BENGALURU CENTRAL UNIVERSITY
Department of Education
Bengaluru, Karnataka-560001

REGULATIONS AND SYLLABUS
4 Year Integrated B.Sc. B.Ed. Programme

CBCS SEMESTER SCHEME

With Effect From
2018-19
BENGALURU CENTRAL UNIVERSITY
DEPARTMENT OF EDUCATION
Bengaluru, Karnataka

4 year Integrated B.Sc. B.Ed Course
CBCS Semester Scheme

PREAMBLE

Quality and excellence, standardization and comparability of educational programmes across are one of the important steps that the UGC has taken related to academic reforms in the university and college system. These reforms mainly include introduction of semester scheme, grading system, Choice-Based Credit system, regular curriculum development, transparent admission procedures, reform of examination system with switch over to continuous internal evaluation and reducing the written examination component, credit transfer and credit accumulation. This has been welcomed by universities and many of them initiated changes in their academic practices.

Choice –based credit system

Choice –based credit system has several unique features. Enhanced learning opportunities, ability to match students’ scholastic needs and aspirations, inter-institution transferability of students, part-completion of the academic programme in institution of enrolment and part-completion in a specialized institution.

The CBCS imminently fits into the emerging socio-economic milieu, and could effectively respond to the educational and occupational aspirations of the upcoming generations. In view of this, institutions of higher education in India would do well to invest through and resources into introducing CBCS. Aided by modern communication and information technology, CBCS has a high probability to be operationalised efficiently and effectively-elevating students, institutions and higher education system in the country to newer heights.
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21. Miscellaneous
Core Subjects

Part 1: Languages

English ..................................................................................................................................................
Hindi ....................................................................................................................................................
Kannada ................................................................................................................................................

Part 2: Disciplinary Courses

Physics ..................................................................................................................................................
Mathematics .......................................................................................................................................... 
Chemistry ............................................................................................................................................
Botany ..................................................................................................................................................
Zoology ................................................................................................................................................

Part 3: Educational Courses

Nature and purpose of Education ...........................................................................................
ICT in Education ..............................................................................................................................
Critical Reading and Expository Writing ....................................................................................... 
Childhood, adolescence and growing up ....................................................................................... 
Language Across Curriculum ........................................................................................................
Health and Physical Education ........................................................................................................
Creating an Inclusive Society ........................................................................................................
Pedagogical Content Knowledge 1- Part1 ........................................................................................
ICT Mediation ...................................................................................................................................
Learning and Teaching ....................................................................................................................
Pedagogical Content Knowledge 1- Part2 ........................................................................................
Arts and Craft in Education ............................................................................................................
Contemporary India and Education .................................................................................................
Optional Course ............................................................................................................................... 
Assessment for Learning ................................................................................................................

Pedogogical Content Knowledge2- Part1

Theatre in Education

Knowledge and Curriculum

Development and Management in School

Action Research

Pedogogical Content Knowledge 2- Part2

Pre- Internship Activities

Gender, School and Society

School Internship Programme

Education and National Concern

School Internship Programme

Post-internship Activities

Action Research Project

Part 4: Foundation Course/ Skill Development

Acknowledgements
Regulations governing the Programme

1. Programme and Duration:

4 Year Integrated Programme of Teacher Education titled ‘Bachelor of Science Education’ (B.Sc.B.Ed.) degree programme. The programme will be of four years duration organized on the semester scheme (CBCS pattern) with 2 semesters in a year. Each semester will consist of 16 weeks of instruction excluding examination.

1.1 Equivalence:

The programme contents related to Physics/ Chemistry/ Mathematics/ Botany/ Zoology offered in B.Sc.B.Ed. are equivalent to that of B.Sc. (PCM/CBZ) of Bengaluru Central university. The programme contents related to education components in B.Sc.B.Ed. are equivalent to that of B.Ed. of Bangalore University. This degree B.Sc.B.Ed. is equivalent to B.Sc. and B.Ed. degrees of the Bangalore University or any other Recognised University. Students who pass this course are considered eligible to pursue Masters Degree in the respective subjects in the Departments of the Bengaluru Central University or any other Recognised University.

2. Eligibility for admission to B.Sc.B.Ed.

2.1 Candidates seeking admission to the B.Sc.B.Ed. Programme should have passed the two years Senior Secondary examination/ Pre-University examination of Karnataka or any other examination considered as equivalent thereto, with 45% marks in the aggregate. Relaxation upto 5% of marks shall be given to the SC/ST, Category-1 and physically challenged students.

