mathbf{L_y}$, $\mathbf{L_z}$ and $\mathbf{L^2}$. Raising and lowering operators $\mathbf{L_+}$and $\mathbf{L_-}$. Eigenvalues and eigenfunctions of. $\mathbf{L^2}$ and $\mathbf{L_z}$. Parity of angular momentum eigenfunctions. Rigid rotator. Particle on the surface of a sphere.

References:

1. Mathematical Methods for Physicists – G. B. Arfken (Academic Press)
2. Mathematics for Physicists and Engineers – H. A. Pipes (Tata McGraw Hill)
3. Mathematical Physics – B. S. Rajput (Pragati Prakashan)
4. Mathematical Physics – Satyaprakash (Sultan Chand)
5. Essential of Mathematical Physics – P. C. Naik (Kalyani Publishers)
6. Quantum Mechanics – L. I. Schiff
7. Quantum Mechanics – J. L. Powell and B. Craseman (Narosa)
8. Quantum Physics – S. Gasiorowicz
9. Quantum Mechanics – B. H. Bransden and C. J. Joachain (Pearson Education)
10. Modern Quantum Mechanics – J. J. Sakurai (Pearson Education)
11. Quantum Mechanics – V. K. Thankappan (New Age International)
12. Quantum Mechanics – S. L. Gupta, V. Kumar, H. V. Sharma and R. C. Sharma (Jai Prakash Nath)

Physics Paper 8.4: Practical

Contact Hours per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25(Expt-18, Viva-4, Record-3)

Objectives:

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

apply the principles of electronics to various circuits,

develop skill of plotting and interpreting graphs.

List of Experiments:

1. To construct and study an astable multivibrator
2. To study a MOSFET
3. To study RS, D and JK flipflops
4. To study the behaviour of ultrasonic vibrations
5. To study modulation and demodulation of waves
6. To study sensitivity and selectivity of the given radio receiver using a dummy antenna
7. To determine Planck's constant using a photo-voltaic cell
8. To determine loss of energy per cycle due to Hysteresis for the given metal using a CRO
9. To determine dielectric constant of the given solid using Lecher wire
10. To study counting statistics in radioactivity using a GM counter
11. To study Hall effect
12. To determine electronic charge by Millikan's method
13. To construct a low-pass filter and a high-pass filter of cutoff frequency f_{CO} and study their frequency response

Syllabus for Four Year Integrated B.Sc.B.Ed. (Subject Specialisation)

SCHEME OF EXAMINATION IN MATHEMATICS (HONOURS)

Babasaheb Bhimrao Ambedkar Bihar University Muzaffarpur (Bihar)

(Based on NCTE Curriculum Framework for Four year Intigrated B.Ed. Programme)

SCHEME OF EXAMINATION IN MATHEMATICS (HONOURS)
B.Sc.B.Ed.

FIRST YEAR

Semester-I Examination

Paper-1.1 **Calculus, Ordinary Differential Equation and Analytical Solid Geometry**

a)	Calculus	25 marks
b)	Ordinary Differential Equations	20 marks
c)	Analytical Solid Geometry	15 marks
	Sessional	15 Marks
Paper-1.2	Practical	25 marks

Semester-II Examination

Paper-2.1 **Analysis-I, Abstract Algebra andTheory of Equations**

a)	Analysis-I	30marks
b)	Abstract Algebra & Theory of Equations	30 marks
	Sessional	15 Marks
Paper-2.2	Practical	25 marks

SECOND YEAR

Semester-III Examination

Paper-3.1 **Advance Calculus and Linear Algebra**

a)	Advance Calculus	30 marks
b)	Linear Algebra	30 marks
Sessional		15 Marks
Paper-3.2	Practical	25 marks

Semester-IV Examination

Paper-4.1 **Partial Differential Equation and Number Theory**

	a)	Partial Differential Equation	30 marks
	b)	Number Theory	30 marks
		Sessional	15 Marks
Paper-4.2		Practical	25 marks

THIRD YEAR

Semester-V Examination

Paper-5.1	**Probability Theory**	60 Marks
	Sessional	15 Marks
Paper-5.2	Practical	25 marks

Semester-VI Examination

Paper-6.1 **Programming in 'C' and Trigonometry**

	a)	Programming in 'C'	30 marks
	b)	Trigonometry	30 marks
		Sessional	15 Marks
Paper-6.2		Practical	25 marks

FOURTH YEAR

Semester-VII Examination

Paper-7.1 **Analysis-II (R & C) and Discrete Mathematics**

	a)Analysis-II (R & C)	35 marks
	b)Discrete Mathematics	25 marks
	Sessional	15 Marks
Paper-7.2	Practical	25 marks

Paper-7.3 **(Honours)Mathematical Modeling and Mechanics**

a) Mathematical Modeling	35marks
b) Mechanics	25 marks

	Sessional	15 Marks
Paper-7.4	(Honours) Practical	25 marks

Semester-VIII Examination

Paper-8.1	**Operation Research and Differential Geometry**		
	a)	Operational Research	30 marks
	b)	Differential Geometry	30 marks
		Sessional	15 Marks
Paper-8.2	Practical		25 marks
Paper-8.3	(Honours) **Numerical Analysis**		60 Marks
	Sessional		15 Marks
Paper-8.4	(Honours) Practical		25 marks
		Total	**1000 marks**

* Paper 4(a) Mathematics for CBZ 50 marks

SEMESTER-I

Mathematics Paper-1.1 : Calculus, Ordinary Differential Equation and Analytical Solid Geometry

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

After studying this paper, students should be able to –

- define the terms curvature and asymptote,
- derive the formulae for curvature and asymptote in different forms,

- develop the strategy to trace the graphs of different curves,
- define the terms rectification, quadrature, volume and surface area of solid of revolution,
- derive the formulae for rectification, quadrature, volume and surface area of solid of revolution,
- solve problems based on above knowledge,
- solve the ordinary differential equations of the first and second order in different forms and apply these to solve some practical problems,
- develop an understanding of laplace transformation,
- acquire the knowledge of different equations of sphere, cones and cylinders and solve real life problem on them.

Calculus

Unit-I

Curvature, Asymptotes. Tracing of curves (Cartenary, Cycloid, Folium of Descartes, astroid, limacon, cissoid and loops)

Unit-II

Rectification, quadrature, Volume and surface area of solids of revolutions.

Books Recommended :

1. Textbook of Calculus, Part-II – Shantinarayan, S. Chand and Co., Ch.8 (Art 24, 25 & 26)
2. Textbook of Calculus, Part-III – Shantinarayan, S. Chand and Co., Ch.1 (1 & 2), 3, 4 (Art 10-12 omitting Simpsons Rule), 5 (Art 13) and 6 (Art 15).

Ordinary Differential Equations

Unit-III

Ordinary differential equations of 1^{st} order and 1^{st} degree (variables separable, linear homogenous, exact), Equations of 1^{st} order and higher degree.

Unit-IV

Second order linear equation with constant coefficients, homogeneous forms second order equation with variables coefficients, variation of parameters, Laplace Transformations and its application to solutions of differential equations.

Books Recommended :

1. A course of Ordinary and Partial differential equations – Dr. J. Sinnaroy and Dr. S. Padhy, Kalyani Publisher, Ch.2.1 to 2.7), 3, 4 (4.1 to 4.7), 5, 9, (9.1, 9.2, 9.4, 9.5, 9.10, 9.11, 9.13)

Analytical Solid Geometry

Unit-V

Sphere : Plane section of a sphere, intersection of two spheres, sphere with a given diameter. Equation, sphere through a given circle.

Cones and Cylinders : Definition, Equation of a cone with a conic as guiding curve. The Right circular cone, its definition and equation. Definition and Equation of Cylinder Enveloping cylinders. Definition and Equation of right circular cylinder.

Conicold : General equation of conicold, shapes of some surfaces.

Books Recommended :

1. Analytical Solid Geometry – Shanti Narayan and P. K. Mittal, S. Chand and Co.

   Chapters : 6(6.3, 6.3.1, 6.3.2, 6.3.3, 6.4, 6.4.1, 6.5, 6.6, 6.6.1, 6.7, 6.7.1), 7 (7.1), 7.1.1, 7.1.2, 7.2, 7.4, 7.4.1, 7.4.2, 7.6, 7.6.1, 7.7, 7.7.1, 7.6, 7.8.1, 7.8.2), 8 (8.1, 8.2, 8.3, 8.3.1, 8.3.2, 8.3.3)

Mathematics Paper-1.2: Practical

Contact Hours per week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 1.1
- Mathematics project
- Seminar

SEMESTER-II

Mathematics Paper-2.1 : Analysis-I, Abstract Algebra and Theory of Equations

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

After studying this paper, students should be able to –

- recall the basic algebraic properties of real numbers like order completeness, density, countability and uncountability,
- define a sequence and convergence of a sequence,
- prove different theorems on convergence of sequence and subsequence,
- solve problems on sequences and their convergence,
- develop the concepts of abstract algebra involving groups and rings and their various properties,
- solve the algebraic equations involving higher degree.

Analysis-I

Unit-I

Algebra of real numbers, order completeness (continium). Density, Decimal representation of real numbers, Cardinality, Countability and uncountability (restricted). Convergence of sequences, Limit theorems, Wierstrass, Completeness Principle, Cantor's completeness principle, subsequences and Bolzano-Wierstrass theorem.

Unit-II

Cauchy's completeness principle, Convergence of series and series of positive terms, Analytic properties of R and C.

Unit-III

Limits and continuity of a function, Discontinuities properties, Infinite limit and limit at infinity, Uniform continuity, Differentiability of functions, Mean-Value theorems, Indeterminate forms, Hogher order derivatives and Taylor's theorem.

Books Recommended :

1. Fundamentals of Mathematical Analysis – G. Das and S. Patnaik (TMH), Ch.2 (2.2 to 2.7), 3 (3.2, 3.3, except proofs of Thm 2 and Thm (3, 3.4), 4 (4.1 to 4.7, 4.10, 4.11), 5 (5.1 to 5.5), 6 (6.1 to 6.7, 6.9), 7 (7.1 to 7.6).

Abstract Algebra & Theory of Equations

Unit-IV

The integer, Groups and Sub-groups, Normal subgroups, Quotient groups, group homomorphism.

Unit-V

i) Rings, special types of rings, ideals and quotient rings, Ring Homomorphism.

ii) Preliminaries, property of equations, Descrate's Rules of Science, Relation between Roots and Coefficients. Solution of cubic Candanan's method. Solution of Biquadratic.

Books Recommended :

1. Topics in Algebra – I. N. Herstein (Vikas Publishing), Ch.1 (1.3), 2 (2.1 to 2.7), 3 (3.1 to 3.5)
2. Theory of Algebra – Chandrika Prasad (Pothisala), Ch.11 (11.1 to 11.4), 12 (12.1 to 12.3, 12.6)

Mathematics Paper-2.2 : Practical

Contact Hours per week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 2.1
- Mathematics project
- Seminar

SEMESTER-III

Mathematics Paper-3.1 : Advance Calculus and Linear Algebra

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

After studying this paper, students should be able to –

- identify different concepts in advance calculus and linear algebra,
- define the limit and continuity of a function of several variables,
- differentiate between ordinary derivatives and partial derivatives and prove different theorems on functions of several variables,
- solve the problems on maxima and minima,
- develop the various concepts in vector calculus involving gradient, div., curl of a vector,
- prove important theorems like Stoke's and Green's theorems,
- develop the understanding of vector space, linear transformations, matrix and determinant theory,
- analyse and solve some problems based on the above concepts.

Advance Calculus

Unit-I

Limits and continuity of function of several variables, partial derivatives, homogenous functions, change of variables, Mean value theorem and Maclaurin's theorem.

Unit-II

Maxima and Minima of function of two and three variables, (NASC without proof), Lagranges Multiplier, Multiple integral.

Vector differentiation, Grad, div, curl, line integral, surface and volume integrals; Statements of Gauss, Stoke's and Green's theorems (without proof).

Books Recommended :

1. Mathematical Analysis – S. C. Mallick, S. Arora and others (New Age International), Ch.15 (1 to 10), 17, 18.

2. Topics in Calculus – R. K. Panda and P. K. Satapathy

Linear Algebra

Unit-III

Vector space, sub-space, span, linear dependence and independence, dimensions and basis.

Unit-IV

Linear transformations, range, Kernal, rank, nullity, inverse of a linear map. Rank nullity theorem, matrices and linear maps, Rank and Nullity of a matrix, transpose of a matrix, types of matrices.

Unit-V

Elementary row operations system of linear equations, Matrix inversion using row operations, Determinant, Minors and rank of matrices, Eigen values, Eigenvectors. Quadratic forms.

Books Recommended :

1. An introduction to Linear Algebra – V. Krishnamurthy, V. P. Mainra, J. L. Arora (EWP). Ch.3, 4 (4.1 to 4.7), 5 (except 5.3), 6 (6.1, 6.2, 6.5, 6.6, 6.8), 7 (7.4 only).

Mathematics Paper-3.2 : Practical

Contact Hours per week : 2

Examination Duration : 3 Hours

Maximum Marks : 25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 3.1
- Mathematics project
- Seminar

SEMESTER-IV

Mathematics Paper-4.1: Partial Differential Equation and Number Theory

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

After studying this paper, students should be able to –

- develop the proper knowledge in the areas of partial differential equation and number theory,
- solve linear and non-linear partial differential equations,
- state and prove different theorems on divisibility like division algorithm, fundamental theorem of arithmetic,
- develop the concept of congruence relation and feel the importance of this concepts in study of number theory,
- solve problems on the above concepts.

Partial Differential Equation

Unit-I

Linear partial differential equations.

Unit-II

Non-linear partial differential Equations of the First Order, Linear Partial differential Equations with Constant Co-efficients, Equations Reducible to Linear forms Partial Differential Equations with variable co-efficients, some standard forms of variable co-efficients, Non-Linear Equations of the Second Order.

Books Recommended :

1. A Course on Ordinary and Partial Difference equations (with Applications) - J. Sinharoy, S. Padhy, Kalyani Publishers. Articles : 11.1 to 11.4, 12.1 to 12.6, 13.1 to 13.5, 13.7.

Number Theory

Unit-III

Divisibility, Prime numbers, The Binomial Theorem and its application.

Congruences, Format's Theorem, Euler's Theorem, Wilson's Theorem.

Soluton of Congruences, the Chinese Remainder Theorem.

Statements of Theorems 2.19 and 2.20 only, Public-Key Cryptography.

Unit-IV

Quadratic Reciprocity and Quadratic Forms.

Unit-V

Some functions of Number Theory, Solution of Diophantine Equations.

Books Recommended :

1. An Introduction to the Theory of Numbers – Ivan Niven, Herberts Zuckermang, Hygh L. Montgomery (Wiley Student edition)

   Chapter- 1, 2.1 to 2.5 (excluding 2.4), 3.1 to 3.3, 4.1 to 4.3, 5.1 only.

Mathematics Paper-4.2 : Practical

Contact Hours per week : 2

Examination Duration : 3 Hours

Maximum Marks : 25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 4.1
- Mathematics project
- Seminar

SEMESTER-V

Mathematics Paper-5.1 : Probability Theory

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Probability Theory

Unit-I Set, Probability, Independent Events, Artithmatic Density, Counting principles.

Unit-II Random Variables, Distribution and Expectation.

Unit-III Conditioning and Independence, Basic Formulas, Baye's Theorem and their applications.

Unit-IV Mean, Variance and Transforms, Covariance, Standard Deviation, Generating function.

Unit-V Poisson and Normal Distribution.

Books Recommended:

1. Elementary Probability theory with Statistic Processes – Kai Lai Chung (Springer Int. Student Edution).

   Chapter- 1, 2, 3, 4, 5.1, 5.2, 5.5, 6.1 to 6.5, 7.1 to 7.6.

Mathematics Paper-5.2 : Practical

Contact Hours per week : 2

Examination Duration : 3 Hours

Maximum Marks : 25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 5.1
- Mathematics project
- Seminar

SEMESTER-VI

Mathematics Paper-6.1 : Programming in 'C' and Trigonometry

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Unit-I

Overview of C, Basic structure of C Program, Programming style, Constant, Variables, and Data type, Operations and Expressions, Managing Input and Output operations.

Unit-II

Decision making and Branching, Decision making and Looping.

Unit-III

Arrays, Handling of Character and Strings.

Unit-IV

De Moivre's Theorem and its application, Direct and Inverse Circular and Hyperbolic Functions, Logarithm of a Complex Quantity.

Unit-V

Expansion of Trigonometric functions, Gregory's Series, Summation of Series.

Books Recommended :

1. Programming in ANSI'C' – E. Balagurusamy (Relevant Chapters)
2. S.L. Loney, Trigonometry Part-II, Macmillan and Co., London (Relevant Chapters)
3. R. S. Verma and K. S. Shukla, Textbook on Trigonometry, Pothishala Pvt. Ltd., Allahabad.

Mathematics Paper-6.2 : Practical

Contact Hours per week : 2

Examination Duration : 3 Hours

Maximum Marks : 25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 6.1
- Mathematics project
- Seminar

SEMESTER-VII

Mathematics Paper-7.1 : Analysis-II (R & C) and Discrete Mathematics

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15

Objectives :

After studying this paper, students should be able to –

- define power series, multiplication of series and develop the concept of their convergence,
- develop the concept of Riemann integration,

- deduce the Riemann integration formula and properties of Riemann integrals,
- differentiate between point wise convergence and uniform convergence,
- Prove the theorem on uniform convergence and continuity, uniform convergence and differentiation, uniform convergence and integration of series,
- Develop a significant knowledge in different aspects of discrete mathematics, realize the important concepts involved in discrete mathematics in solving real life problems.

Analysis-II (Real and Complex)

Unit-I

Power series, Multiplication of series. Compactness, Riemann Integration, Properties, of Riemann Integrals. Fundamentals Theorem of Integral Calculus Improper Integral.

Unit-II

Point wise convergence and Uniform Convergence of series, uniform convergence and continuity. Terms-by-Term Integration and differentiation of series, Power series and Taylor series.

Books Recommended :

1. Fundamentals of Mathematical Analysis – G. Das and S. Pattnaik (TMH)

   Chapters : 4 (4.8, 4.12 to 4.15), 5 (5.6), 8 (8.1 to 8.5), 9 (9.1 to 9.7)

Unit-III

Complex Analysis :

Functions of complex variable, Limits and theorems on limits, continuous functions, Differentiability, the Cauchy-Riemann equations, Analytic functions. Definite integral, Cauchy's Theorem. Cauchy's Integral Formula.

Books Recommended :

1. Complex Analysis – S. Arumugam, A. T. Isac and A. Samasundram (SCITECH)

   Chapters : 2 (2.1 to 2.7), 6 (6.0 to 6.3, 6.4 (restricted), 7 (7.0 to 7.3, 7.4 (restricted), 8 (8.1, 8.2 (restricted).

Discrete Mathematics

Unit-IV

Proportional equivalence predicates and quantifiers, Nested Quantifier; Methods of Proof, Relations and their properties, n-array relations and their applications, Boolean functions and their representation. The basic counting, the Pigeon-hole principle, Gensralised permutations and combinations.