2.2 (a) Candidates should have passed the qualifying examination with the following combinations of subjects. For admission to the PCM stream: Physics, Chemistry, Mathematics/ and any other subject approved by Bengaluru Central University for admission to CBZ stream: Chemistry, Biology / Chemistry, Botany, Zoology and any other subject approved by Bengaluru Central University from time to time.

2.3 Admission shall be regulated through selection on the basis of marks in the qualifying examination or performance in a specially designed selection test or both as per the admission

2.4 A candidate seeking admission for B.Sc.B.Ed programme must fulfill the eligibility criteria as per the directives of Government of Karnataka from time to time.
3. Allocation of seats

3.1 College shall admit all the candidates allotted by the Government of Karnataka.

3.2 For filling the other seats the respective colleges shall select the candidates following eligibility criteria as envisaged in Regulations 2.1 to 2.4.

3.3 The college should get the selected candidates both under Government and Management quota within the last date fixed for admission by the Bengaluru Central University.

3.4 The total intake of all colleges shall be as fixed by Bengaluru Central University / Government of Karnataka from time to time.

4. Courses of Study:

Details of courses and scheme of study, duration etc, are provided in Table 1 & 2. Courses of Study are organized into six categories:

a) Languages
b) Disciplinary courses
c) Hard Core
d) Soft Core
e) Optional Course
f) Enhancing Professional Capacities (EPC)
g) Foundation, skill development and interdisciplinary courses

4.1 Languages
Two languages are mandatory for all students.

a) Regional Language: Any one of the following languages – Kannada/ Hindi / Any other
b) English

4.2 Disciplinary Course
Three disciplinary course are mandatory for all students.

For B.Sc.B.Ed: Physics/Chemistry/Mathematics or Chemistry/ Botany/Zoology or any other courses of study approved by Bengaluru Central University from time to time under science Bachelors degree courses.

4.3 Hard Core
Comprises of 14 education courses that are mandatory for all students.

4.4 Soft Core
Two pedagogy courses

Following four streams are offered:

a) Pedagogy of Physical Science and Pedagogy of Mathematics
b) Pedagogy of Language and Pedagogy of Mathematics
c) Pedagogy of Language and Pedagogy of Biological Science
d) Pedagogy of Physical Science and Pedagogy of Biological Science

The programme also includes a comprehensive school attachment programme; the internship in teaching.

4.5 Optional Course
Comprises of one education course (Guidance and Counseling/ Education for Peace/ Education of children with special needs).

4.6 Enhancing Professional Capacities (EPC)
These are mandatory courses and comprise of 8 courses meant for a teaching professional.

4.7 Foundation and skill development courses
These are mandatory courses for every student.

5. Attendance:
Every student has to attend a minimum of 75% of the classes conducted in each course. If a candidate has failed to put in a minimum of 75% attendance in a course, she/he is deemed to have dropped the course and is not allowed to write the semester end examination of that course. She/he has to attend the classes of that course in the subsequent years whenever it is offered after registering for the same course.

6. Medium of Instruction
The Medium of Instruction is either English or Kannada. Student Teachers can opt for English or Kannada medium schools for internship. Student teachers are allowed to write theory examination either in English or Kannada.
### 7. Course structure of B.Sc.B.Ed

#### Table: 1
**FRAMEWORK OF THE COURSES OF EIGHT-SEMESTERS**

<table>
<thead>
<tr>
<th>Courses</th>
<th>Number</th>
<th>Instruction hrs per week</th>
<th>Duration of exam</th>
<th>IA marks</th>
<th>Term End</th>
<th>Total marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td><strong>a) I/II/III/IV Semester</strong></td>
<td></td>
<td></td>
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<tr>
<td>Part 1</td>
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<tr>
<td>2 Languages (Hindi/Kannada + English)</td>
<td>2 theory</td>
<td>2x4</td>
<td>2x3</td>
<td>2x30</td>
<td>2x70</td>
<td>2x100</td>
<td>2x2</td>
</tr>
<tr>
<td>3 Subjects (PCM;CBZ or any other subject approved under bachelor of Science)</td>
<td>3 theory+3 practical/project work</td>
<td>3x4+3x3</td>
<td>3x3</td>
<td>3x50</td>
<td>3x100</td>
<td>3x150</td>
<td>3x3</td>
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</tr>
<tr>
<td>Edcn (HC:6 Courses; SC:2 Courses; EPC:4 Courses)</td>
<td>2 theory+1 practical</td>
<td>1x4+2x2</td>
<td>1x3 + 2X1.5</td>
<td>1X30+2X15</td>
<td>1X70+2X35</td>
<td>1X100+2X50</td>
<td>1x2+2x1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>FC/SDC</td>
<td>1 theory/1 practical</td>
<td>1x1</td>
<td>1x1.5</td>
<td>1x15</td>
<td>1x35</td>
<td>1X50</td>
<td>1X1</td>
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<td><strong>b) V/VI Semester</strong></td>
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</tr>
<tr>
<td>Edcn (HC:4 Courses; SC:2 Courses; EPC:2 Courses)</td>
<td>3 theory+1 practical</td>
<td>2x4+1x2 +1X5</td>
<td>2x3+3X1.5</td>
<td>2X30+3X15</td>
<td>2X70+3X35</td>
<td>2X100+3X50</td>
<td>2x2+3x1</td>
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</tr>
<tr>
<td>FC/SDC</td>
<td>1 theory/1 practical</td>
<td>1x2</td>
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<td>1x50</td>
<td>1X1</td>
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<td><strong>c) VII/VIII Semester</strong></td>
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</tr>
<tr>
<td>Edcn (HC:2 Courses; EPC:2 Courses)</td>
<td>2 theory+Internship</td>
<td>2X2+Internship</td>
<td>2x1.5</td>
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8. **Change of Stream:**
Once chosen, change of stream is not permissible under any circumstances during that or subsequent semesters.

9. **Scheme of Examination:**
9.1 There shall be a University Examination at the end of each semester.
9.2 Detailed Scheme of Examination along with course titles and break up of marks course-wise is as given below:
## Table: 2  
B.Sc.B.Ed. Scheme of Examination

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<td>35</td>
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<td>Nature and purpose of education</td>
<td>30</td>
<td>70</td>
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<tr>
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10. **Conduct of Examination**

10.1 **Internal assessment:**
The internal assessment marks shall be based on a variety of assessment, strategies and tools to assess with processes and products.

10.2 **Practical Examination**
The university shall conduct Practical Examination with the help of “Practical Examination Boards” approved by the Chairman, Board of Examiners. Each Practical Examination Board shall consist of two members i.e., one from the College and the other from practicing school.
A Method teacher with a minimum of 3 years of teaching experience at B.Ed. level (Internal) and Headmaster/Headmistress or a senior teacher (External) with 10 years of teaching experience from the practicing school can be an examiner for practical examination. The marks awarded to the student shall be average of the marks awarded by the internal & external examiner.

10.3 **Question Paper setting for external examination**

There shall be a separate Board of Examiners for each subject for preparing, scrutinizing and approving the question papers and scheme of valuation for the use at the next examination/s.

11. **Minimum for a Pass**

11.1 No candidate shall be declared to have passed the Semester Examination as the case may be under Part I / Part II / Part III unless he/she obtains not less than 35% marks in written examination and 40% marks in the aggregate of written examination and internal assessment put together in each of the subjects, 40% marks in practical examination (in subjects with practicals) and 40% marks in Project work & viva wherever prescribed.

11.2 If a candidate fails in a subject, either in theory or in practicals, he/she shall appear for that subject only at any subsequent regular examination, within the maximum period prescribed for completing the programme. He/she must obtain the minimum marks for a pass in that subject (theory and practicals separately) as stated in para (11.1) above.

12. **Carry Over**

A candidate who fails in a lower semester examination may go to the higher semester. However, no candidate shall be permitted to take the a) fifth semester examination unless he/she passes all the papers of the first semester examination and b) No candidate shall be permitted to take the sixth semester examination unless he/she passes all the papers of the first and second semester examinations.
13. Grading:

The results of successful candidates at the end of all Four Semesters shall be classified on the basis of aggregate percentage of marks obtained in all the semesters and the aggregate or cumulative grade point average (CGPA) for the award of B.Sc.B.Ed.

14. Declaration of classes on the basis of Percentage of Aggregate Marks

First Class with Distinction 70 % and above (A+, A++ or O)
First Class 60% and above but less than 70% (A)
Second Class 55% and above but less than 60% (B+)
Pass Class 50% and above but less than 55% (B)

14.1 Each semester result shall also be declared in terms of grades. A six point grading system which based on the actual absolute marks scored and alpha-sign grade as described below shall be adopted.