Unit-V

Recurrence relations and their solutions, inclusion – Exclusion and applications.

Graphs : Introduction, Graph terminology, Representing Graphs and Graph isomorphism, Connectivity, Euler and Hamiltonian Path.

Books Recommended :

1. Discrete Mathematics and its Applications – Kenneth H. Rosen (5^{th} edition, TMH)

   Chapters : 1 (1.1 to 1.5), 4 (4.1, 4.2, 4.5), 6 (6.1, 6.2, 6.5, 6.6), 7 (7.1, 7.2), 8, 10, (10.1, 10.2

Mathematics Paper-7.2 : Practical

Contact Hours per week : 2

Examination Duration : 3 Hours

Maximum Marks : 25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 7.1
- Mathematics project
- Seminar

SEMESTER-VII

Mathematics Paper-7.3 : (Honours) Mathematical Modeling and Mechanics

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

After studying this paper, students should be able to –

- state the meaning of mathematical modeling,
- identify different techniques of mathematical modeling and apply them to solve different kinds of real life problems,
- realize the importance of application of this branch of mathematics in the present time,
- identify and explain different aspects of mechanics to solve physical problems related to the real life.

Mathematical Modeling

Unit-I

Simple Situations Requiring Mathematical Modeling. The Technique of Mathematical Modeling, Mathematical Modeling through differential equations. Linear growth and Decay Models, Non-linear growth and decay models, compartment models, mathematical modeling of geometrical problems through ordinary differential equations of first order.

Unit-II

Mathematical modeling in population dynamics, mathematical modeling of epidemics through systems of ordinary differential equations of first order, compartment models through systems of- ordinary differential equations, Mathematical modeling in economics through systems of ordinary differential equations of first order. Mathematical models in Medicine, Arms Race, Battles and International Trade in terms of systems of ordinary differential equations, Mathematical modeling of Planetary Motions, Mathematical modeling of circular motion and motion of satellites. Mathematical modeling through linear differential equations of second order.

Unit-III

Situation giving rise to partial differential equations models, Mass-balance equations: First method of getting PDE models, Momentum-balance equations; The second method of obtaining partial differential equation models, Variational principles, Third method of obtaining partial differential equations models, Probability generating function. Fourth method of obtaining partial differential equation models, Model for Traffic flow a Highway. Situations that can be modeled through graphs. Mathematical models in terms of directed graphs, Optimization principles and techniques. Mathematical modeling through calculus of variations.

Books Recommended :

1. Mathematical Modeling—J.N. Kapur

Chapters : 1 (1.1, 1.2), 2 (2.1 to 2.6), 3 (3.1 to 3.5), 4 (4.1 to 4.3), 6 (6.1 to 6.6), 7 (7.1, 7.2), 9 (9.1, 9.2).

Mechanics

Unit-IV

Method of plane static, application in plane statics.

Unit-V

Plane Kinematics, methods of plane dynamics, application in plane dynamics. Motion of a particle and motion of rigid body.

Books Recommended :

1. Mechanics—J.L. Synge and Griffith, Mc Graw Hill

Chapters : 2.3 (excluding 3.3, Cables with smooth and rough curves & 3.5), 4, 5 (excluding 5.3), 6 (6.1 and 6.2), 7 (7.1, 7.2, 7.3, 7.5)

Mathematics Paper-7.4 : (Honours) Practical

Contact Hours per week : 2

Examination Duration : 3 Hours (Internal)

Maximum Marks : 25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 7.3
- Mathematics project
- Seminar

SEMESTER-VIII

Mathematics Paper-8.1 : Operation Research and Differential Geometry

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Operation Research

Unit-I

Convex Sets and their properties, convex funcuons, Mathematical formulaton of LPP, Graphical solution of LPP; General, Canonical and Standard form of LPP; Fundamental properties and solutions of LPP, Use of artificial variable, Two phase method, Big M method. General primal dual pair.

Unit-II

Duality theorem, Complementary Slackness, Theorems, Duality and Simplex methods, Dual Simplex method. Transporation Problem, Assignment Problem.

Books Recommended:

Operations Research - Kantiswarup, P.K. Gupta. Man Mohan (Sultan Chand). Ch.-0 (0.13, 0.14, 0.15), 2, 3, 4 (4.1 to 4.4), 5, 10 and 11.

Differential Geometry

Unit-III

Introduction, Curves with Torsion

Unit-IV

Envelope, developable surfaces, Curvilinear Co-ordinates on a Surface.

Unit-V

Fundamental Magnitudes, Curves on Space.

Books Recommended :

1. Differential Geometry—C.E. Weatherburn (ELBS)

Chapters : 1(1, 2, 3, 4, 7, 8, 10), 2(13, 14, 16, 17), 3.4 (29, 30, 31, 35, 37, 38)

Mathematics Paper-8.2 : Practical

Contact Hours per week : 2

Examination Duration : 3 Hours

Maximum Marks : 25

List of Activities

- Activity oriented problem solving/ experiments based on the content studied in Paper 8.1
- Mathematics project
- Seminar

Mathematics Paper-8.3 : (Honours) Numerical Analysis

Contact Hours per week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

After studying this paper, students should be able to –

- form the numbers in different system of numeration,
- develop different numerical techniques like Bisection method, Regula-False method, Newton-Raphson method etc to solve algebraic and transdential equations,
- state and derive Lagrange's interpolating polynomial and Newton divided difference interpolating polynomial for approximating a given function,
- use the numerical differentiation and integration for solving practical problems,
- develop the different aspects of programming language 'C' and use the language to solve practical problems using computer.

Numerical Analysis

Unit-I Number system and Errors, Binary numbers, Octal numbers, hexa-decimal numbers, Floating point Arithmetic, K-digit Arithmetic, Errors, Sources of Errors.

Unit-II Numerical Solution of non-linear equations, method of bisection, Regula-Falsi method, Secant method, Newton-Raphson method, Fixed point Iteration method, Aikeen's process.

Unit-III Polynomial Interpolation. Existence and uniqueness of interpolating polynomials, Lagranges Interpolating polynomial, Error in interpolation, Newton's divided difference interpolating polynomial, Forward and Backward difference operators, Newton's forward difference Interpolation Formula, Newton's Backward Difference Interpolation Formula. Approximation of functions, Discrete least square approximation.

Unit-IV Numerical Differentiation, Simple Numerical methods, Interpolatory Formulas. Numerical integration, Simple Quadrature Rules, Newton's Cotes Rule, Gauss Quadrature Rule, Gauss-Legendre Rule.

Unit-V Numerical solution of Differential Equation. Picard's method, Euler's method, Modified Equler's method, Runge-Kutta methods.

Books Recommended :

1. A Course of Numerical Analysis – B. P. Acharya & R. N. Das (Kalyani)

   Chapters : 1, 2 (2.1 to 2.4, 2.6, 2.8, 2.9), 3 (3.1 to 3.4, 3.6 to 3.8, 3.10), 4 (4.1, 4.2), 5 (5.1 to 5.3), 6 (6.1 to 6.3, 6.10, 6.11), 7 (7.1 to 7.4, 7.7)

Mathematics Paper-8.4 : (Honours) Practical

Contact Hours per week : 2

Examination Duration : 3 Hours

Maximum Marks : 25

Students are required to perform the following experiments using 'C' language.

List of Experiments

1. To solve a given Algebraic or Transdental equation numerically.
   - i) Bisection method
   - ii) Secant method
   - iii) Newton-Raphson method

2. Experiments based on Finite Differences
   - i) Newton's formula for backward differences with equal interval
   - ii) Newton's formula for unequal interval
   - iii) Lagrange's Interpolation Formula

3. Numerical Integration
   - i) Trapezoidal rule
   - ii) Simpson rule

4. Numerical solution of ordinary differential equations
   - i) Euler's method
   - ii) Runge-Kulta method

5. Computer Programs for solving ordinary differential equations

Syllabus for Four Year Integrated B.Sc.B.Ed. (Subject Specialisation)

SCHEME OF EXAMINATION IN CHEMISTRY (HONOURS)

Babasaheb Bhimrao Ambedkar Bihar University Muzaffarpur (Bihar)

(Based on NCTE Curriculum Framework for Four year Intigrated B.Ed. Programme)

SCHEME OF EXAMINATION IN CHEMISTRY (HONOURS)
B.Sc.B.Ed.

Semester-I **Examination** (Terminal-60, Sessional-15) 75 marks

Paper 1.1 **Gaseous State of Matter, Atomic Structure & Peridic Table. Isomerism**

Unit 1: (Physical) : *Gaseous state of matter*
Unit 2: (Inorganic) : *Atomic Structure, Electronic configuration*
Unit 3: (Inorganic) : *Long form of Periodic Table and Periodic properties*
Unit 4: (Organic) : *Introduction to Organic Chemistry*
Unit 5: (Organic) : *Isomerism of Organic Compounds with special emphasis on Stereoisomerism*

Paper 1.2 Practical 25 marks

Semester-II **Examination** (Terminal-60, Sessional-15) 75 marks

Paper 2.1 **LiquidState of Matter, Chemical Bonding, p-block elements & Organic Reactions**

Unit 1: (Physical) : *Liquid state of matter*
Unit 2: (Physical) : *Dilute Solutions and Colligative properties*
Unit 3: (Inorganic) : *Chemical Bonding*
Unit 4: (Inorganic) : *Chemistry of p-block elements-I (B, C and N)*
Unit 5: (Organic) : *Principles of Organic Reactions*

Paper 2.2 Practical 25 marks

Semester-III **Examination** (Terminal-60, Sessional-15) 75 marks

Paper 3.1 **SolidState, d-block elements & hydrocarbons**

Unit 1: (Physical) : *Solid state of matter and Band Theory*
Unit 2: (Inorganic) : *Chemistry of p-block elements-II (Oxygen, Halogens and Noble gases)*
Unit 3: (Inorganic) : *Chemistry of 1st, 2nd, 3rd row Transition Metals*
Unit 4: (Organic) : *Types of Organic Reactions*
Unit 5: (Organic) : *Hydrocarbons (Aliphatic, Aromatic and Polynuclear)*

Paper 3.2 Practical 25 marks

Semester-IV **Examination** (Terminal-60, Sessional-15) 75 marks

Paper 4.1 **Colloids, Chemical & Ionic Equilibria, f-bloc elements. Derivatives of Hydro carbon**

Unit 1: (Physical) : *Surface and Colloid Chemistry*
Unit 2: (Physical) : *Chemical and Ionic Equilibrium*
Unit 3: (Inorganic) : *Chemistry of Lanthanides & Actinides*
Unit 4: (Organic) : *a) Alkyl and Aryl Halides,*
b) Alcohols and Phenols,
c) Ethers and Epoxides
Unit 5: (Organic) : *a) Aldehydes and Ketones,*

b) Carboxylic Acids and their derivatives

Paper 4.2	Practical	25 marks
Semester-V	**Examination** (Terminal-60, Sessional-15)	75 marks
Paper 5.1	**Thermodynamics Electro & Coordination Chemistry, Metallurgy.**	
	Active Methylene & Alicyclic compounds	

Unit 1: (Physical) : *Thermodynamics*
Unit 2: (Physical) : *a) Electrochemistry*
b) Electrochemical Cells
Unit 3: (Inorganic) : *Coordination chemistry & Metal-Ligand bonding in transition metal complexes*
Unit 4: (Inorganic) : *Metallurgy*
Unit 5: (Organic) : *a) Organic Synthesis via Enolates (Active Methylene Compounds)*
b) Alicyclic Compounds

Paper 5.2	Practical	25 marks
Semester-VI	**Examination** (Terminal-60, Sessional-15)	75 marks
Paper 6.1	**Phase Equilibrium, Kinetics. Heterocyclic compounds**	

Unit 1: (Physical) : *Phase Equilibrium*
Unit 2: (Physical) : *Chemical Kinetics*
Unit 3: (Inorganic) : *Bio-Inorganic chemistry*
Unit 4: (Organic) : *Organic Compounds of Nitrogen*
Unit 5: (Organic) : *Heterocyclic compounds*

Paper 6.2	Practical	25 marks
Semester-VII	**Examination** (Terminal-60, Sessional-15)	75 marks
Paper 7.1	**Spectroscopy, Polymers & Carbohydrates**	

Unit 1: (Physical) : *Principles of Molecular Spectroscopy – I*
Unit 2: (Physical) : *Principles of Molecular Spectroscopy – II*
Unit 3: (Inorganic) : *Inorganic Polymers*
Unit 4: (Organic) : *a) Petroleum and Petrochemicals*
b) Synthetic Polymers, Fats, Oils, Detergents
Unit 5: (Organic) : *Carbohydrates*

Paper 7.2	Practical	25 marks
	(Honours) (Terminal-60, Sessional-15)	**75 marks**
Paper 7.3	**Complex Reactions, Metal Complexes. Dyes & Drugs & Chromatography**	

Unit 1: (Physical) : *Kinetics of Complex Reactions*
Unit 2: (Inorganic) : *Magnetic Properties and Electronic spectra of Transition Metal Complexes*
Unit 3: (Inorganic) : *Thermodynamic and Kinetic aspects of metal complexes*

Unit 4: (Organic)	: *Synthetic Dyes and Drugs*	
Unit 5: (Analytical)	: *a) Chromatography*	
	b) Activation analysis	
Paper 7.4 (Honours)	Seminar and Project	25 marks

Semester-VIII	**Examination** (Terminal-60, Sessional-15)	75 marks
Paper 8.1	*Nuclear Chemistry, Non-aqueous Solvents,* **Organometallic Compounds, Polypeptides & Nuclic Acids**	
Unit 1: (Physical)	: *Nuclear Chemistry*	
Unit 2: (Inorganic)	: *Non-aqueous Solvents*	
Unit 3: (Inorganic)	: *Organometallic Compounds*	
Unit 4: (Organic)	: *Amino acids, Proteins*	
Unit 5: (Organic)	: *Nucleic acids*	
Paper 8.2	Practical	25 marks
	(Honours) (Terminal-60, Sessional-15)	**75 marks**
Paper 8.3	**Quantum Mechanics, Photochemistry, Metal Carbonyls**	
Unit 1: (Physical)	: *Elementary Quantum Mechanics*	
Unit 2: (Physical)	: *Photochemistry*	
Unit 3: (Inorganic)	: *Metal Carbonyls & Nitrosyls*	
Unit 4: (Organic)	: *Application of Spectroscopy - I*	
Unit 5: (Organic)	: *Application of Spectroscopy - II*	
Paper 8.4 (Honours)	Practical	25 marks

Total	**1000 Marks**

SEMESTER-I

Chemistry Paper 1.1: Gaseous State of Matter, Atomic Structure & Peridic Table. Isomerism

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course the students will be able to

- explain the behaviour of real gases
- describe the conditions required for liquifaction of gases.
- describe Bohr atomic model.
- understand the important features of the quantum mechanical model of atom.
- state the de Broglie relation and Heisenberg uncertainty principle.
- define an atomic orbital in terms of quantum numbers.
- state aufbau principle, pauli exclusion principle and Hund's multiplicity rule.
- write the electronic configurations of atom.
- understand the significance of atomic number and electronic configuration as the basis for periodic classification.
- classify elements into s, p, d, f blocks and learn their main characteristics.
- recognize the periodic trends in physical and chemical properties of elements.
- compare the reactivity of elements.
- write the IUPAC nomenclature or organic compounds.
- understand the structure of organic compounds.
- understand the concept of stereoisomerism
- differentiate between types of stereoisomerism

Unit I: Gaseous state of matter:

Kinetic molecular theory, derivation of kinetic gas equation, deduction of gas laws from kinetic gas equation, gas constant. Behaviour of real gases, vander waals equation of state. Qualitative discussion of Maxwell's distribution of molecular velocities and energy (derivation excluded), molecular velocities – root mean square, average, most probable velocities. Liquifacation of gasses and critical phenomena, Laws of corresponding state, collision number, collision diameter, mean free path.

Unit II: Atomic Structure

Recapitulation of Bohr's Theory, Sommerfeld's model, wave nature of matter, de Broglie's equation, Heisenberg's uncertainty principle, probablity and shapes of orbitals, Schrodinger's wave equation. Significance of Ψ&Ψ^2. Quantum numbers. probability distribution curves. Shapes of s, p, d, f orbitals. Aufbau principle and Pauli exclusion principle, Hund's multiplicity rule. The slater's rule and its application, Screening effect, Effective nuclear charge, electronic configuration of atoms.

Unit III: Long form of periodic table and periodic properties

Division of elements into s, p, d, f, blocks, covalent radii, and vander waals radii ionic radii, ionisation enthalpy, electron gain enthalpy, electrongativity (definition, methods of determination and trends in periodic table and applications in predicting and explaining chemical behaviour).

Unit IV: Introduction to Organic Chemistry

Classification, IUPAC nomenclature and Structure of organic compounds. Concept of hybridization of carbon, Orbital representation of methane, ethane, ethyne, benzene. Homologous series – general trends in properties and structure in these homologue serie

Unit V: Isomerism of Organic Compounds with special emphasis on stereo-isomerism – Concept of isomerism, Types of isomerism

a) **Optical isomerism-** elements of symmetry, molecular chirality, writing the Fischer projection and flying wedge formulae. Illustration of inter-conversion of one type of structural representation into another type of formulaes. Enantiomers, dia-stereomers, stereogenic centre, optical activity, properties of enantiomers, optical purity, chiral and achiral molecules with two stereogenic centres, threo and erythro designation, meso compounds, resolution of enantiomers by salt forming method, inversion, retention and racemization.

Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

b) **Geometrical isomerism –** determination of configuration of geometric isomers, cis–trans and E&Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

c) **Conformational isomerism-**conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono and di substituted cyclohexane derivatives. Newman projection and Sawhorse formula,

Difference between configuration and conformation.

Chemistry Paper 1.2: Practical

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25 (Expt.-18, Viva-4, Record-3)

Objectives:

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

- identify cations and anions present in the salt mixture,

1. Inorganic Chemistry: Qualitative analysis of inorganic salt mixture (only colourless salts in absence of interfering ions).

SEMESTER-II

Chemistry Paper 2.1: LiquidState of Matter, Chemical Bonding, p-block elements &Organic Reactions

Contact Hours Per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course, the students will be able to

- describe various properties of liquids and their application
- explain different types of liquid crystals.
- distinguish between ideal and non-ideal solution.
- explain deviations of real solutions from Raoult's law.
- describe colligative properties of solutions and correlate these with molar masses of the solutes.
- explain abnormal colligative properties exhibited by some solutes in solutions.
- explain the formation of different types of bonds.
- describe the VSEPR theory and predict the geometry of simple molecules.
- explain the valence bond approach for the formation of covalent bonds.
- describe the Molecular Orbital Theory of homonuclear and hetero nuclear diatomic molecule.
- describe the properties of carbon, boron and nitrogen family elements.
- learn the industrial preparation of Al, Sn & Pb ceramic, glass and cement.
- explain the influence of electronic displacements on structure and reactivity of organic compounds.

Unit I: Liquid state of matter

Intermolecular forces, Structure of liquids (A qualitative description), kinetic theory of liquids, liquid crystals. Classification and structure of nematic and cholestric phases, Surface tension, parachor, vicosity, molar refraction.

Unit II: Dilute Solutions and Colligative properties

Methods of expressing concentration of solutions. Colligative properties: Raoult's law. Relative lowering of vapour pressure, law of osmotic pressure and its measurement. Elevation of boiling point and depression of freezing point. Determination of molecular weight using colligative properties. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molecular mass. (Molecular association and dissociation). Degree of dissociation and association of solutes. Ideal and non-ideal solutions, activity and activity coefficients.

Unit III: Chemical Bonding

Covalent bond- valence bond theory and its limitations, directional characteristics of covalent bond. Various types of hybridization and shapes of simple inorganic moclules and ions, VSEPR theory. (Shapes of molecules and ions), Molecular Orbital Theory (LCAO method) – homo nuclear and hetero nuclear diatomic molecules (CO, NO) multicenred bonding in electron deficient moleules. Bond strength, bond energy, percentage of ionic character, dipole moment and Electro negativity difference.

Ionic bonds – Ionic structures, radius ratio effect and coordination number, limitations of radius- ratio rule. Born-Haber cycle, lattice energy. Solvation energy and solubility of ionic solids. Polarizing power and polarizability of ions. Fazan's rule.

Unit IV: Chemistry of p-block elements -I (B, C and N)

An overview of the chemistry of carbon and boron family elements, bonding, catenation and network structure, acidic and basic properties, oxidising and reducing abilities. The unusual chemistry of boron and silicon, hydrides of boron and silicon, industrial preparation of Al, Sn and Pb, Ceramics, glass and cement industries in India.

An overview of nitrogen family -nitrogen cycle, oxides and oxyacids of nitrogen and phosphorus, hydrides of nitrogen and phosphorus, fertilizers.

Unit V: Principles of Organic Reactions

Cleavage of covalent bond: homolysis and heterolysis. Electronic effect and their applications (Inductive, electromeric, hyperconjugation and resonance). Structure and stability of reactive intermediates (carbocation, carbanion, free radicals, carbine and nitrene)

Types of attacking reagents (electrophiles and nucleophiles)

Chemistry Paper 2.2: Practical

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25(Expt.-18, Viva-4, Record-3)

Objectives:

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

- identify cations and anions present in the salt mixture, insoluble inorganic salts interfering cations and anions.

Inorganic Chemistry:

i) Qualitative Analysis of Inorganic Salt mixtures (coloured salts), Insoluble inorganic salts including removal of interfering cations and anions.

Physical Chemistry:

Viscosity, surface tension

(i) To determine the percentage composition of a given mixture (non interacting systems) by viscosity method

(ii) To determine the viscosity of amyl alcohl in water at different concentrations and calculate the excess viscosity of their solutions.

(iii) To determine the percentage composition of a given binary mixture by surface tenson method (acetone and ethylmethyl ketone)

SEMESTER-III

Chemistry Paper 3.1: SolidState, d-block elements & hydrocarbons

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives :

On completion of the course, the students will be able to

- explain the microscopic properties of solids
- understand the laws of crystallography.
- describe the chemistry of p-block elements (oxygen, halogens and noble gases)
- describe the chemistry of 1^{st}, 2^{nd}, & 3^{rd} row transition metals.
- understand the structure of benzene
- explain the term Aromaticity.
- explain the chemistry of polynuclear hydrocarbons.
- understand the concept of organic reaction mechanism.
- recognize the types of organic reactions and the reactive intermediates.
- learn about various methods of preparation of alkanes, alkenes, alkynes.
- distinguish between different types of aliphatic hydrocarbons on the basis of physical and chemical properties.

Unit I: SolidState of matter and Band theory:

Microscopic properties of solids. Types of Solids. definition of space lattice, unit cell, study of crystals and crystal systems. Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry of elements in crystals. X-Ray diffraction by crystals, derivation of Bragg's equations, determination of crystal structure of simple cubic systems of NaCl (fcc) and CsCl (bcc) by Laue's method and powder method. Metallic bond - free electron, band theory of metals, conductors, Semi-conductors and non conductors, weak interactions- hydrogen bonding and Van der Walls forces.

Unit II: Chemistry of p-block elements-II (Oxygen, Halogens and Noble gases)

Oxygen family: Vertical relationship.Oxyacids: Manufacture of sulphurous acid and sulphuric acids and its uses.

Halogen Family: An overview of halogen family, General characteristics of halogens, oxides and oxyacids of halogens, relative strengths of hydrohalic acids and oxyacids of chlorine. Interhalogen compounds

The noble gas family: General characteristics of noble gas compounds(Xenon compounds), their structures and uses.

Unit III: Chemistry of 1^{st}, 2^{nd} and 3^{rd} row transition metals

The chemistry of elements of First Transition Series: Characteristic properties of d-block elements. Properties of the elements of 1^{st} transition series, their binary compounds and complexes, illustrating relative stability of their oxidation states. Coordination number and geometry.

Chemistry of elements of 2^{nd} and 3^{rd} transition series – General characteristics, comparative treatment with their 3^{rd} analogous in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereo chemistry.

Unit IV: Types of Organic Reactions

Substitution, addition, elimination, nucleophillic, and electrophillic reaction, oxidation, reduction and rearrangement reactions (with mechanism): Pinacol-Pinacolone, Hofmann bromamide, Beckmann, Benzidine and Fries rearrangement.

Unit V: Hydrocarbons (Aliphatic, Aromatic and Polynuclear)

Alkanes: Methods of preparation (with special reference to wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids). Physical properties and chemical reactions (with mechanism).

Alkenes : Methods of preparation (mechanism of dehydration of alcohols), dehydro-halogenation of alkyl halides, regio selectivity in alcohol dehydration, saytzeff rule, Hoffmann elimination, physical properties and relative stabilities of alkenes, chemical reactions of alkenes. (Mechanism involved in hydrogenation, electrophilic and free radical additions, Markonikoff's rule, and peroxide effect hydroboration- Oxidation, oxy-mercuration, reduction,epoxidation, ozonolysis, hydration, hydroxylation, oxidation with $KMnO_4$, polymerisation of alkenes, substitutions at the allylic and vinylic positions of alkenes). Industrial application of ethene and propene.

Alkynes: Nomenclature, structure and bonding in alkynes, methods of preparations, chemical reactions of alkynes, Acidity of alkynes, mechanism of hydroboration- oxidation, metal-ammonia reduction, Oxidation and polymerisation.

Arenes and Aromaticity :- Nomenclature of benzene derivatives aromatic nucleus and side chain, the aryl group, structure of beneze, kekule structure, stability, carbon-carbon bond length of beneze, resonance structure, MO structure, aromaticity, Huckels rule, aromatic ions, antiaromaticity,non-aromaticity

Aromatic electrophilic substitution, general pattern of mechanism, role of σ- and π-complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Fridel crafts reaction, energy profile diagrams, activating and deactivating substitutents, orientation, and ortho/para ratio, side chain reactions of benzene derivatives. Birch reduction, methods of formation and chemical reactions of alkyl benzenes, alkyl aryl benzenes and biphenyl.

Polynuclear Aromatic hydrocarbons: Naphthalene and Anthracene,Isolation, elucidation of their structure, preparation of α and β-naphthols, electrophilic substitution of naphthalene, structural elucidation of anthraquinone and alizarins.

Chemistry Paper 3.2: Practical

Contact Hours Per Week : 2
Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.-18, Viva-4, Record-3)

(Expt.-18, Viva-4, Record-3)

Objectives:

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

- calibrate fractional weights, pipettes,
- prepare standard solution,
- determine alkali content in antacid tablets.

Inorganic Chemistry:

Quantitative Volumetric Analysis

(i) Calibration of fractional weights, pipettes and burettes. Preparation of standard solutions- dilution 0.1M to 0.001 M.
(ii) Determination of alkali content-antacid tablets using HCl.
(iii) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
(iv) Estimation of hardness of water by EDTA/Mg^{2+} estimation by EDTA
(v) Estimation of ferrous and ferric by dichromate method.
(vi) Estimation of copper using thiosulphate

SEMESTER-IV

Chemistry Paper 4.1: Colloids, Chemical & Ionic Equilibria, f-bloc elements.

Derivatives of Hydro carbon

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course, the students will be able to

- define the colloids, adsorption
- classify the colloids and adsorption
- understand chemical and ionic equilibrium
- classify the acids and bases as hard and soft
- describe the chemistry of lanthanides and actinides.

- discuss the reactions involved in the preparation of alcohols, phenos, ethers, epoxides, aldehydes and ketones.
- understand and distinguish the chemistry of alkyl halides and aryl halides.
- describe the chemistry of polyhalogen compounds.
- describe the chemical properties of alcohols, phenos, ethers, epoxides, aldehydes and ketones.
- to know the preparations chemical reactions of carboxylic acids and their derivatives.

Unit I: Surface and Colloids Chemistry

Colloidal state : Definitionof colloids, classification of colloids, solids in liquids (sols) : Properties- kinetic, optical and electrical, stability of colloids, protective action; Hardy-Schulze law, gold number, liquids in liquids (Emulsions): types of emulsons, preparation, emulisifer, liquid in solid (gels): classfication, preparation, and properties, general application of colloids.

Adsorption: Types of adsorption, Freundlich, Langmuir and Gibb's adsorption isotherm.

Unit II: Chemical and Ionic Equilibrium

Nature of chemical equilibrium, the equilibrium constant, external effects on equilibrium, equilibria involving reactions in gaseous phase and in adequeous solutions, ionic equilibria – Arhenius theory, ionization of acids and bases, Acid-base concepts, pH and pK_a, equilibria involving sparingly soluble salts, hydrolysis, buffer solutions, acid-base indicators.

HSAB : Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness.
Symbiosys : Theoretical basis of hardness and softness, electronegativity.

Unit III: Chemistry of Lanthanides & Actinides

Chemistry of lanthanide elements.

Electronic structure, oxidation states, ionic radii, lanthanide contraction and its effect. Complex formation, occurrence and isolation (separation by ion exchange method only).

Chemistry of actinides: General properties and chemistry of actinides, chemistry of uranium, comparison between later actinides and later lanthanides.

Unit IV: (Organic)

(a) **Alkyl and Aryl Halides:** Nomenclature and classess of alkyl halides, methods of preparation, chemical reactions, mechanism of nucleophilic substitution, reactions of alkyl halides, SN_2, SN_1 reactions, energy profile diagram.

(b) **Alcohols and Phenols**:

Alcohols: Classification and nomenclature, Overview of Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding,acidic nature, reactions of alcohols. Dihydric alcohols- Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage, (lead acetate, and periodic acid) pinacole–pinacolone rearrangement. Trihydric alcohols-nomenclature and methods of formation, chemical reactions of glycerol.

Phenols : Nomenclature, structure and bonding, preparation of phenols. Physical properties and acidic character. Comparision of acidic strengths of alcohols and phenols, resonance stabilisation of phenoxide ion. Reactions of phenols-Electrophilic aromatic substitution, acylation and carboxylation. Mechanism of Fries rearrangement. Claisen rearrangement, Gatterman synthesis. Hauben-Hoesch reaction. Lederer Manasse reaction, Reimer-Tiemann reaction.

(c) **Ethers and Epoxides :** Nomenclature of ethers, methods of their formation, physical properties, chemical reactions- cleavage and auto oxidation, Ziesel's method, synthesis of epoxides, acid and base catalysed ring opening of epoxides, orientation of epoxide ring opening.

Unit V:

(a) **Aldehydes and Ketones :** Nomenclature and structure of the carbonyl group, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3 dithiane, synthesis of ketones from nitriles and from carboxylic acids, physical properties, mechanism of nucleophillic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction. Uses of acetals as protecting group, oxidation of aldehydes, Bayer -Villiger oxidation of ketones, Canizzaro reaction, MPV, Clemmensen, Wolff -Kishner, $LiAlH_4$ and $NaBH_4$ reductions, Halogenation of enolizable ketones. An introduction to α, β- unsaturated aldehydes.

(b) **Carboxylic Acids and their derivatives :** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, preparation of carboxylic acids, reaction of carboxylic acids, Hell-Volhard-Zellinsky reaction, synthesis of acid chlorides, esters and amides, reduction of carboxylic acids, mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids, hydroxy acids.Maleic, tartaric and citric acids. Methods of formation and chemcial reactions of unsaturated monocarboxylic acids, dicarboxylic acids. Methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives : Structure and nomenclature of acid chloride, esters, amides (urea) and acid anhydries. Relative stability of acyl derivatives. Physical

properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions, Mechanism of esterification and hydrolysis (acidic and basic)

Chemistry Paper 4.2: Practical

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25 (Expt.-18, Viva-4, Record-3)

Objectives:

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

- develop the skill of gravimeter estimation of certain metals,
- apply the principle of distillation, crystallization and sublimation to different experiments.

Inorganic Chemistry:

Gravimetric estimation of following metals

(i) Ba as $BaSO_4$

(ii) Pb as $PbSO_4$

(iv) Ni as Ni (dimethyl glyoxime)

Laboratory techniques

(a) Distillation

(i) Simple distillation of ethanol-water mixture using water condenser.

(ii) Distillation of nitrobenzene and aniline using air condenser.
(iii) Fractional distillation

(b) Crystallisation `

(i) Phthalic acid from hot water. (Using fluted filter paper ad stemless funnel)
(ii) Acetanilide from boiling water.
(iii) Naphthalene from ethanol.
(iv) Benzoic acid from water.
(v) Fractional crystallization

(c) Sublimation (simple and vacuum)

Camphor, Naphthalene, Phthalic acid and succinic acid.

SEMESTER-V

Chemistry Paper 5.1: Thermodynamics Electro & Coordination Chemistry, Metallurgy.

Active Methylene & Alicyclic compounds

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

On completion of the course, the students will be able to

- understand thermodynamic terms.
- know first law of Thermodynamics and to calculate w,q, dU and dH for the expansion of ideal gases under different condition.
- understand details of thermochemistry.
- understand different statement of 2nd law of thermodynamics.
- learn the concept of entropy
- understand third law of thermodynamics.
- describe types of reversible electrodes.
- understand the electrode reactions.
- describe the electrochemical series and its significances.
- differentiate the electrolytic and galvanic cells.
- understand and calculate the EMF of cells.
- explain the process of corrosion
- understand the application of conductivity measurements, conductometric titrations and potentiometric titrations.
- know the general principles of metallurgy
- know Werner's co-ordination theory, effective atomic number concept, chelates, isomerism in co-ordination compounds
- learn the synthetic application of active methylene compounds.

Unit I: Thermodynamics

Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics : Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Calculation of w,q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Second law of thermodynamics : need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodyamic scale of temperature. Joule's law, Joule-Thomson coefficient and inversion temperature.

Concept of entropy: entropy as a state function, entropy as a function of V&T,entropy as a function of P and T, entropy change in physical change, Calusius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as

criteria for thermodynamic equilibrium and spontaneity, their advantages over entropy change. Variation of G and A with P,V and T.

Third law of thermodynamics:Nernst heat theorm, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions;

Thermochemistry: *S*tandard state, standard enthalpy of formation- Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoff's equation.

Unit II:

(a) Electrochemistry

Electrical transport- conduction in metals and in electrolyte solutions, specific conductance (conductivity), molar conductivity and equivalent conductivity, measurement of equivalent conductivity, variation of equivalent conductivity and conductivity with dilution.

(b) Electrochemical Cells

Types of reversible electrodes: gas-metal ions, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrode, standard electrode potential, sign conventions, electrochemical series and its significance. Use of redox potential, principles involved in extraction of metals.

Electrolytic and Galvanic cells- reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, computation of cell EMF, calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, over potential and hydrogen over voltage.

Concentration cell with and without transference, liquid junction potential, application of concentration cells, activity co-efficient, potentiometric titrations.

Determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Storage cells – dry cells, lead storage batteries and fuel cells.

Corrosion-types, theories and methods of combating it.

Unit III:

Coordination Chemistry and metal-ligand bonding in transition metal complexes

Werner's coordination Theory and its experimental verification, nomenclature of co-ordination compounds. Effective atomic number concept, chelates, isomerism in coordination compounds. Valency bond theory (VBT) limitation of valency bond theory, an elementary idea of CFT, crystall field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters.

Unit IV: Metallurgy

General principles of metallurgy, occurrence of metals with special emphasis on mineral wealth of India, concentration, calcinations, roasting and smelting of ores with reference of extraction of Fe, Cu, Zn, Ni, Ag, Cr, Mn various methods of refining, (parting process, zone refining electrolytic refining, solvent extraction) with suitable examples, Alloys and their importance.

Unit V:

a) Organic Synthesis *via* Enolates (Active Methylene Compounds)

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

Alkylation of 1,3 dithianes. Alkylation and acylation of enamines synthetic applications of ethyl acetoacetate and diethylmalonate.

b) Alicyclic Compounds

Cycloalkanes: Methods of formation, chemical reaction, Baeyer strain theory and its limitations. Ring strain in small rings. Theory of strainless rings, structure of cycloalkanes.

Cycloalkenes: Methods of preparation, conformation and chemical reactions of cycloalkenes.

Chemistry Paper 5.2: Practical

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.-18, Viva-4, Record-3)

(Expt.-18, Viva-4, Record-3)

Objectives:

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

- prepare inorganic compounds,

- synthesize organic compounds,
- develop skill of doing practical related to thermo chemistry.

Inorganic Chemistry:

Inorganic Preparations (Any three)

(i) Cuprous chloride or Tetra cupric ammonium sulphate, $Ni(NH_3)_6^{2+}$
(ii) Pt Trioxalato chromate (III)
(iii) Pt Trioxalato ferrate (III)
(iv) Sodium thiosulphate
(v) Lithophone
(vi) Lead tetraacetate
(vii) Barium tetra thio cyanate

Organic Chemistry:

Organic synthesis

(i) Acetyl salicylic acid
(ii) Iodoform
(iii) m-dinitrobenzene
(iv) p-nitroacetanilide
(v) Methyl orange

Physical Chemistry :

Thermo-Chemistry

(i) To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
(ii) To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and to determine the enthalpy of ionisation of weak acid /weak base.
(iii) To determine the enthalpy of solution of solid calcium chloride and to calculate the lattice energy of calcium chloride from its enthalpy data using Born-Haber cycle.

SEMESTER-VI

Chemistry Paper 6.1: Phase Equilibrium, Kinetics. Heterocyclic compounds

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

On completion of the course, the students will be able to

- understand phase equilibrium.
- study about Bio-inorganic polymers.
- know the methods of preparation and properties of organic compounds of nitrogen.
- understand the stereochemistry of amines and separation of a mixture of primary, secondary and tertiary amines.
- differentiate between molecularity and order of the reaction.
- define the rate constant for various reactions.
- derive the integrated rate equation for zero, 1^{st}, 2^{nd}, pseudo 1^{st} order reactions.
- describe the collision theory and absolute rate theory.
- understand the mechanism of enzyme catalysed reactions.
- describe the chemistry of heterocyclic compounds (Pyrrole, Furan, Thiophene, Pyridine)

Unit I: Phase Equilibrium

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibb's phase rule, phase equilibiria of one component system water, and S systems.