<table>
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<th>% Marks</th>
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<td>6&lt;-7</td>
<td>7&lt;-8</td>
<td>8&lt;-9</td>
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14.2 The semester Grade point Average shall be computed by dividing the sum of the Grade Point weights (GPW) of all the subjects of study by the maximum credits for the semester. The Grade Point Weights are intu-turn calculated as the product of the grade points earned in the subject and the credits assigned to that subject, The maximum total marks for a course is 100, while the credit assigned is 2.

14.3 The Aggregate or Cumulative Grade Point Average (CGPA) at the end of the four semesters examination shall be calculated as the weighted average of the semester grade point averages. The CGPA is obtained by dividing the total of semester credit weightages by the maximum credits for the programme.

14.4 The candidates who pass all the semesters examination in the first attempts in two academic years are eligible for ranks provided they secure 60 % and above marks or at least an alpha sign Grade A.

15. Rejection of Results

15.1 A candidate may be permitted to reject the result of the whole examination of any semester. Rejection of result paper wise/subject wise shall not be permitted. The candidate who has rejected the result shall appear for the immediately following examination.

15.2 The rejection shall be exercised only once in each semester and the rejection once exercised cannot be revoked.

15.3 Application for rejection along with the payment of the prescribed fee shall be submitted to the Registrar (Evaluation) through the college of study together with the original statement of marks within 30 days from the date of publication of the result.
15.4 A candidate who rejects the result is eligible for only class and not for ranking.

16. Provision for Appeal

A candidate, if dissatisfied with the grades that he/she has got with a feeling that he/she is unnecessarily penalized can approach the grievance cell with the written submission together with all facts, factual and all the assignments, test papers etc. which were evaluated. He/She can do so before the semester-end examination (based on 2 continuous assessment components already completed) or after the semester-end examination. The grievance cell is empowered to review the grades if the case is genuine and is also empowered to penalize the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend to take disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance Cell is final.

The Registrar (Evaluation) will be the Chairman and Convenor of the Grievance Cell. For every subject there will be one grievance cell. The composition of the Grievance Cell is as follows:

1. Three senior faculty members (other than those concerned with the evaluation of the paper concerned) drawn from the Department/ discipline and/or from the sister departments/sister disciplines.
2. Three senior faculty members/subject experts drawn from outside the University Department.
3. The Registrar (Evaluation) ex-officio Chairman/Convenor.
4. The Dean of the respective faculty.
5. Additional lady faculty member (in case not covered by 1,2,3,4,6 and 7).
6. Additional faculty member from a minority community (in case not covered by 1,2,3,4,6 and 7) and
7. The Chairman, BoS, Chairman, DoS and Chairman, BoE.

The appropriate fee as fixed by the University shall be collected from the candidate who goes for an appeal to the Grievance Cell.

17. Academic Monitoring Committee

The university shall constitute a committee to monitor curricular and co-curricular activities conducted by the college of education affiliated to the university. The Vice-Chancellor shall constitute the committee comprising members from colleges of education affiliated to Bengaluru Central University &University Department of Education on the basis of rotation and seniority. However, the number of members shall not exceed seven including the chairman. This committee shall monitor the activities of all the eight semesters.

18. Marks Cards:

The marks card shall be laminated after affixing the hologram only when a candidate passes (at the time of passing) all papers of a particular semester.
19. Barring of Simultaneous Study

19.1 No student admitted to a degree course in a college under the jurisdiction of this university, shall be permitted to study simultaneously in any other course leading to a degree (regular, evening, morning) offered by this university.

19.2 If a candidate gets admitted to more than one course, the university shall cancel without giving prior notice his/her admission to all the courses to which he/she has joined.

20. Transfer of Admission: Transfer of admissions permissible only for III and V semesters for the students of other universities and within the University.

20.1 Conditions for transfer of admission of students within the University.

i) His/Her transfer admission shall be within the intake permitted to the college.

ii) Availability of same combination of subjects studied in the previous college.

iii) He/She shall fulfill the attendance requirements as per the University Regulation.

iv) He/She shall complete the programme as per the regulation governing the maximum duration of completing the programme.