Phase Equilibria of two component systems: Solid-liquid equilibria, simple eutectic, Pb-Ag systems, desilverisation of lead.

Solid solutions- compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($NaCl$-H_2O) system, freezing mixture, acetone-dry ice.

Liquid-Liquid mixtures- Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes- HCl-H_2O and ethanol -water systems.

Partially miscible liquids- Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation.

Unit II: Chemical Kinetics

Chemical kinetics and its importance, order and molecularity, mathematical characteristics of simple chemical reactions of zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of the reaction(Differential method, Integration method, method of half life period, isolation method) Radioactive decay as a 1^{st} order phenomenon. Simple ideas of consecutive,parallel reactions. Theories of chemical kinetics **:** Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy, simple collision theory based on hard sphere model, transition state theory (Equilibirum hypothesis). Expression for the rate constant based on equilbirum constant and thermodynamic aspects. Mechanism of Complex reaction **:** Equilibrium Approximation, steady state approximation

Unit III: Bio-Inorganic Chemistry

Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}. Nitrogen fixation.

Unit IV: Organic Compounds of Nitrogen

Methods of preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.Halonitroarenes: reactivity. Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann-bromamide reaction.

Unit V: Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution, Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.
Introduction to condensed five and six-membered heterocyclics. Preparation and reactions of indole, quionoline and isoquinoline with special reference to Fisher -indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of eletrophilic substitution reactions of indole, quinoline and isoquinoline.

Chemistry Paper 6.2: Practical

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.-18, Viva-4, Record-3)

(Expt.-18, Viva-4, Record-3)

Objectives:

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

- determine strength of given acids,
- learn solubility, solubility products and titration.

Physical Chemistry:

Electrochemistry

(i) To determine the strength of the given acid conductometrically using standard alkali solution.
(ii) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
(iii) To study the saponification of ethylacetate conductometrically.
(iv) To determine the ionisation constant of a weak acid conductometrically.
(v) To titrate potentiometrically HCl vs NaOH.
(vi) To titrate potentiometrically $AgNO_3$ vs KCl.

SEMESTER-VII

Chemistry Paper 7.1: Spectroscopy, Polymers & Carbohydrates

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

On completion of the course, the students will be able to

- understand the principles of UV, IR, Raman, NMR, Mass spectroscopy
- study about bioinorganic polymers
- study about petrochemicals
- describe the chemistry of synthetic polymers
- explain the chemistry of fats, oils and detergents
- know the basis of classification of carbohydrates and their nomenclature
- elucidate the structure of configuration of monosaccharides
- develop the skill of inter-conversion of aldose to ketose and vice versa

Unit I: Principles of Molecular Spectroscopy – I

Emission and absorption spectra. Width and intensity of spectra lines. Transition probabilities and selection rules. Pure rotational spectra. Diatomic molecules. Rigid rotor model. Linear triatomic molecules. Vibrational-rotational spectra. Diatomic molecules. Harmonic oscillator-rigid rotator approximation. Anharmonicity effect. Normal modes of vibration. Infrared spectra of linear and bent AB_2 molecules. Characteristic group frequencies. Electronic spectra of diatomic molecules. Vibrational structure. Franck-Condon principle. Raman spectra.

Unit II: Principles of Molecular Spectroscopy – II

Nuclear Magnetic Resonance spectroscopy. Chemical shifts. Spin-spin splitting. Relaxation times. Electron Spin Resonance. Nuclear hyperfine splitting. Mass spectra.

Unit III: Inorganic Polymers

Comparison between inorganic and organic polymers. Synthesis, structural aspects and applications of borazines, phosphazines, silicates and silicons.

Unit IV:

a) Petroleum and Petrochemicals

Origin of petroleum, composition, refining, reforming, fractionation, cracking, knocking. Octane number, Cetane number, kerosene, naphtha, LPG, synthetic petrol, petrochemicals.

b) Synthetic Polymers, Fats, Oils, Detergents

Addition or chain-growth polymerization, free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta Polymerization and vinyl polymers.
Condensation or step growth polymerization, polyesters, polyamides, phenol-formaldehyde resins, urea-formaldehyde resins, epoxy resins and poly urethanes, Natural and synthetic rubbers.

Fats, Oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value, soaps, synthetic detergents, alkyl and aryl sulphonates.

Unit V: Carbohydrates

Classification and nomenclature, mono-sachharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosachharides. Erythro and threo diasteromers, conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides, cyclic structure of D(+) glucose. Mechanism of mutarotation, structure of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Chemistry Paper 7.2: Practical

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.-18, Viva-4, Record-3)

(Expt.-18, Viva-4, Record-3)

Objectives:

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

- verify theoretical knowledge in chemical kinetics.

Physical Chemistry :

a) Chemical Kinetics

(i) To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate. Catalysed by hydrogen ions at room temperature.

(ii) To study the effect of acid strength in the hydrolysis of an ester.

(iii) To compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of ethyl acetate.

(iv) To study kinetically the reaction rate of decomposition of iodide by H_2O_2.

b) Colloids

(i) To prepare arsenious sulphide sol and compare the precipitating power of mono/ di/trivalent anions.

Chemistry (Honours) Paper 7.3: Complex Reactions, Metal Complexes. Dyes & Drugs & Chromatography

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives:

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

- understand the kinetics of complex reactions
- explain the magnetic behaviour of transition metal complexes
- explain electronic spectra of transition metal complexes
- understand the thermodynamic stability of metal complexes
- appreciate the utility of some selected chemical compounds as synthetic dyes
- appreciate the utility of some selected chemical compounds as drugs
- learn the chromatography techniques

Unit I: Kinetics of Complex Reactions

Reversible (first order in both directions), concurrent, consecutive reactions. Unimolecular gas reactions (Lindmann theory), steady-state approximations, theory of absolute reaction rate and its thermodynamical formulation, temperature dependence of frequency factor, numerical problems.

Unit II: Magnetic Properties and Electronic Spectra of Transition Metal Complexes

Magnetic Properties: Types of magnetic behaviour, curie law, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of μ_s and μ_h values. Orbital contribution to magnetic moments, application of magnetic moment data for 3-d metal complexes.

Electronic spectra: Types of electronic transitions, selection rules for d-d transition, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of hexahydrate titainum (III) complex. $(T_i(H_2O)_6]^{+3}$.

Unit III: Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planer complexes.

Unit IV: Synthetic Dyes and Drugs

Synthetic dyes: Colour and constitution (electronic concept). Classifi-cation of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, fluorescein, Alizarin and Indigo.

Drugs: Chemical structure and physiological activity of drugs, mechanism of action of drugs: synthesis of the following: Antimalarials – Pamaguin and Chloroquin; Sulpha drugs – Sulphanilamide and sulphadiazine; Anaesthetics – Procaine and xylocaine; Analgesics and Antipyrelics – Antipyrine, Aminopyrine, and aspirin; Antibiotics – Chloromycetin and Penicillin (excluding structural determination)

Unit V: Chromatography

Separation of mixtures by chromatographic techniques (column, paper, thin layer).

Chemistry(Honours) Paper 7.4 Seminar and Project

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25

1.	Project	:	15 marks
2.	Seminar	:	10 marks

Objectives:

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

- develop the skills of investigation,
- develop the skill of oral presentation using ICT.

SEMESTER-VIII

Chemistry Paper 8.1: Nuclear Chemistry, Non-aqueous Solvents,
Organometallic Compounds, Polypeptides & Nuclic Acids

Contact Hours per Week	:	4
Examination Duration	:	3 Hours
Maximum Marks	:	75 (Terminal-60, Sessional-15)

Objectives :

On completion of the course, the students will be able to

- understand the nuclear chemistry and radioactive isotopes
- explain the chemistry of organometallic compounds (Grignard reagents)
- classify common solvents.
- describe the acid-base, solvolysis and precipitations reactions with liquid ammonia solvent system.
- describe the chemistry of organic natural polymers (proteins and nucleic acids)

Unit I:Nuclear Chemistry

Isotopes: their separation and applications. Nuclear forces, nuclear binding energy, stability of nucleus, energy changes in nuclear reactions, Bethe notation, nuclear fission and fusion. Uses of nuclear radiations (radiation, sterilization, radiation energy for chemical synthesis). Radio isotopes as a source of electricity.

Unit II: Non-Aqueous Solvents

Classification of solvents: liquid ammonia solvent system with reference to a) acid-base reactions b) solvolysis c) precipitation reactions.

Unit III: Organometallic Compounds

The Grignards reagent-formation, structure and chemical reactions and its applications, Organozinc compounds-formation and chemical reactions. Organolithium compounds-formation and chemical reactions

Unit IV: Amino Acids, Proteins

Classification, structure and stereochemistry of amino acids. Acid base behaviour, isolectric point and electrophoresis, preparation and reactions of α-amino acids.
Structure and nomenclature of peptides and proteins. Classification of proteins, peptide structure determination, end group analysis, selective hydrolysis of peptides, classical peptide synthesis, solid-phase peptide synthesis, structures of peptides and proteins, Levels of protein structure. Protein denaturation/renaturation.

Unit V: Nucleic Acids:

Introduction, Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Chemistry Paper 8.2: Practical

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25 (Expt.-18, Viva-4, Record-3)

(Expt.-18, Viva-4, Record-3)

Objectives:

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

- identify the organic compound through functional group analysis, b.p/m.p and suitable derivatives.

Identification of organic compounds through the functional group analysis, determination of b.p/m.p. and suitable derivatives.

Chemistry (Honours) Paper 8.3:Quantum Mechanics, Photochemistry, Metal Carbonyls

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- understand black-body radiation, plank's law, Stefan-Boltzmann law, photoelectric effect and compton effect.
- explain the schrodinger wave equation and its importance.
- know the significance of eigen function and eigen values.
- predict the shapes of orbitals from angular wave function.
- state and explain the laws of photochemistry.
- describe various photo physical process.
- describe the preparation and understand the structure of metal carbonyls.
- elucidate the structure of simple organic compounds using UV, IR & NMR spectroscopic technique.

Unit-I: Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, Stefan-Boltzmann law, photoelectric effect, heat capacity of solids. Compton effect.
Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom,separation into three equations (without derivation),Eigen value,eigen functions,radial wave functions, angular wave functions, quantum numbers and their importance, angular wave functions (shapes of orbitals), hydrogen like wave functions, radial distribution curve, electron cloud picture of 1s, 2s, 2p, 3s, 3p, 3d orbitals.

Unit II: Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions- energy transfer processes (simple examples).

Unit III: Metal Carbonyls and Nitrosyls

Preparation and structures of mononuclear carbonyls of chromium, iron and nickel effective atomic number rule, preparation and structure of binuclear carbonyls $Mn_2(CO)_{10}$, $Fe_2(CO)_9$, $Co_2(CO)_{10}$

Unit IV: Application of Spectroscopy – I

Application of visible UV and IR spectroscopy in organic chemistry. UV spectra of conjugated enes and enones. Interpretation or IR spectra of simple organic compounds.

Unit V: Application of Spectroscopy – II

Interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1, 2-tribromoethane, ethyl acetate, toluene and acetophenone. Application of mass spectroscopy.

Chemistry Paper 8.4: Practical

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.-18, Viva-4, Record-3)

Objectives:

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

- develop the laboratory techniques like column chromatography, paper chromatography, thin layer chromatography, colorimetry and polarimetry.

Laboratory Techniques

(A) Column chromatography

(i) Separation of fluorescein and methylene blue
(ii) Separation of leaf pigments from spinach leaves
(iii) Resolution of racemic mixture of (±) mandelic acid.

(B) Paper Chromatography: Ascending and Circular

Determination of R_f values and identificaiton of organic compounds.

(i) Separation of mixture of a phenylalanine and glycine, Alanine and aspartic acid. Leucine and glutamic acid. Spray regent-ninhydrin.
(ii) Separation of mixture of D,L- alanine, glycine, and L-Leucine using n-butanol: acetic acid : water (4:1:5) spray reagent-rinhydrin.
(iii) Separation of monosacchrides- a mixture of D-galactose and D-fructose using n-butanol : actone : water (4:5:1), spray reagent-aniline hydrogenphosphate.

(C) Thin layer Chromatography

Determination of R_f values and identification of organic compounds.

(i) Separation of given leaf pigments (Spinach leaves may be used)
(ii) Preparation and separation of 2,4 dinitrophenylhydrazine of acetone, 2-butanone, hexane-2-and 3-one using toluene and light petroluem (40:60)
(iii) Separation of a mixture of dyes using cyclohexane and ethylacetate (8.5:1.5)

(D) Colorimetry

To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

(E) Polarimetry

To determine the specific rotation of a given optically active compound.

BOOKS RECOMMENDED FOR THEORY PAPERS:

Physical Chemistry

Principles of Physical Chemistry – Puri, Sharma & Pathania.

Physical Chemistry – Bahl and Tuli.

Physical Chemistry – S. Glasstone

Physical Chemistry(Vol I to V) – K.L.Kapoor

Physical Chemistry – Soni, Dharmarah and Dash

Physical Chemistry – P.C. Rakhit

Thermodynamics for Chemists – S. Glasstone

Electrochemistry – S. Glasstone

Physical Chemistry – Atkins.

Basic Physical Chemistry – W.J. Moore

Physical Chemistry – G.M. Barrow

Physical Chemistry(Solved Problems) – Dogra and Dogra

Problems in Physical Chemistry – Pahari and Pahari

Inorganic Chemistry

Concise Inorganic Chemistry – J.D. Lee

Advanced Inorganic Chemistry – R.D.Madan

Inorganic Chemistry - Puri,Sharma,Kalia

Selected Topics in Inorganic Chemistry – Malik, Tuli and Madan

Inorganic Chemistry – J.E. Huheey

Inorganic Chemistry - Meissler

Nuclear Chemistry – H.J.Arnikar

Nuclear Chemistry – U.N.Dash

Advanced Inorganic Chemistry – F.A. Cotton and Wilkinson

Theoretical Inorganic Chemistry – Day and Selbin

Inorganic Chemistry – R.L. Dutta

Magnetochmeistry - R.L. Carlin

Organic Chemistry

1. Advanced Organic Chemistry – Bahl & Bahl
2. Advanced Organic Chemistry – jagadamba Singh & L.D.S.yadav
3. Organic Reaction Mechanism – P.S.Kalsi
4. Organic Chemistry – R.K. Bansal
5. Organic Chemistry – Mukherjee, Singh and Kapoor
6. Organic Chemistry –I.L. Finar
7. Organic Chemistry – R.T. Morrison & R.N. Boyd
8. Organic Chemistry - Clayden,Greeves,Warren and Wothers
9. Organic Chemistry –Solomon
10. Stereochemistry, Conformation and Mechanism – P.S. Kalsi
11. Stereochemistry of carbon compounds – D. Nasipuri
12. Advanced Organic Chemistry – Reactions, Mechanism and Structure, Jerry March
13. Advanced Organic Chemistry – F.A. Carey & R.J.Sundberg
14. Reaction Mechanism in Organic Chemistry – S.M. Mukherjee and S.P. Singh.
15. A Guidebook of Mechanism in Organic Chemistry – Peter Sykes
16. Organic Chemistry – P.Y.Bruice

Spectroscopy

1. Spectroscopy – P.S. Kalsi
2. Spectroscopy – Y.R. Sharma
3. Spectroscopic Identification of Organic Compounds – Silverstein & Bassler

General Chemistry

1. University General Chemistry – C.N.R.Rao

2. Chemistry – Raymond and Chang

BOOKS RECOMMENDED FOR PRACTICAL :

1. Inorganic Qualitative Analysis – A.I. Vogel
2. Inorganic Quantitative Analysis –A.I. Vogel
3. A Text book of Practical Organic Chemistry – A.I. Vogel
4. Laboratory Manual in Organic Chemistry – R.K. Bansal.
5. Experimental Organic Chemistry (Vol.I & II)– Singh, Gupta & Bajpai.
6. Practical Organic Chemistry – I.L. Finar.
7. Handbook of Organic Analysis, Qualitative and Quantitative – M.T. Clarke.

Syllabus for Four Year Integrated B.Sc.B.Ed. (Subject Spacilasation)

Scheme of Examination in Botany (Honours)

Babasaheb Bhimrao Ambedkar Bihar University Muzaffarpur (Bihar)

(Based on NCTE Curriculum Framework for Four year Intigrated B.Ed. Programme)

Scheme of Examination in Botany (Honours)

B.Sc. B. Ed.

Semester-I	**Examination**	
Paper 1.1:	Plant Diversity-I (Terminal-60,Sessional-15)	75 marks
Paper 1.2:	Practical	25 marks
Semester-II	**Examination**	
Paper 2.1:	Plant Diversity-II(Terminal-60,Sessional-15)	75 marks
Paper 2.2:	Practical	25 marks
Semester-III	**Examination**	
Paper 3.1:	Plant Diversity-III(Terminal-60,Sessional-15)	75 marks
Paper 3.2:	Practical	25 marks
Semester-IV	**Examination**	
Paper 4.1:	Cell Biology, Genetics and Plant Breeding (Terminal-60,Sessional-15)	75 marks
Paper 4.2:	Practical	25 marks
Semester-V	**Examination**	
Paper 5.1:	Plant Growth, Development and Biostatistics (Terminal-60, Sessional-15)	75 marks
Paper 5.2:	Practical	25 marks
Semester-VI	**Examination**	
Paper 6.1:	Plant Physiology and Biochemical Techniques (Terminal-60, Sessional-15)	75 marks

Paper 6.2:	Practical	25 marks

Semester-VII Examination

Paper 7.1:	Biochemistry, Molecular Biology and Biotechnology (Terminal-60, Sessional-15)	75 Marks
Paper 7.2:	Practical	25 marks
Paper 7.3: (Honours) Applied Botany(Terminal-60,Sessionsl-15)		75 marks
Paper 7.4: (Honours) Practical		25 marks

Semester-VIII Examination

Paper 8.1:	Ecology and Utilization of Plants (Terminal-60,Sessionsl-15)	75 marks
Paper 8.2:	Practical	25 marks
Paper 8.3: (Honours) Plant Biotechnology (Terminal-60,Sessionsl-15)		75 marks
Paper 8.4: (Honours) Practical		25 marks

Total	**1000 Marks**

SEMESTER-I

Botany Paper 1.1: Plant Diversity-I

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- explain the structure and economic importance of *Virus, Bacteria* and *Cyanobacteria*.
- recognize the economic importance of microbes in daily life.
- expand the diversities of plant life.
- describe the life cycle pattern and affinities of Algae, Fungi.
- discover the diseased plant in field condition.
- narrate the evolutionary pattern and economic importance of Algae, Fungi and Lichen.

UNIT-I

Diversity of Plant : Definition, scope and Classification of the Kingdom : Basic concepts of Evolution and Plant Diversity.

Viruses : Structure, multiplication and economic importance of viruses.

Bacteria : Structure, nutrition, reproduction and economic importance.

Cyanobacteria : General account, thallus organisation and economic importance.

UNIT-II

General characters: Classification, economic importance and affinities of Algae.

Structure, reproduction life history and systematic positon of *Volvox, Oedogonium* and *Chara*.

UNIT-III

Important features and life history of *Vaucheria, Ectocarpus Polysiphonia*.

General account of Bacillariophyceae.

UNIT-IV

General characters, Classification, Nutrition and Economic importance of fungi.

Structure, Reproduction, Life history and Systematic position of *Albugo, Mucor, Penicillium, Puccinia* and *Alternaria*.

General account of Lichens (Structure, Reproduction and Economic importance).

UNIT-V

General account of plant pathogens, host pathogen interactions

Major diseases of plants and their control (blast and blisat of rice, rust and smut of wheat, downy mildew and tikka disease of groundnut, citrus canker and powdery mildew).

References:

1. Smith, G.M., 1971, Cryptogrammic Botany, Vol.I, Algae and Fungi, Tata McGraw Hill Publishing Co.New Delhi.
2. Sharma, P.O., 1991, The Fungi, Rastogi and Co., Meerut
3. Dube, H.C., 1990, An Introduction to Fungi, Vikas Publishing House, Pvt. Ltd, New Delhi.
4. Clifton, A., 1958, lntroduction to the Bacteria, McGraw Hill and Co, New York.
5. Bold, H.C., Alexopoulous, C.J. and Delevoryas, T., 1980, Morphology of Plant and Fungi (4th Edn) Harper and Row Co., New York.
6. Kumar, H.D., 1988, Introductory Phycology affiliated East- West Press Ltd., New York.
7. Mandahar, C.L., 1998, Introductions to Plant Viruses, Chand and Co., Ltd. Delhi.
8. Sharma, O.P., 1992, Text book of Thallophytes, McGraw Hill Publishing Co.

Botany Paper 1.2 (Practical)

Contact Hours Per Week : 2

Examination Duration : 3 hours

Maximum Marks : 25 (Expt.18, Viva-4, Record-3)

Objective :

- To enable students to do practical work based on the syllabus.
- Acquaint practical techniques used to investigate the life processes.
- To enable the students to gain inside basic laboratory procedures, process and techniques.

Suggested Laboratory Exercises

1. Study of the plant types included under algal and fungi.
2. Observation of disease symptoms in hosts infected by fungi, viruses and bacteria. Slide preparation of diseased material and identification of pathogens.
3. Gram-staining techniques of bacteria
4. Study of various types of Lichen thalli.

SEMESTER-II

Botany Paper 2.1 Plant Diversity – II

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- explain the geological time scale and different processes of fossilization.

- illustrate the evolution of seed habit.
- identify the significance of stellar evolution.
- recognize the importance of living fossils and its origin and evolution of naked seeded plants.

UNIT-I

General characters, classification and affinities. Reduction theory and progressive sterilization in sporogenous tissue.

Morphology, anatomy, life history and affinities of *Riccia, Marchantia, Anthoceros* and *Funaria*.

UNIT-II

General characters, classification and affinitiesx;. Evolution of stelar system, Telome concept, Heterospory and seed habit.

UNIT-III

Morphology, anatomy, life history and affinities of *Lycopodium Selaginella, Equisetum* and *Marsilea*.

UNIT-IV

General characters, classification and affinities, of Gymnosperms.

Life history of *Cycas, Pinus* and *Gnetum*.

UNIT-V

Geological time scale, fossils and fossilization processes; study of fossils : *Rhynia, Lepidodendron* and *Cycadeoidea*.

References

1. Smith, G.M., 1971, Cryptogammic Botany, Vol.II, Bryophytes and Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.

2. Sharma, O.P., 1990, Text book of Pteridophytes , McMillan India Ltd.

   Puri, P., 1980, Bryophyta, Atma Ram & Sons, Delhi.

3. Willson, N.S. and Rothwel G.W., 1983, Palaeobotany and Evolution of Plants (2nd Edn.) CambridgeUniversityPress, U.K.

4. Arnold, C.A., Introduction to Paleobotany.

5. Stewart, W.M., 1983, Palaeobotany and the Evolution of Plants, CambridgeUniversity Press, Cambridge.

Botany Paper 2.2 (Practical)

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.-18, Viva-4, Record-3)

Objective :

- To enable students to do practical work based on the syllabus.
- Acquaint practical techniques used to investigate the life processes.
- To enable the students to gain inside basic laboratory procedures, process and techniques.

Suggested Laboratory Exercises

1. Study of morphology, reproductive structures and anatomy of the examples cited under Bryophyta, Pteridophyta and Gymnosperms.
2. Study of fossils from materials and slides.

SEMESTER-III

Botany Paper 3.1 Plant Diversity – III

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- state the principles of plant systematics and nomenclature of Angiosperms.
- identify plants and assign to them for specific taxa.
- differentiate the anatomy of higher plants and anomaly in them.
- build the knowledge about collection and preservation of Flora.
- aware the modern trends in classification of plants.

UNIT-I

A brief account of Vegetative and Reproductive Organs (in terms of Botanical terms).

Comparative account of Benthom and Hooker and Engler and Prantle System of Classification.

A brief account of international code for Botanical nomenclature.

A brief account of current concepts in Taxonomy, Cytotaxonomy, Numerical Taxonomy and Anatomy in relation to Taxonomy.

UNIT-II

Diversity of following plants among the members of the families

Rutaceae, Fabaceae, Caesalpinaceae, Mimosaceae, Cucurbitaceae, Rubiaceae, Asteraceae.

UNIT-III

Diversity of following plants among the members of the families

Asclepiadaceae, Acanthaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Palmae and Poaceae.

UNIT-IV

Tissues Meristematic tissues, organization of shoot and root apices; permanent tissues.

Tissue system, epidermal, ground and vascular; principle and distribution of mechanical tissue in plants.

UNIT-V

Normal secondary growth in stem and root. Anomalous secondary growth in *Bignonia, Boerhaavia, Strychnos, Amaranthus, Nyctanthes,* Dracaena;

Ecological Anatomy in Hydrophyte and Xerophytes

Root-stem transition and origin of lateral shoot and root.

References

1. Bhatnagar, S.P. and Moitra, A., 1996, Gymnosperms, New Age International Limited, New Delhi.
2. Clifford, E.M. and Foster, A.S., 1988, Morphology and Evolution of Vascular Plants, W.H Freeman and Company, New York.
3. Davis, P.H. and Heywood, V.H., Principles of Angiospermn Taxonomy, Oliver and Boys, London.
4. Stace, C.A. Plant Taxonomy and Biosystematics Edward Arnold, London, Stuessy, T.F. Plant Taxonomy, ColumbiaUniversity Press, New York.
5. Singh G., Plant Systematics : Theory and Practice, Oxford and IBM Publishing Co. Pvt. Ltd., New Delhi.
6. Sporne, K.R., 1965, The Morphology of Gymnosperms, Hutchinson & Co. (Publishers) Ltd., London.
7. Radford, A.E., 1986, Fundamentals of Plant Systematic. Harper and Row. New York.
8. Heywood, V.H. and Moore, D.M., (eds.) 1984, Current Concepts in Plant Taxonomy. Academic Press, London.
9. Jeffrey, C., 1982 An Introduction to Plant Taxonomy, CambridgeUniversity Press, Cambridge, London.
10. Gutter, E.G., 1969, Part I, Cells and Tissues Edward Arnold, London.
11. Cutter, E.G., 1971, Plant Anatomy Experiment and Interpretation. Part-ll Organs, Edward Arnold, London.
12. Esau, K., 1977, Anatomy of Seed Plants, 2nd Edition- John Wiley & Sons, New York.

13. Fahn, A., 1974. Plant Anatomy, 2nd Edition, Peragamon Press, Oxford.

14. Mauseth, J.D., 1988, Plant Anatomy, The Benjamin Cummings Publishing Company Inc., Mento park, California, USA.

Botany Paper 3.2 (Practical)

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.18, Viva-4, Record-3)

Objective :

- To enable students to do practical work based on the syllabus.
- Acquaint practical techniques used to investigate the life processes.
- To enable the students to gain inside basic laboratory procedures, process and techniques.

Suggested Laboratory Exercises

1. The following plant types are suitable for study. This list is only indicative. Teachers may select plants available in their locality. Poaceae, Musaceae, Magnoliaceae, Rutaceac, Euphorbiaceae, Apiaceae, Apocyanaceae, Asclepiadaceae, Scrophulariacea, Lamicea, Rubiaceae, Cucurbitaceae.
2. Preparation and submission of herbarium specimens (15 nos.) available in the locality.
3. Study about tissues of xylem and phloem adopting tissue meceration technique.
4. Study of primary structure of stem, root and leaf of dicot and monocot.
5. Study of an amolous secondary growth in dicot stems (Bignonia, Boerhaavia, *Amaranthus, Nyctanthes*).
6. Ecological anatomy with special reference to adaptation: Hydrophyte and Xerophyte

SEMESTER-IV

Botany Paper 4.1 Cell Biology, Genetics and Plant Breeding

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- define the basic concepts of cell structure.
- state the process of cell division and cell cycle in eukaryotic organisms.
- identify the principles of variation and hereditary.
- demonstrate the techniques of plant breeding in crop improvement.
- distinguish the genetic control of life processes.

UNIT-I

The cell, historical background, cell theory, cell structure (prokaryotic and eukaryotic cell); ultra-structure and functions of cell organelles: cell wall, plasma membrane, mitochondria, chloroplast, ribosome, endoplasmic reticulum, golgi bodies, nucleus and vacuole.

UNIT-II

Cell cycle and Cell division :mitosis and meiosis and its significance.

Genetics Inheritance : Mendelism, laws of segregation and independent assortment.

UNIT-III

Linkage and Crossing over and its significance

Genetic variation : Mutation, spontaneous and induced mutation.

UNIT-IV

Chromosomal aberration : types, meiotic behaviour and effects of deletion, duplication, inversion and translocation.

Polyploidy and its role in plant breeding.

UNIT-V

Types of plant reproduction : Vegetative, sexual micro propagation and apomixes;

Self incompatibility and male-sterility.

Methods of plant improvement : Pure-line and mass selection; hybridization in self and cross-pollinated crops; introduction and acclimatization; hybrid vigour.

Mutations and polyploidy as methods of plant improvement.

References

1. Atherly, A.G., Girton, J.R. and McDonald, J.F., 1999, The Science of GeneticsSaundersCollege Publishing. Fort Worth, U.S.A.
2. Russel, P.J., 1998, Genetics. The Benjamin/ Cummings Publishing Co. Inc. USA.
3. Snustad, D.P. and Simmons M.J., 2000, Principles of Genetics John Wiley and Sons, Inc. USA.

Botany Paper 4.2 (Practical)

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.18, Viva-4, Record-3)

Objective :

- To enable students to do practical work based on the syllabus.
- Acquaint practical techniques used to investigate the life processes.
- To enable the students to gain inside basic laboratory procedures, process and techniques.

Suggested Laboratory Exercises

1. Comparative study of Cell structure in Onion cells, *Hydrilla* and *Spirogyra*.
2. Study of various stages of mitosis and meiosis using appropriate plant material (onion root tips, onion flower buds)
3. Measurement of cells and microscopic objects with the help of micrometry.
4. Problems related to genetics.
5. Emasculation and bagging technique.

SEMESTER-V

Botany Paper 5.1 Plant Growth, Development and Biostatistics

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- differentiate the process of development of different plants organs anatomically.
- compare the structure of different plants.
- identify the plant body with basic structure.
- understand the principles of biostatistics and its use in plant science.
- the organization of life into hierarchy involving organic molecules, cells, organs, populations and community of species.
- appreciate environmental modification of life process.

UNIT-I

Growth : Definition, phases of growth, kinetics of growth.

Growth hormones : Auxins, Gibberellins, Cytokinins, Abscicic acid and Ethylene, their structure and physiology.

Plant Movements : Tropic and nastic movements, Biological clocks

UNIT-II

Seed dormancy Seed germination and factors for their regulations.

Photomorphogenesis, Phytochrome - discovery and mechanism of action

Concept of photoperiodism, physiology of flowering and florigen concept and vernalisation.

Fruit ripening and senescence.

UNIT-III

Male gametophyte, microsporogenesis: Development of pollen grains, germination of pollen grains, growth of pollen tube, development of male gametophyte.

Megasporogenesis, Structure, types and development of ovules

Development of megaspore and embryosac, types of embryosac (Mono and bi-sporic) and fertilization.

UNIT-IV

Development of monocot and dicot embryos.

Types of endosperm, their development and function.

Preliminary ideas about apomixis polyembryony and oogenesis

Embryo culture

UNIT-V

Distribution of data in biology : Mean, Mode & Median

Measurement of dispersion : Coefficient of variation, standard deviation, standard error of mean

Comparison of means of two samples, t-test for paired samples, F-test.

Chi-square test

References

1. Raghavan, V., 1986, Embryogenesis in Argiosperms : A Developmental and Experimental Study, CambridgeUniversityPress, New York, USA.

2. Bhojwani, S.S. and Bhatnagar, S.P., 2000, The Embryology of Argiospherms, 4th revised and enlarged edition, Vikas Publishing House, Delhi.

Botany Paper 5.2 (Practical)

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.18, Viva-4, Record-3)

Objective:

- To enable students to do practical work based on the syllabus.
- Acquaint practical techniques used to investigate the life processes.
- To enable the students to gain inside basic laboratory procedures, process and techniques.

Suggested Laboratory Exercises

1. Slides of embryology including diversity of style and stigma
2. Study of types of embryos
3. Study of viability of pollen grains
4. Pollen germination by hauging drops or sitting drop technique
5. Verification of Chi-square test
6. Comparison of means of two samples for 't' - test.

SEMESTER-VI

Botany Paper 6.1: Plant Physiology and Biochemical Techniques

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives:

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

- know the principles of the plant physiology.
- explain the mechanism of photosynthesis and respiration.
- distinguish the biology of Nitrogen fixation and the process of growth and development.

UNIT-I

Importance of water to plant life, physical properties of water.

Diffusion and osmosis : Chemical potential and water potential.

Absorption and transport of water and transpiration

Essential macro elements and micro elements and their role Ion absorption; transport of organic substances.

UNIT-II

Photosysthesis : Historical background and significance

Photosynthetic pigments, action spectra and enhancement effects.

Concept of two phtosystems, z scheme Photophosphorylation

Carbon dioxide fixation in plants : C_3 , C_4 and CAM pathway. Photorespiration

Factors affecting photosynthesis, concept on law of limiting factor.

UNIT-III

Aerobic and anaerobic respiration.

Glycolysis, Krebs cycle, electron transport mechanism Oxidativephosphorylation

Pentose phosphate pathway.

UNIT-IV

Nitrogen fixation : non-symbiotic and symbiotic mechanisms, Nlf-genes, regulation of nitrate reductase and nitrogenase, nitrate and ammonia assimilation.

Amino acid synthesis : reductive animation and transamination.

UNIT-V

Centrifuge and Ultracentrifuge, cell fractionation procedure, chromatography - paper chromatography, TLC, electrophoresis - paper and gel electrophoresis, colorimetry and spectrophotometry.

References

1. Galston, A.W., 1989, Life Processes in Plants Scientific American Library, Springer-Verlag, New York, USA.
2. Hopkins, W.G., 1995, Introduction to Plant Physiology, John Wiley & Sons, Inc. New York, USA.
3. Mohr, H. and Schopfer, P., 1995, Plant Physiology, Springer-Verlag, Berlin, Germany.
4. Salisbury, F.B., and Ross C.W., 1992, Plant Physiology (4th Edition), Wadsworth Publishing Co, California, USA.
5. Taiz, L. and Zeiger, E., 1998, Plant Physiology (2nd Edition), Sinauer Associates, Inc. Publishers, Massachusetts, USA.
6. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds.) 1997, Plant Metabolis (2nd Edn), Longman, Essex, England.

Botany Paper 6.2 (Practical)

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.18, Viva-4, Record-3)

Objective :

- To enable students to do practical work based on the syllabus.
- Acquaint practical techniques used to investigate the life processes.
- To enable the students to gain inside basic laboratory procedures, process and techniques.

Suggested Laboratory Exercises

1. Determining the Osmotic Potential of Cell sap by Plasmolytic method.
2. Determination of water potential of any tuber
3. Determination of rate of imbibition in starchy, oilly and proteinaceous seeds.
4. To determine the resistance offered by the cuticle of phyllocladode of Opuntia
5. To determine the rate of stomatal transpiration by potometer.
6. To determine the rate of photosynthesis in different wavelengths of light Co_2 concentration / environmental conditions.
7. To determine the rate of catalase activity by paper disc method.
8. Study of pigments in plants by solvent method.
9. To study the effect of temperature on permeability of plasmamembrane.
10. Separation of amino acids by paper chromatography
11. Demonstration of gel - electrophoresis
12. Verification of Beer - Lambert's Law

SEMESTER-VII

Botany Paper 7.1 Biochemistry, Molecular biology and Biotechnology

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- appreciate the higher studies in biochemistry, molecular biology and biotechnology.
- handle with the modern areas of biology.
- recognize the importance of tissue culture, protoplast culture, somatic hybridization.
- know the methods of gene delivery and importance of transgenic plants.

UNIT-I

Biomolecules : Covalent bond and other weak interactions (electrostatic interaction, hydrogen bond, Vander Waal's forces, hydrophobic interactions) and their significance in biomolecules. Reactive groups in biomolecules.

lonization of water, pH and buffer.

Enzymology : Classification and nomenclature of enzymes, enzyme as biocatalyst, physico-chemical properties of enzymes, co-enzymes, isoenzyme, mode of enzyme action, factors affecting enzyme activities (substrate concentration, enzyme concentration, temperatures, pH).

UNIT-II

Carbohydrate : Classification, structure of some representative, examples of monosaccharides, disaccharides and polysaccharides.

Lipid: Classification and structure of lipid and fatty acids; saturated and unstructured fatty acids.

Amino acid and protein : Structure, characteristic and classification of amino acids; Protein and non-protein amino acids ; primary, secondary and tertiary structure of protein.

UNIT-III

Nucleic acid and their composition, nucleosides and nucleotides, DNA : structure and forms of DNA, Replication of DNA in prokaryotic system, enzymatic equipments of DNA

replication, denaturation and renaturation of DNA. RNA ; structure, different types and their role, transcription in prokaryotes.

UNIT-IV

Concept of gene : Gene organization in prokaryotes and eukaryotes (split genes).

Gene expression : Central dogma, genetic code, protein biosynthesis (translation), post-translational modifications of protein.

Gene regulation : Gene regulation in prokaryotes - operon concept : inducible, repressible operons ; positive and negative gene regulation, concept of gene regulation in eukaryotes.

UNIT-V

Plant biotechnology : Tissue culture, cellular differentiation and totipotency; organogensis and embyogenesis, protoplast isolation and culture, somatic hybridzation.

Recombinant DNA Technology : Restriction endonucleases, cloning vectors, genomic and cDNA library, Southern and Northern blotting techniques, DNA finger-printing (RFLP, RAPD, AFLP), Polymerase chain reaction.

Transgenic plants : Methods of gene delivery (physical and Agrobacterium mediated), examples of transgenic plants.

References

1. Bhojwani, S.S., 1990, Plant Tissue Culture : Applications and Limitations, Elsevier Science Publishers, New York, USA.

2. Lea, P.J. and Leegood, R.C., 1999, Plant Biochemistry and Molecular Biology, John Wiley & Sons, Chichester, England.

3. Vasil, I.K. and Thorpe, T.A., 1994, Plant Cell and Tissue Culture, Kluwer Academic Publishers, The Netherlands.

4. Old, R.W. and Primrose, S.B. 1989, Principles of Gene manipulation. Black well Scientific Publications, Oxford, UK.

Botany Paper 7.2 (Practical)

Contact Hours Per Week : 2

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.18, Viva-4, Record-3)

Objective:

- To enable students to do practical work based on the syllabus.
- Acquaint practical techniques used to investigate the life processes.
- To enable the students to gain inside basic laboratory procedures, process and techniques.

Suggested Laboratory Exercises

1. Qualitative tests for carbohydrates, proteins and lipids
2. Quantitative measurement of sugar.
3. Preparation of tissue culture media
4. In Vitro Culture of explants.

Botany (Honours) Paper 7.3 :Applied Botany

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- understand the methods of plant propagation
- know the methods of technique of plant protection

- know the drugs yielded from plants
- understand the seed proialnction method.

UNIT-I

Biology of Angispermic plant, factors affecting sexual and asexual reproduction. Micro-propagation layering – nature and types, CTiP laying, compound layering and continuous layering, cutting and their types, grafting, nature, types and methods, budding.

UNIT-II

Concept of pest and need for plant protection. Measures of plant protection, pesticides and their use, bio-pesticides, host resistance and IPM.

UNIT-III

Edible and poisonous mushroom. Nutritional value of mushrooms, spawn production, bed preparation, mushroom cultivation, disease and pests.

UNIT-IV

Introduction to medicinal plants, evaluation of crude drugs. Drugs yielded from roots, stem, leaf, seed and fruit. Idea about cultivation of medicinal plants.

UNIT-V

Seed definition and morphology seed and grain seed dormancy, germination and viability. Breakdown of different seed compounds, seed storage and classification.

References

1. Cultivation and Utilization of Medical Plants, Atal, C.K. and B.M. Kapoor, RRL (CSIR), Jammu-Tawai
2. Medical Plants – S.K. Jain, National Book Trust of India, New Delhi.

3. Understanding Bio-Diversity, Kothari, A., Orient Longman.

4. Plant Pathology, B.P. Panday, S. Chand & Company, New Delhi.

5. Plant Pathology – Agrios, G.N., Academic Press, New Delhi.

Botany (Honours) Paper 7.4: Seminar and Project

Contact Hours Per Week : 2

Examination Duration : 3 Hours

Maximum Marks : 25

1. Seminar : 10 Marks
2. Project : 15 Marks

SEMESTER-VIII

Botany Paper 8.1: Ecology and Utilization of Plants

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives:

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

- analyse the ecological factors and principles of succession.
- distinguish about pollution, balance of nature and conservation.
- identify natural resources in a sustainable manner.
- show favourable attitude for conservation and management of natural resources.
- know the economic importance and use of plants and specific parts in daily life.

UNIT-I

Atmosphere : Gaseous composition, water cycle, photosynthetically active radiation, factors : temperature, light and wind.

Lithosphere : Soil profile, physico-chemical properties of soil.

Hydrosphere : Surface water bodies, ocean and estuarine habitat, aquatic organisms.

Morphological, anatomical and physiological responses of plants to ecological factors.

UNIT-II

Structural aspects : abiotic and biotic components; Functional aspects : Food chain and food web; Types of ecosystem : Forest, grass land, desert and aquatic.

Ecological pyramids and energy flow in ecosystems

Primary productivity and secondary productivity

Biogeochemical cycles : carbon, nitrogen, phosphorous and sulphur cycle.

UNIT-III

Growth curves of populations, 'r' and 'k' - selection, carrying capacity and population regulation

Characteristics of the community, frequency, density , cover, life-forms and biological spectrum.

Ecological niche

Ecological succession; Hydrosere, xerosere, monoclimax and polyclimax theories

Biogeographic regions of India.

UNIT-IV

Pollution of air, water and soil and their control.

Degradation of forest, encroachment and desertification

Ozone depletion and global warming

Social forestry and agro-forestry

Environmental management and sustainable development

Air, water and environmental acts.

UNIT-V

Food plants : rice, wheat, maize and potato.

Fibres : cotton and jute.

Vegetable oil : Mustard and Groundnut.

Spices : General account.

Timber yielding plants : Botany and importance of Sal, Teak and Sishoo.

Medicinal plants : Brief account of ten important plant drugs and their chief constituents used in indigenous and allopathic systems of Medicine.

Beverages : Tea and Coffee.

References

1. Odum, E.P., 1983, Basic Ecology, Saunders, Philadelphia.
2. Kormondy, E.J., 1996 Concepts of Ecology, Prentice - Hall of India Pvt. Ltd. New-Delhi.
3. Mackenzie, A. et al 1999, Instant Notes in Ecology, Viva Books Pvt. Ltd., New Delhi.
4. Kocchar, S.L., 1998, Economic Botany in Tropics 2nd Edn. McMillan India Ltd. New Delhi.
5. Sambamurthy, A.V.S.S. and Subramanyam, N.S., 1989. A text book of Economic Botany Wiley Eastern Ltd. New Delhi.
6. Sharma, O.P., 1996, Hills Economic Botany (Late Dr. A. F. Hill, adapted by O. P. Sharma. Tata McGraw Mill Co. Ltd. New Delhi.
7. Simpson, B.B., and Conner, Ogorzaly, M., 1986. Economic Botany - Plants in our World, McGraw Hill, New York.

Botany Paper 8.2 (Practical)

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.18, Viva-4, Record-3)

Objective :

- To enable students to do practical work based on the syllabus.
- Acquaint practical techniques used to investigate the life processes.
- To enable the students to gain inside basic laboratory procedures, process and techniques.

Suggested Laboratory Exercises

1. To measure the aboveground plant biomass in a grassland.

2. To determine diversity indices (richness, Simpson, Shannon-Wiener) in grazed and protected grassland.

3. To compare bulk density and porosity of grassland garden soil, clay and sand.

4. To determine the species diversity using Quadrant Method.

5. To determine moisture content and water holding capacity of cow dung, brick soil, garden soil and grassland soil.

6. To estimate transparency (Using Sachii disc method), pH and conductivity of different water bodies.

7. To measure dissolved Oxygen content in polluted and unpolluted water samples.

8. To estimate salinity of different water samples.

9. To estimate dust holding capacity of the leaves of different species.

10. Study of morphology, botanical name, common name, parts used and principal ingredients present in the following useful plants :

    a) Food plants - Cereals, pulses, vegetables and fruits

    b) Fiber plants - Cotton, Jute and Coir

    c) Timber yielding - All timber yielding plants including bamboo available in the locality.

    d) Spices -

    e) Beverages -

    f) Medicinal plants -

11. Preparation of a project of 20 plants used in the locality on any category.

12. Field Visits : To study the flora of the locality

Botany (Honours) Paper 8.3 Plant Biotechnology

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives:

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

- Understand the concept and applications of biotechnology.
- Know the techniques of plant tissue culture.
- Appreciate the potentiality of biotechnology in production of GM plants.

UNIT-I

Definitions, scope and importance of biotechnology. Plant cell and tissue culture. Concept of totipotency, equipment and techniques, nutrient media and their preparations, shoot and root apical meristem, growth regulations.

UNIT-II

Culture of Explants, callus formation and its culture. Organogenesis and embryogenesis. Somoclonal variation. Protoplat culture and regeneration, protoplast fusion and somatic hybridization, Anther and Pollen culture.

UNIT-III

Mars propagation of plants through tissue culture, genetic manipulation of plants, transfer of genes into plants and animals, basic idea about vectors – genetic transportation (Agrobacterium mediated and shot gun method)

UNIT-IV

Production of disease free and disease resistant plants, induction and selection of mutants for abiotic and biotic stress, transgenic plants.

UNIT-V

Brief accent of bio-transformation, bio-reactor industrial plant products, industrial microbial products, preliminary idea about protcomic, genomics and bio-transformation.

References

1. Plant Biotechnology by K. B. Ramanath, S. Chand Publications.
2. Plant Tissue Culture (Theory & Practice), S. S. Boiwani and Razdan, M. K., Elsevier Science Publications.
3. Biotechnology, Keshav Treham, Wiley Easterm Ltd.
4. Plant Biotechnology, Kung, S. and C. J. Arntzen, Butterworths, London.
5. An Introduction to Plant Tissue Culture, M. K. Razdan (IBH Publications).
6. Plant Cell and Tissue Culture, John, M. Walker, Human Press, New Jersey.
7. Plant Cell Tissue and Organ Culture, Gamborg, O.L. and Phillips, G,W., Narosa Publishing House.

Botany (Honours) Paper: 8.4 (Practical)

Contact Hours Per Week	:	2
Examination Duration	:	3 Hours
Maximum Marks	:	25 (Expt.18, Viva-4, Record-3)

Suggested Laboratory Exercises:

- Aseptic techniques
- Surface sterilizations and explant preparations
- Instruments associated with plant biotechnology – principles and applications
- Preparation of M.S. and BS medium for callus growth.
- Preparation of medium for growth of bacteria
- Agar plating for single colony and counting of colonies
- Protoplast isolation and counting
- Micrometry for calibrating of microscope
- Pollen grain isolation and culture
- Dissection and stating of Angiospermic rule.

Syllabus for Four Year Integrated B.Sc.B.Ed. (Subject Spacilasation)

SCHEME OF EXAMINATION IN ZOOLOGY (HONOURS)

Babasaheb Bhimrao Ambedkar Bihar University Muzaffarpur (Bihar)

(Based on NCTE Curriculum Framework for Four year Intigrated B.Ed. Programme)

SCHEME OF EXAMINATION IN ZOOLOGY (HONOURS)

B.SC. B.ED.

FIRST YEAR

SEMESTER-I	**Examination**	
Paper-1.1	Animal Diversity-I(Terminal-60, Sessional-15)	75 marks
Paper-1.2	Practical	25 marks
SEMESTER-II	**Examination**	
Paper-2.1	Animal Diversity – II(Terminal-60, Sessional-15)	75 marks
Paper-2.2	Practical	25 marks

SECOND YEAR

SEMESTER-III	**Examination**	
Paper-3.1	Animal Diversity – III(Terminal-60, Sessional-15)	75 marks
Paper-3.2	Practical	25 marks
SEMESTER-IV	**Examinations**	
Paper-4.1	Cytology, Genetics and Evolution(Terminal-60, Sessional-15)	75 marks
Paper-4.2	Practical	25 marks

THIRD YEAR

SEMESTER-V	**Examination**	
Paper-5.1	Animal Physiology, Endocrinology and Immunology (Terminal-60, Sessional-15)	75 marks
Paper-5.2	Practical	25 marks
SEMESTER-VI	**Examination**	
Paper-6.1	Ecology, Zoo-Geography, Wild Life and Ethology	

	(Terminal-60, Sessional-15)	75 marks
Paper-6.2	Practical	25 marks

FOURTH YEAR

SEMESTER-VII	**Examinations**	
Paper-7.1	Biochemistry, Molecular Biology and Biotechnology	
	(Terminal-60, Sessional-15)	75 marks
Paper-7.2	Practical	25marks
Paper-7.3	(Honours) Applied Zoology(Terminal-60, Sessional-15)	75 marks
Paper-7.4	(Honours) Seminar and Project	25 marks

SEMESTER-VIII	**Examinations**	
Paper-8.1	Animal Development, Biostatistics and Instrumentation	
	(Terminal-60, Sessional-15)	75 marks
Paper-8.2	Practical	25 marks
Paper-8.3	(Honours) Pisiculture(Terminal-60, Sessional-15)	75 marks
Paper-8.4	(Honours) Practical	25 marks

Total	**1000 marks**

* Paper 4(c) Biology for PCM 100 marks

SEMESTER – I

Zoology Paper-1.1: Animal Diversity-I

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives :

- The prospective teacher trainee would be able to -
- understand the diversity of form, structure and function of the invertebrate organism varying from simple protozoans to complex annelid metazoans,
- appreciate the habits, habitats and lie history of different invertebrates,
- state classification of the various phyla upto class and order level with suitable examples,
- appreciate the affinities and phylogenetic positions of the organisms/ groups,
- gain an understanding of the vital life processes that sustain the organisms.

Unit-I : Animal classification and Protozoa

Principles of classification, outline classification of animal kingdom upto phyla.

Protozoa – General characters and classification of Protozoa up to classes with examples. Type study : *Paramecium* – External and internal structure, physiology. Locomotion, osmoregulation, nutrition and reproduction in Protozoa.

Unit-II : Porifera

General characters and classification of Porifera up to order with examples.

Type study : *Sycon* – habit and habitat, morphology, body wall and canal system, physiology, asexual and sexual reproduction. Canal system in Porifera (Ascon type, Sycon type, Rhagon type and Leucon type).

Skeleton in sponges.

Larval forms in Porifera.

Economic importance of sponges.

Unit-III : Coelenterta and Ctenophora

Coelenterata : General characters and classification of Coelenterata up to order with examples.

Type study : *Aurelia* – habit and habitat, external and internal structure, physiology, reproduction.

Mesenteries in Metridium.

Polymorphism in Coelenterata.

Coral and coral reefs - types, formation, theories and importance.
Ctenophora : General characters, structure and affinities.

Unit-IV : Platyhelminthes and Nemathelminthes

Platyhelminthes : General characters and classification of the phylum upto order with examples : (a) Type study : *Fasciola hepatica* – external and internal structure, digestive, excretory, nervous and reproductive system, life history and parasitic adaptations; (b) Type study : *Taenia solium* – external and internal structure, physiology, nervous system, reproductive system, life cycle.

Nemathelminthes : General characters and classification of the phylum upto order with examples. Type study : *Ascaris* – external and internal structure, digestive, excretory and reproductive systems and life-cycle. Parasitism and Parasitic Adaptations in the helminthes.

Unit-V : Annelida

General characters and classification of the phylum upto order with examples.

Type study : *Nereis* – external and internal structure, coelome, locomotion, digestive, blood vascular, excretory, nervous, reproductive systems and life history.

Nephridial system and coelomoduct in Annelids.

References:

1. Barington, E.J.W. (1969) Invertebrates Structure and Function, Oliver and Boyd, London.
2. Hall, R.P. (1953) Protozoology, New Yorik.
3. Harner, S.F. and Shipley, A.E. (1895-1909) The Cambridge Natural History, Macmillan and Co., London.
4. Hyman, L.H. (1967) The Invertebrates, McGraw Hill, New York.
5. Parker T.J. and Haswell, W.A. (1974) Textbook of Zoology. Invertebrates, The Macmillan Press, London.
6. Sedgwick, Adam (1968) A Students' Textbook of Zoology, Central Book Depot, Allahabad.
7. Meglitsch, P.A. (1967), Invertebrate Zoology, OxfordUniversity Press, New York.
8. Mohanty, P.K. (2000) Illustrated Dictionary of Biology, Kalyani Publishers, Ludhiana.
9. Starer, T.I. and Usinger, R. (1957) General Zoology, New York.

Zoology Paper-1.2 : Animal Diversity-I (Practical)

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.- 18, Viva- 4, Record- 3)

Objectives :

The prospective teacher trainee would be able to -

- dissect, display the internal anatomical systems and appreciate the bio-organisation of the organ system inside the organisms,
- identify the diverse invertebrates and be conversant with their habitat and adaptations,

- develop competency to make microscopic preparations for detailed cellular and sub-cellular studies,
- develop abilities to prepare records/illustrations of the various activities carried out in laboratory and prepare field notes on the bio-diversities.

1. Study of permanent slides of Protozoa : *Amoeba, Entamoeba, Euglena, Paramecium*, *Paramecium* conjugation, *Paramecium* binary fission, *Noctiluca, Plasmodium, Foraminifera, Vorticella*.
2. Culture of protozoans.
3. Study of permanent slides and museum specimens of Porifera, *Leucosolinia, Sycon, Spongilla*, sponge spicules, *Hyalonema, Euspongia*, sponge gemmules, L.S. of Sycon and T.S. of Sycon.
4. Mounting of temporary slides of sponge spicules and gemmules.
5. Study of permanent slides and museum specimens of Coelenterata :
   Hydra, Hydra with bud, *Hydra* with gonad, *Obelia* colony, *Obelia* medusa, *Porpita, Physalia*, Ephyra larva, *Metridium*, T.S. of *Metridium, Aurelia, Gorgonia, Pennatula*.
6. Study of specimens and slides of Platyhelminths, *Fasciola hepatica, Tenia solium, Planaria*, different segments of *T. solium* (scolex, mature, gravid), T.S. of *F. hepatica* and different larval stages of *Fasciola*.
   Study of specimens and slides of Nematohelmenthis.
   Male and female of *Ascaris*, T.S. of male and female *Ascaris*.
7. Study of museum specimens and slides of Annelida
   Nereis, Heteronereis, Pontobdella, Chaetopterus, Aphrodite, Sipunculus, Earthworm T.S. through phyarynx, gizzard, intenstie, Leech T.S. through crop and caecum region.
8. Mounting of temporary slides of spermatheca, ovary and nerve ring of earthworm, parapodia of nereis.
9. Dissection of *Pheretima*
   Digestive system and nervous system.

SEMESTER - II

Zoology Paper-2.1 : Animal Diversity – II

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives :

- The prospective teacher trainee would be able to -
- understand the diversity of form, structure and function of the advance invertebrate arthropoda organism onwards to lower chordate cyclostomes,
- appreciate the habits, habitats and life history of different invertebrates,
- state the classification of various phyla up to class and order level with suitable examples,
- develop and appreciate the skills of logical, holistic and system's thinking up to order and able to classify the organic diversity,
- appreciate the affinities and phylogenetic position of the organism/ gmps,

- gain an understanding of the vital life processes and various adaptations that sustain the organism
- Understand the diversity of the habit, habitat, structure, life history of the various chordates and state their affinities, phylogenetic relationships and classification,
- appreciate the chordate characteristics, peculiarities and evolutionary uniqueness of the Hemichordates, Urochordates and Cephalochordates and their interrelationship,

Unit-I : Arthropoda and Onychophora

Arthropoda : General characters and classification of Arthropoda upto classes with examples.

Type study : Prawn (*Palaemon*) – External and internal morphology, appendages, digestive, circulatory, respiratory, excretory, nervous and reproductive system.

Onychophora – *Peripatus* structural organization and affinities.

Larval forms of Crustacea.
Social organization in insects.

Unit-II : Mollusca

General characters and classification of Mollusa upto classes with example.

Type study : *Pila* and *Unio* – external and internal structure morphology, digestive, respiratory, circulatory, excretory, nervous and reproductive systems.

Torsion and detersion in Gastropoda.

Unit-III : Echinodermata

General characters and classification of Echinodermata upto classes with example.

Type study : *Asterias* : External and internal structure, digestive, water-vascular, perihaemal, haemal, reproductive systems, development and metamorphosis. Water vascular system and Larval forms in Echinodermata.

Unit-IV : Chordata

Elementary idea about Chordate ancestry. General characters and classification of Chordata upto classes with examples.

Protochordata : Type study : (a) *Balanoglossus* : External and internal structure, digestive, respiratory, blood vascular systems, reproductive systems and life history, (b) *Herdmania*: External and internal structure, digestive, respiratory, blood vascular, reproductive systems

and lie history, (c) *Amphioxus* : External and internal structure, digestive, respiratory, blood vascular and reproductive systems.

Inter-relationship among Protochordates.

Unit-V : Cyclostomata

General characters and classification of Cyclostomata upto orders with examples.

Petromyzon and *Myxine* : External morphology and digestive system. Life history, affinities and phylogenetic position.

References:

1. Barington, E.J.W. (1969) Invertebrates Structure and Function, Oliver and Boyd, London.
2. Hall, R.P. (1953) Protozoology, New Yorik.
3. Harner, S.F. and Shipley, A.E. (1895-1909) The Cambridge Natural History, Macmillan and Co., London.
4. Hyman, L.H. (1967) The Invertebrates, McGraw Hill, New York.
5. Parker T.J. and Haswell, W.A. (1974) Textbook of Zoology. Invertebrates, The Macmillan Press, London.
6. Sedgwick, Adam (1968) A Students' Textbook of Zoology, Central Book Depot, Allahabad.
7. Meglitsch, P.A. (1967), Invertebrate Zoology, OxfordUniversity Press, New York.
8. Mohanty, P.K. (2000) Illustrated Dictionary of Biology, Kalyani Publishers, Ludhiana.
9. Starer, T.I. and Usinger, R. (1957) General Zoology, New York.

Zoology Paper-2.2 : Animal Diversity – II (Practical)

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 25

Objectives :

The prospective teacher trainee would be able to -

- dissect, display the internal anatomical systems and appreciate the bio-organisation of the organ system inside the organisms,
- identify the diverse invertebrates and be conversant with their habitat and adaptations,

- develop competency to make microscopic preparations for detailed cellular and sub-cellular studies,
- develop abilities to prepare records/illustrations of the various activities carried out in laboratory and prepare field notes on the bio-diversities,
- dissect, display the internal anatomical systems and appreciate the bio-organisation of the organ system inside the organism,
- appreciate the developmental biology of economically important insect like honeybee and silk moth,
- develop abilities to prepare records/illustrations of the various activities carried out in the laboratory and prepare field notes on the bio-diversities and state-of-art report.

1. Study of permanent slides and museum specimens of Arthropoda.
   Daphnia, Cypris, Cyclops, Sacculina, Balanus, Eupagurus, Crustaccan larvae (mysis, megalopa, nauplius, zoea), centipede, millipeds, *Limulus* and *Peripatus*.
   Mounting of mouthparts of cockroach and appendages of prawn.

2. Study of permanent slides and museum specimens of mollusca.
   Chiton, Dentalium, Mytilus, Loligo, Octopus, Sepia, Nautilus, Glochidium larva, Veliger larva, T.S. through gill of *Unio*.
   Mounting radula of *Pila*.

3. Study of permanent slides and museum specimens of Echinodermata.
   Astropecten, Clypeaster, Cucumaria, Antedon, Echinus, larval forms of Echinodermata ((Bipinnaria, Echinopluteus, Ophiopluteus larva)

4. Study of permanent slides and museum specimens of protochordates and Cyclostomes.
   Balanoglossus, Herdmania, Amphioxus, Doliolum, Salpa, Petrmyzon, Myxine
   Balanoglossus : T.S. through Proboscis, collar and trunk region.
   Amphioxus : T.S. through oral hood, pharynx, intestine, tail.

5. Dissection :
   - Nervous system and digestive system of prawn.
   - Nervous system of *Pila*.
   - Salivary gland of cockroach.

SEMESTER - III

Zoology Paper-3.1 : Animal Diversity – III

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

The prospective teacher trainee would be able to -

- State the dignostic characters and classification of vertebrates,
- understand the piscine diversity and their adaptive radiation leading to the evolution of Dipnoi and their adventures to conquest the land,

- appreciate the beginnings of tetrapod evolution, development of parental care and regenerative capacities found among the amphibians,
- know the different poisonous snakes of India and adaptive radiation of the reptiles along with their habits and habitat,
- understands the origin of birds, the flight mechanism and their migrational behaviour,
- appreciate the structural diversity, functional specialization and phylogenetic relationship among the prototherian and metatherian mammals and the process of descent with modification.

Unit-I : Pisces

General characters and different groups such as Elasmobranch and Teleost with examples.

Type Study : *Scoliodon* – External and internal structure, digestive, respiratory, circulatory, Nervous, urinogenital systems and sense organs.

Dipnoi and its affinities.

Accessory respiratory organs, Swim (air) bladder in fishes.

Unit-II : Amphibia and Reptilia

General characters and classification up to orders with examples.

Origin of tetrapods.

Parental care in Amphibia.

Poisonous and non-poisonous snakes of India.

Poison apparatus and biting mechanism in snakes.

Dinosaurs : Types and extinction.

Unit-III : Aves and Mammalia

General characters and classification up to orders with examples.

Flight adaptation and migration in birds.

Archaeopteryx - Structure and affinities.

General characters and affinities of Prototheria and Metatheria.

Adaptation in Chiropetera and Cetacea.

Unit-IV : Comparative Anatomy of Vertebrates-I

Comparative studies in fishes, amphibian, reptiles, birds and mammals of the following systems :

a) Integumentary system: Integument; integumentary derivatives- structure and development of placoid scales, feathers and hair.

b) Heart and blood vascular system; evolution of aortic arches.

Unit-V : Comparative Anatomy of Vertebrates-II

Comparative studies in fishes, amphibians, reptiles, birds and mammals of the following systems.

a) Respiratory system,

b) Nervous system,

c) Urinogenital system: evolution of vertebrate kidney and urino-genital ducts.

References:

1. Bhatia, K.S. (1982) The Protochrdates, Central Book Depot, Allahabad.
2. Gharpurey, K.G. (1954), Snakes of India and Pakistan, Popular Prakashan, Bombay.
3. Gee, E.P. (1965) The Wildlife of India, Collings.
4. Colbert, E.H. (1954) Evolution of Vertebrates, Wiley Ltd., New Delhi.
5. Hyman, L.H. (1942) comparative Vertebrate Anatomy, Chicago University Press, Chicago.
6. Kingsley, J.S. (1958) Outlines of Comparative Anatomy of Vertebrates, Allahabad.
7. Parker, T.J. and Haswell, W.A. (1967) A Textbook of Zoology, Vertebrates, Macmillan, London.
8. Lull, R.S. (1940) Organic Evolution, New York.
9. Gregory, W.K. (1951) Evolution Emerging, Vol.I and II, Macmillan, London.
10. Goodrich, E.S. (1958) Studies on the Structure and Development of Vertebrates, Vol.I and II, London.
11. Carl Gans (1970) Biology of the Reptilia, Vol.I and II, Academic Press, New York and London.
12. Noble, G.K (1931) Biology of the Amphibia, New York.
13. Osborn, H.F. (1918) The Origin of Evolution of Life, London.
14. Young, J. Z. (1958) The Life of Vertebrtes, OxfordUniversity Press, London.
15. Young, J. Z. (1958) The Life of Mammals, OxfordUniversity Press, London.
16. Remer, A.S. (1960) The Vertebrate Story, ChicagoUniversity Press, Chicago.
17. Remer, A.S. (1945) The Vertebrate Story, ChicagoUniversity Press, Chicago.
18. Remer, A.S. (1945) Man and Vertebrates, ChicagoUniversity Press, Chicago.
19. Wallace, A.R. (1962) The Geographical Distribution of Animals, Vol. I and II, New York.

20. Berill, N. J. (1955) The Origin of Vertebrates, New York.

21. Holmes, Arthur (1975) Principles of Physical Geology, English Language Book Society and Nelson, Great Britain.

22. Jain, P. C. and Anantha Raman, M.S. (1990) Palaentology, Evolution and Animal Distribution, Vishal Publication, New Delhi.

23. Swinton, W.E. (1970) The Dinosaurs, Allen and Unwin Ltd., London.

24. Kurten, Bjorn (1968) The age of Dinosaurs, World University Library, London.

25. Deoras, P.J. (1978) Snakes of India, National Book Trust, New Delhi

26. Lull, R.S. (1940) Organic Evolution, New York.
27. Gregory, W.K. (1951) Evolution Emerging, Vol.I and II, Macmillan, London.
28. Goodrich, E.S. (1958) Studies on the Structure and Development of Vertebrates, Vol.I and II, London.

Zoology Paper-3.2 : Animal Diversity – III (Practical)

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.- 18, Viva- 4, Record- 3)

Objectives :

The prospective teacher trainee would be able to -

- dissect, display the internal anatomical systems and appreciate the bio-organisation of the organ system inside the organism,
- identify the diverse vertebrates and be conversant with their habitat and adaptations,
- develop abilities to prepare records/illustrations of the various activities carried out in the laboratory and prepare field notes on the bio-diversities and state-of-art report.

1. Study of museum specimens and permanent slides of fishes :
   Pristis, Terpedo, Ophiocephalus, Hippocampus, Echenis, Chimaera, Lepidosiren (lung fish), *Eocoetus, Trygon, Clarius, Anabass*, placoid, ctenoid and cycloid scales.
2. Study of museum specimens and permanent slides of Amphibians.
   Hyla, Toad, *Rhacophorus*, Salamander *Triton*, *Alytes*, *Axoltl* larva, Uraaetyphlus, T.S. of pancreas, liver, intestine, ovary and testis.
3. Study of museum specimens of reptiles.
   Calotes, Uromastix, Chamaeleon, Draco, Varanus, cobra, viper, krait, sea snake, turtle.
4. Study of museum specimen of birds :
   Kingfisher, pigeon, parrot, koel, parrot, owl, duck, house sparrow
5. Study of museum specimens and slides of mammals.
   Bat, Rabbit, Rat, squirrel, mongoose
   T.S. of skin, stomach and spinal cord.

6. Osteology : Study of skull, vertebrale, girdle and permanent limb bones of Varanus, fowl and rabbit
7. Dissection : *Scoliodon*: Dissection of afferent and efferent branchial arteries, cranial nerves (5^{th}, 7^{th}, 9^{th} and 10^{th}), Internal ear and brain
   Toad : Hyoid apparatus
8. Preparation of temporary slide of ctenoid, cycloid and placoid scales.

SEMESTER - IV

Zoology Paper-4.1 : Cytology, Genetics and Evolution

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives :

The prospective teacher trainee would be able to -

- Understand the concept of prokaryote, eukaryote cell types and the structure and function of sub-cellular components.
- State the structure and chemical composition of chromosomes and their behavior during mitosis and meiosis
- Understand the principle of inheritance of characters from one generation to another generation.
- Know that there are definite chromosomes that determines sex of the individual and certain diseases are sex linked.

CYTOLOGY

Unit-I

Cell structure: Prokaryotic and Eukaryotic cell, Cell theory.

Cell membrane – Ultrastructure, composition, Fluid mosaic model, modifications and functions. membrane transport.

Structure and functions of mitochondrion, endoplasmic reticulum, Golgi body, ribosomes, lysosomes, and centrosome.

Unit-II

Nucleus: Nuclear envelope, nuclear matrix and nucleolus.

Chromosomes: Structure, types and chemical composition; euchromatin, heterochromatin; polytene and lampbrush chromosomes.

Cell reproduction: Mitosis and meiosis - cell cycle, regulation of cell cycle in eukaryotes.

Chromosomal mutations- (i) Variation in chromosome number (aneuploidy and euploidy). (ii) Structural changes in chromosomes (deletion, duplication, inversion and translocation).

GENETICS

Unit-III

Mendelian principles of inheritance – monohybrid and dihybrid crosses, back cross and test cross; deviation of Mendelism – incomplete dominance and, co-dominance. Gene interactions: Epistasis, complementary, supplementary, duplicate and collaborator genes.

Multiple alleles: ABO blood groups and Rh factor inheritance.

Unit-IV

Sex-determination- Genetic, hormonal and environmental

Sex-linked inheritance

Linkage and crossing over- types, mechanism and significances.

EVOLUTION

Unit-V

Concept of evolution, origin of life, variation, natural selection, isolation, species and speciation, modern synthetic theory of evolution and evolution of man.

References:

29. Karp (1998) Cell and Molecular Biology, Purnina Book Distributor, New Delhi.
30. Thorpe, B. (1994) Cell Biology, John Willey and Sons, USA.
31. Fiedfedier, D. (1994) Molecular Biology, John and Bartlett Publishing Inc. USA and Narosa Publishing House, New Delhi.
32. Altenberg, Edger (1970) Genetics, Oxford and IBH Publishing Co., New Delhi.
33. Benjamin, Lewin (1997) Genes VI, OxformUniversity Press, Oxford, New York and Tokyo.
34. Mange, Elaine Johansew and Mange, Arthur, P. (1997) Basic Human Genetics, Sinacur Associates Inc., Massachusets, USA.
35. Tamarin, Robert H. (2002) Principles of Genetics, McGraw Hill Co. Ltd., New Delhi.
36. Novitskii, Edward (1977) Human Genetics, Macmillan Publishing Co. Inc., New York and Collier Macmillan Publishers, London.
37. Sinnat, E.W.; Dunn, L.C. and Dobzhanksy, T. (1958) Principle of Genetics, McGraw Hill, New York.
38. Gardner, E.J. and Sastad, D.P. (1984) Principles of Genetics, John Willey and Sons, USA.

Zoology Paper-4.2: Cytology, Genetics and Evolution (Practical)

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.- 18, Viva- 4, Record- 3)

Objectives :

The prospective teacher trainee would be able to -

- develop competency to make microscopic preparations for detailed cellular and sub-cellular studies,
- develop the ability to confidently communicate, the principles behind the practical exercises carried out by him/her.

CYTOLOGY :

1. Study of permanent slides of cell organelles, mitosis and meiosis.
2. Temporary squash preparation of onion root tip or tadpole tail for the study of mitosis.
3. Temporary squash preparation of onion bud or grasshopper testis/ testis for the study of meiosis.
4. Morphology of cancer cells (Horn carcinoma or oral squamous carcinoma cells)
5. Culture of Drosophila and study of its life cycle.
6. Study of barr bodies in human buccal epithelial cells.

GENETICS :

7. Temporary squashing preparation and study of polytene chromosomes of Drosophila.
8. Solving of problems relating to monohybrid and dihybrid crosses, gene interaction and pedigree analysis.
9. Study of Karyotype and Idiogram of man.

SEMESTER - V

Zoology Paper-5.1 : Animal Physiology, Endocrinology, Immunology

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

The prospective teacher trainee would be able to -

- Appreciate the internal anatomical diversity of the various systems of the vertebrates ad their adaptive modifications.
- Know, understand and appreciate the importance of the endocrine system and the structure and functional significance of the glands like Pituitary, Thyroid, Adrenal, and gonads.
- Appreciate the physiological mechanisms of digestion, respiration, and excretion.
- State the composition and functions of blood, blood clotting, cardiac cycle, blood factor and its regulation
- Understand the structure, function and importance of the tissues of muscles and nerves.

PHYSIOLOGY :

Unit-I

Physiology of Digestion and Circulation

Digestion : Digestion of dietary constituents, absorption and assimilation. Vitamins and Minerals

Circulation : Composition and function of blood and lymph, blood coagulation and blood groups and Rh factor.

Heart : Structure, regulation of heartbeat, cardiac cycle & blood pressure.

Unit-II

Physiology of Respiration and Excretion

Respiration : Mechanism and control of breathing. Hemoglobin and transport of O_2 and CO_2.

Excretion : Structure and function of human kidney urine formation, Acid-base balance and Osmoregulation.

Homeostasis and thermo regulation in animals.

Unit-III

Physiology of muscle and nerve

Nerve conduction : Structure and functions of neuron, synapse mechanism of conduction of nerve impulse and synaptic transmission, neurotransmitters.

Muscle : Types and function; ultra-structure, chemical composition and physiological basis of skeletal muscle contraction.

ENDOCRINOLOGY :

Unit-IV

General organization of mammalian endocrine system.

Structure and function of following endocrine glands, pituitary, thyroid, parathyroid and adrenal.

Hormones: Classification, properties of hormones.

Mechanism of hormone actions.

IMMUNOLOGY :

Unit-V

Immunity : Innate and adaptive cells, tissues, organ, molecules of immune system.

Antigen and antibody : structure, types and reaction.

Humoral and cell-mediated immunities, immunotolerance, autoimmunity and hypersensitivity.

AIDS - structure of HIV, mechanism of immuno deficiency and preventive measures.

References:

1. Hoar, W.S. (1983) General and Comparative Physiology, Prentice Hall of India, New Delhi.
2. Prossor, C.L. and Brown, F.A. (1965) Comparative Animal Physiology, Prentice Hall of India, New Delhi.
3. Chatterjee, C.C. (1986) Human Physiology, Vol.I and II, Medical Allied Agency, Kolkata.
4. Hoar, W.S. General and Comparative animal Physiology (Prentice Hall of India)
5. Prosser C.L., Comparative Animal Physiology (Satish Book Enterprises)
6. Wood, D.W., Principles of Animal Physiology.
7. Guyton, A.C., Textbook of Medical Phsiology (W.B. Saunders Co.)
8. Chatterjee, C.C., Human Physiology (Medical Allied Agency)
9. Conn, E. and P.K. Stumpf Outlines of Biochemistry (Wiley Eastern Ltd.)
10. Raven, P.H., Johnson, G.B. Jonanthan, B.L. and S.R. Singer (Tata McGrew Hill Publishing Co. Ltd.)
11. Nielson : animal Physiology (Cambridge)
12. Eckert, Animal Physiology (W.H. Freeman)
13. Drickamer and Vessey : animal Behaviour, Concepts, Processes and Methods (Wadsworth).
14. Grier : Biology of Animal Behaviour (MosbyCollege)
15. Lorenz : The Foundation of Ethology (Springer-Verlag)
16. Balinsky : Introduction to Embryology (CBSCollege Publishers)
17. Hadley : Endocrinology (Prentice Hall)
18. Nalbandor : Reproductive Physiology.
19. Copper, S.R. (1982) General Immunology, Pergamon Press, UK.

Zoology Paper-5.2 : Animal Physiology, Endocrinology, Immunology (Practical)

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.- 18, Viva- 4, Record- 3)

Objectives :

The prospective teacher trainee would be able to -

- have hands on experience and demonstrative abilities of determination of haemoglobin content, W.B.C. and R.B.C. count in the human blood, action of salivary amylase on starch and effect of NaCI and Hcl on R.B.C.,
- know the principles of making permanent slides and microtomy techniques.

A. Physiology :

1. Estimation of haemoglobin of goat/ human.
2. Enumeration of RBC and WBC in blood samples of goat/ human.
3. Preparation of haemin crystal of goat/ human.
4. Measurement of blood pressure, heartbeat and pulse rate of human being.
5. Determination of blood groups and Rh factor of human.
6. Effect of different concentrations of NaCl on RBC.
7. Slides of ganglia, neuron, glea
8. Dissect and display endocrine glands of cockroach.

B. Study of permanent slides of endocrine glands: pituitary, thyroid, parathyroid, pancreas, adrenal and gonads of mammals.

SEMESTER - VI

Zoology Paper-6.1 : Ecology, Zoo-Geography, Wild Life And Ethology

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

The prospective teacher trainee would be able to -

- know the principles and scopes of ecology-ecosystem and biosphere,
- appreciate the inter and intra specific biotic relations vis-a-vis the abiotic environmental components,
- appreciate the need for protection of the environment, animals and plants and their conservation.

ECOLOGY :

Unit-I

Concepts and dynamics of ecosystem

Food chains and food webs

Ecological pyramids, Energy flow.

Ecological factors : water, soil, temperature and light.

H_2O, O_2, Co_2 - cycles.

Unit-II

Populations and Community: Characteristics such as density, natality, mortality, growth and growth form, immigration and emigration, migration, sex ratio, dispersal and dispersion.
Intra and Interspecific animal associations.

Community : Concept, structure, organization and development and major biomes.

Unit-III

Air Pollution: Sources, prevention and control; acid rain, photochemical smog and Green –house effect (global warming).
Water pollution: sources, prevention and control; eutrophication.
Noise and soil pollution: Sources, prevention and control.

ZOOGEOGRAPHY AND WILD LIFE :

Unit-IV

General idea about zoogeographical realms of the world and faunal peculiarities with special reference to oriental region. Evolution of realms, plate tectonics and continental drift.

Conservation and management of wild life, endangered species and their conservation, Red data book.

Habit, habitat, distribution and breeding of tiger, elephant and crocodile.

ETHOLOGY :

Unit-V

Introduction to Ethology

Behaviour: Innate behaviour (tropism, taxes, reflexes and instincts) and acquired behaviour (learning and reasoning).

Communication: Definition, types of signals (touch, sound, chemical and visual),

Pheromones: Types, origin, role in behaviour, pheromones in social insects and their roles in behaviour of insects.

Biological clocks

References:

1. Prater, S.H. (1965) The Book of Indian Animals, Bombay Natural History Society (BNHS), Bombay.
2. Burton, M. and Burton, R. (1970) Funk and Wagnalls Wildlife Encyclopedia, Funk and Wagnolls Inc., New York, Vol.1 to 22.
3. Kumar, H.D. (2000) Plant Animal Interactions, Affiliated East-West Press Pvt. Ltd., New Delhi.
4. Agarwal, V. K. and Gupta Usha (2002) Ecology and Ethology, S. Chand and Co. Ltd., New Delhi.
5. Gundevia, H.S. and Singh, H.G. (2003) A Textbook of Animal Behaviour, S. Chand and Co. Ltd., New Delhi.
6. Kormondy, E.J. (1978) Concepts of Ecology, Prentice Hall of India, New Delhi.
7. Odum, E.P. (1971) Fundamentals of Ecology, W.B. Saunders, Philadelphia, USA.
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9. Dash, M.C. and Dash, S.P. (2008) Fundamentals of Ecology, McGraw Science Education India Ltd.
10. Dash, M.C. (2001) Ecology, Chemistry and Management of Environmental Pollution, Mcmillon Publishing Co., India.

Zoology Paper-6.2 : Ecology, Zoo-Geography, Wild Life And Ethology (Practical)

Contact Hours per Week : 2

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.- 18, Viva- 4, Record- 3)

Objectives :

The prospective teacher trainee would be able to -

- estimate the physicochemical characteristics of water and set-up aquaria,
- develop the skill of collecting, fixing and preserving the plankton, nekton, and benthos.

ECOLOGY :

1. Estimation of the following of different water samples :
   a) Dissolved Oxygen, carbon dioxide
   b) Carbonate, bicarbonate, chloride
   c) Salinity
   d) pH
2. Measurement of transparency of water using Sechhi Disc.
3. Estimation of the water holding capacity and pH of the soil sample.
4. Study of zooplankton (*Cyclops*, zoea larva, naupliues, megolopa, lucifer, Mysis, medusa), nekton (*Pristis, Torpedo, Hippocampus, Exocets, Hemiramphus*), and Benthos (*Chiton, Pennatula, Murex, Metridium Asteris*)
5. Analysis of producers and consumers from the grassland.
6. Study of biodiversity of the five faunal groups.

7. Visit to NandanKananZoologicalPark to study the wild animals and endangered species and submission of report.

SEMESTER - VII

Zoology Paper-7.1 : Biochemistry, Molecular Biology, Biotechnology

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives :

The prospective teacher trainee would be able to -

- understand the principles of physical and chemical organisation of protoplasm,
- acquire knowledge related to the metabolism of the life supporting bio-molecules (carbohydrate, protein and lipid),
- conversant with the modern areas of biology.

BIOCHEMISTRY :

Unit-I Classification, structure and biological properties of carbohydrates, proteins and lipids.

Basic ideas on fibrous/ globular protein, structure and significance of natural fats, steroids and prostaglandins

Enzymes: Nomenclature and classification, mechanism of enzyme action and coenzymes.

Unit-II

Carbohydrate metabolism : Glycolysis, TCA cycle, electron transport system, hexose monophosphate shunt, glycogen metabolism, gluconeogeonesis

Lipid : oxidative pathway of saturated and unsaturated fatty acid

Protein : General reaction of aminoacid metabolism, transamination, deamination, decarboxylation and urea cycle.

MOLECULAR BIOLOGY :

Unit-III

DNA: structure (primary and secondary), forms, organization; denaturation and renaturation

Replication in prokaryotes and eukaryotes.

RNA: Genetic RNA; Non-genetic RNA- structure, types and functions.

Gene mutation: Types and causes of mutation.
DNA repair- types and mechanism.

Unit-IV

Genetic code
Gene expression: Central dogma;Transcription of mRNA in prokaryotes and eukaryotes; Processing of mRNA in eukaryotes.
Translation in prokaryotes and eukaryotes
Regulation of gene expression in prokaryotes (Lac operon and tryptophan operon) and eukaryotes (elementary idea).

BIOTECHNOLOGY :

Unit-V

Basic concepts in genetic engineering;

Recombinant DNA technology: Restriction endonucleases, cloning vectors (plasmids, λ bacteriophase, cosmids, phasmids etc)

Applications of recombinant DNA technology - DNA finger printing, human gene therapy.

Gene amplification: cDNA library, Genomic library and PCR.
Animal tissue culture; Transgenic animals

References:

1. Singh, B.A. (1990) Introductory Biotechnology, Central Book Depot, Allahabad.
2. Singh, B.D. (2002) Biotechnology, Kalyani Publishers, Ludhiana.
3. Chatterjee, C.C. (1986) Human Physiology, Vol.I and II, Medical Allied Agency, Kolkata.
4. Cohn, E. and Stumf, P.K. (1983) Outlines of Biochemistry, Wiley Eastern Ltd., New Delhi.
5. Lodish, H.; Baltimore, D.; Berk, A.; Zipursky, S.L.; Matsudaira, P. and Xarnell, J. (1995) Molecular Cell, Scientific American Books Inc., New York.
6. Stryer, Lubert (1995) Biochemistry, W.H. Freeman and Co., New York.
7. Karp (1998) Cell and Molecular Biology, Purnina Book Distributor, New Delhi.
8. Thorpe, B. (1994) Cell Biology, John Willey and Sons, USA.
9. Fiedfedier, D. (1994) Molecular Biology, John and Bartlett Publishing Inc. USA and Narosa Publishing House, New Delhi.
10. Wilseman, A. (1983) (Ed.) Principles of Biotechnology, Chapman and Hall, New Delhi.
11. William, Ven R. (1982) Genetic Engineering, Academic Press Inc., USA.

12. Paul, J. (1975) Cell and Tissue Culture, E and S Livingston Ltd., Churchill Livingston, London and Glasgold.

13. Hoar, W.S. (1983) General and Comparative Physiology, Prentice Hall of India, New Delhi.

Zoology Paper-7.2 : Biochemistry, Molecular Biology, Biotechnology (Practical)

Contact Hours per Week : 2

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.- 18, Viva- 4, Record- 3)

Objectives :

The prospective teacher trainee would be able to -

- develop experimental abilities of qualitative testing for carbohydrate, protein and fats,
- conversant with the principles of chromatography, pH measurement and buffering action of blood plasma.

Biochemistry :

Quantitative analysis of the following :

1. Carbohydrates : glucose, fructose, sucrose, lactose, maltose, starch and glycogen
   Proteins : egg albumin, gelatin and milk
   Lipids : oils and gee
2. Effect of temperature on enzyme activity
3. Effect of pH on enzyme activity
4. Effect of substrate concentration on enzyme activity.
5. Quantitative analysis of protein by Biuret method.
6. Detection of amino acid by paper chromatography.

Biotechnology and Molecular Biology :

7. Preparation and use of culture media for microbes and animal tissues, sterilization, inoculation and growth monitoring, use of fermentors.

8. Preparation of models of macromolecules (DNA, RNA, nitrogen bases, fibrous and globular protein).

9. Study of DNA by Feulgen reaction.

Zoology (Honours)7.3 Paper: Applied Zoology

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objectives :

The prospective teacher trainee would be able to -

- Know the different human parasites and their effects
- Understand the importance of insects in human welfare
- Know the different types of human diseases
- Develop the skills of preparation of vermicompost

UNIT – I

Protozoan parasites and human diseases**:** Trypanosome**,** Leishmania, Giardia and Trichomonas, Plasmodium.

Pathogenic helminthes and their control: Fasciolopsis, Schistosoma, Ancylostoma, Wuchereia and Dracanculus.

UNIT – II

Insect pests of some economically important crops- sugar cane, paddy, pulses, vegetables and fruits

Insect pest management

Apiculture, Sericulture, Lac culture

UNIT – III

Vermiculture and vermin composting

Pearl culture

Fish and Fisheries

UNIT – IV

Dairy and dairy products

Poultry farming

Goatery and piggery

Pharmatuticals from animals

UNIT – V

Occupational health hazards and preventive measures

HIV and AIDS, STDs

Drug abuse

Hypertension, Cancer, Cardiovascular diseases

References:

1. Kettle, D.S: Medical Veterinary Entomology (CAB International)
2. Cheng, T.C: General Parasitology, (Academic Press).
3. Shukla and Upadhyaya: Economic Zoology (Rastogi Publishers)
4. Srivastava: Text Book of Applied Entomology (Kalyani Publishers)
5. Venkitaraman: Economic Zoology (Sudarshana Publishers)
6. Jhingran, V.G., Fish and Fisheries of India. Hindustan Publishing corporation, New Delhi.
7. Kovaleve, P.A., Silkworm Breeding Stocks, Central Silk Board, Marine Drive, Bombay.
8. Roger, A. Morse, The ABC and XYZ of Bee Culture, A.I. Root & Co., Medina, Ohio44256.
9. Metcalf, C.L. and W.P. Flint, Destructive and Useful Insects, Tata McGraw Hill Publishing Co. Ltd., New Delhi-110051.
10. Bomford, Mason and Swash, Hutchinson's Clinical Methods, Beilliers Tindal, ELBS edition.
11. Harbans Singh and Earl N. Moore, Livestock and Poultry Production, Prentice Hall of India, New Delhi.
12. Fundamentals of Computers, V. Rajaraman, Prentice Hall of India Pct. Ltd.

Zoology (Honours)7.4 Paper: Applied Zoology – Seminar and Project

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 25

Objectives :

The prospective teacher trainee would be able to -

- Develop the skills of investigation
- Appreciate in collecting information and presentation

1. Project- 15
2. Seminar- 10

SEMESTER – VIII

Zoology Paper-8.1 : Animal Development, Biostatistics, Instrumentation

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75(Terminal-60, Sessional-15)

Objectives :

The prospective teacher trainee would be able to -

- Appreciate the internal anatomical diversity of the various systems of the vertebrates ad their adaptive modifications.
- know the vertebrate developmental biology and the principles of gametogenesis, fertilization, cleavage, gastrulation and placentation
- Conversant with the various biostastical techniques to logically (inductive and deductive) interpret the biological phenomenon as to their consistency and feasibility for simulation and modelling of the life.

ANIMAL DEVELOPMENT :

Unit-I

Gametes: structure, types, formation and significance

Fertilization: Types, mechanism and its significance.

Cleavage: Characters, types, patterns and products.

Gastrulation: Morphogenetic movements and significance.

Unit-II

Development of frog up to three germ layers and neurulation; metamorphosis of tadpole

Development of chick up to three germ layers and embryology of chick (different hours)

Extra embryonic membranes in chick- development and functions

Placentation in mammals- types, structure and significance.

Unit-III

Reproductive Biology: Hormonal control of male and female reproduction, implantation, parturition and lactation in mammals; Reproductive cycles in vertebrates
Parthenogenesis: natural and artificial.
Regeneration mechanism in animals.

BIOSTATISTICS :

Unit-IV

Definition, concept of sample and population

Frequency distribution and graphical representation of data (frequency polygon and histograms)

Mean, median and mode, standard deviation, standard error, t-test and chi-square test.

INSTRUMENTATION :

Unit-V

Principles and use of analytical instruments: balances, pH meter, calorimeter, spectro-photometer, centrifuges, microtomes, Microscopes: compound, dissecting and binocular, Microphotography and Micrometers – occular and stage.

References:

1. Berill, N.J. (1983) Developmental Biology, McGraw Hill Publishing Co., USA.
2. Gilbert, S.F. (1994) Developmental Biology, Sinaur Associates Inc., Sutherland.
3. Slack, (1991) From Egg to Embryo, CambridgeUniversityPress, UK.
4. Weddington, C.H.C. (1985) Principles of Development and Differentiation.
5. Oppenheimer, K.M. and Willer, B.H. (1964) Foundations of Experimental Embryology, Prentice Hall of India, New Delhi.
6. Witherperson, J.D. (1984) Human Physiology, Harper and Rai, USA
7. Chainy, G.B.N.; Mishra, G. and Mohanty, P.K. (2004) Basic Biostatistics, Kalyani Publishers, Ludhiana

Zoology Paper-8.2: Animal Development, Biostatistics, Instrumentation (Practical)

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.- 18, Viva- 4, Record- 3)

Objectives :

The prospective teacher trainee would be able to -

- develop skills and abilities in the preparation of models of different chemical bonds of macromolecules, solving bio-statistical problems with regard to mean and S.D. and preparation of frequency tables, frequency polygon and histograms,
- to know the different types of eggs, clevage patterns and development.

1. Study of permanent embryological slides of frog.
2. Study of permanent embryological slides of chick.
3. Study of various developmental stages of frog.
4. Study of the chick embryo at various stages of incubation in vivo by making a window in the egg shell.
5. Histological preparation of different tissues through microtomy.
6. Plasma / serum separation by centrifugation.
7. Measurement of pH of body fluids.
8. Study of different parts and working principles of microscopes, colorimeter and spectrophotometer.
9. Measurement of mean, median, mode, standard deviation and standard error.
10. Molecular separations by chromatography and electrophoresis

Zoology (Honours) 8.3 Paper: Pisciculture

Contact Hours per Week : 4

Examination Duration : 3 Hours

Maximum Marks : 75 (Terminal-60, Sessional-15)

Objective :

The prospective teacher trainee would be able to –

- conceptulise pisciculture and kinds of aquacultural practices
- Know the design and construction of different types of fish pons
- Understand the various types of fish feeds
- Know the different types of fish diseases

UNIT - I

Basic concepts of Pisciculture and its relevance to the Indian aquatic systems,

Kinds of aquacultural practices: pond culture; pisciculture in sewage fed water bodies; brackish water fish culture and prospects of mariculture.

UNIT – II

Design, construction and management of nursery, rearing and stocking ponds; physic-chemical parameters of pond water and soil; plankton and productivity of cultural ponds; fertilization and menuring

UNIT –III

Artificial food supplementation: nutritional requirements of cultivable fishes; methods and formulation of fish feed. Diseases of cultivable fishes (Fin rot, Futunculosis, Ichthyopathiriasis and Argulus) and methods of treatment.

UNIT –IV

Culture of fish in ponds: Mono culture; polyculture; Induced breeding in cultivable fishes and integrated fish farming

UNIT – V

A brief idea about the fishery of ChilkaLake; culture and breeding of fishes like Mullet Breeding and management of aquarium (ornamental)fishes.

References:

1. Bal, D.V. and K.V. Rao, Marine Fisheries. Tata MaGraw Hill, New Delhi.
2. Bal, D.V. and K.V. Rao, Marine Fisheries. Tata MaGraw Hill, New Delhi.
3. Bomford, Mason and Swash, Hutchinson's Clinical Methods, Beilliers Tindal, ELBS edition.
4. Cheng, T.C: General Parasitology, (Academic Press).
5. Fundamentals of Computers, V. Rajaraman, Prentice Hall of India Pct. Ltd.
6. G.G. Simpson, Principle of animal taxonomy, Oxford IBH Publishing Company.
7. G.G. Simpson, Principle of animal taxonomy, Oxford IBH Publishing Company.
8. Gorbman A, Dickhoff W.W., Vigna S.R., Clark N.B. and Ralph C.L., Comparative Endocrinology, John Willey & Sons, Inc., New York.
9. Gorbman A, Dickhoff W.W., Vigna S.R., Clark N.B. and Ralph C.L., Comparative Endocrinology, John Willey & Sons, Inc., New York.
10. Harbans Singh and Earl N. Moore, Livestock and Poultry Production, Prentice Hall of India, New Delhi.
11. Jhingran, V.G., Fish and Fisheries of India. Hindustan Publishing corporation, New Delhi.

12. Jhingran, V.G., Fish and Fisheries of India. Hindustan Publishing corporation, New Delhi.
13. Kettle, D.S: Medical Veterinary Entomology (CAB International)
14. Kovaleve, P.A., Silkworm Breeding Stocks, Central Silk Board, Marine Drive, Bombay.
15. Metcalf, C.L. and W.P. Flint, Destructive and Useful Insects, Tata McGraw Hill Publishing Co. Ltd., New Delhi-110051.
16. Mills, Dick, Aquarium Fish, DK Publishing Book, DK Publishing Inc., New York 10016.
17. Mills, Dick, Aquarium Fish, DK Publishing Book, DK Publishing Inc., New York 10016.
18. Roger, A. Morse, The ABC and XYZ of Bee Culture, A.I. Root & Co., Medina, Ohio44256.
19. Shukla and Upadhyaya: Economic Zoology (Rastogi Publishers)
20. Srivastava: Text Book of Applied Entomology (Kalyani Publishers)
21. Venkitaraman: Economic Zoology (Sudarshana Publishers)

Zoology (Honours) 8.4 Paper: Pisciculture-I (Practical)

Contact Hours per Week : 2

Examination Duration : 3 Hours

Maximum Marks : 25 (Expt.- 18, Viva- 4, Record- 3)

Objectives :

The prospective teacher trainee would be able to –

- Develop the skills of identification of fishes
- Analyze various parameters of fish ponds

1. Collection and identification of important fishes.
2. Analysis of physic-chemical parameters of fish ponds-estimation of nutrients- Nitrite, Silicon-silicate
3. Demonstration and dissection of pituitary gland from fish foe induced breeding
4. Formulation and preparation of fish feed
5. Identification of phyto and zooplankton
6. Visit to CIFA to acquaint students with Piscicultural practices