20.2 Conditions for transfer admission of students of other Universities.

i) A Candidate migrating from any other University may be permitted to join III/V semester of the degree programme provided he/she has passed all the subjects of previous semesters/years as the case may be. Such candidates must satisfy all other conditions of eligibility stipulated in the regulations of Bangalore University.

ii) His/Her transfer admission shall be within the intake permitted to the college.

iii) He/she shall fulfill the attendance requirements as per the University Regulation.

iv) The candidate who is migrating from other Universities is eligible for overall class and not for ranking.

v) He/She shall complete the programme as per the regulation governing the maximum duration of completing the programme as per this regulation.

21. Miscellaneous:

21.1 These revised regulations will apply to the candidates admitted for the academic year 2017-18 and onwards for the courses mentioned in Regulation No.1.0 above.

21.2 Other regulations not specifically mentioned above are as per the Regulations of the University as applicable from time to time.

21.3 Any other issue not envisaged above, shall be resolved by the Vice-Chancellor in consultation with the appropriate Bodies of the University, which shall be final and binding.
Integrated Teacher Education Programme (UG)

Choice Based Credit system (CBCS)
B.Sc.B.Ed. Four year Syllabus

Sememster Scheme

With effect from 2018-19

Bengaluru Central University
Department of Education
Bengaluru -560001
Part 1: Languages
Language English

I Semester BSc General English

Question Paper Pattern for 1st Semester B Sc and all other programmes where the text book *Experience and Expression* are prescribed to conform to the changed CBCS adopted by Bangalore University( 70[ Semester Examination + 30[ CIA])

Begaluru Central University

I Semester English UG syllabus (2018-19)

English-I

**List of lessons for I Semester B.Sc/BCA and other courses coming under the Faculty of Science**

**POETRY**

1. I shall go back in the New Year - Nilim Kumar
2. Sonnet--- Yehuda Amichai

**PROSE**

1. The Wolf –Farooq Sarwar
2. Leaving – M.G. Vassanji
3. Real Food—Chimamanda Ngozi Adichie
4. Wings of Fire—Abdul Kalam
5. Relations between men and women – Raja Ram Mohan Roy
6. Stay Hungry, Stay Foolish- Steve Jobs

Suggested Reading: Literature and Science —Essay

**Grammar and Composition.**

**Listening Skills**


**Reading Skills:** (to be integrated within the literary texts in every unit)

Grammar Usage: Phrase, Clause, Sentence a. Phrases- noun, adjective,
adverb, verb, preposition—articles b. Clauses—coordinate, subordinate c. Sentence—making sentences (simple, compound, complex), subject-verb agreement b. Looking for The Gist-Skimming C. Reading for Comprehension At Different Levels—Factual, Interpretative, Inferential, Evaluative

**Writing Skills:** a. Paragraph Writing b. Letter Writing—Leave Letters, Letters of Complaint

**Guidelines for CIA marking: 30 marks**

Two tests: 15 marks
Attendance: 5 marks
Seminar/Assignment: 10 marks
II Semester B A/BSc

Question Paper Pattern for 2nd Semester B A/BSc and all other programmes where the text books *Experience* and *Expression* are prescribed to conform to the changed CBCS adopted by Bangalore University (70 Semester Examination + 30 IA)

**Part A – Literary Component: 40 Marks**

Question No I: The student will be required to answer any five out of seven: 5x2 = 10
Question No II: The student will be required to answer any three out of five: 3x5 = 15
Question No III: The student will be required to answer any one out of three: 1x10 = 10
Question No IV: Do as Directed 5 Marks

**Part B – Workbook Component: 30 Marks**

Question No V: (On Remedial Grammar) 7 Marks
Question No VI (Reading Comprehension) 5 marks
Question No VII (Choice between two paragraphs) 5 Marks
Question No VIII (Note Making) 5 Marks
Question IX (Do as Directed): 8 Marks

**Guidelines for IA marking: 30 marks**

Two tests: 15 marks
Attendance: 5 marks
Seminar/Assignment: 10 marks

III Semester B A/BSc

Question Paper Pattern for 3rd Semester B A/BSc and all other programmes (coming under the Faculties of Arts & Science) where the text books *Experience* and *Expression* are prescribed to conform to the changed CBCS adopted by Bangalore University (70 Semester Examination + 30 IA)

**Part A – Course Book (Literary Component): 40 Marks**

Question No I: The student will be required to answer any five out of seven 5x2 = 10
Question No II: The student will be required to answer any four out of six 4x5 = 20
Question No III: The student will be required to answer any one out of three

**Part B – Workbook Component: 30 Marks**
Question No IV: RTI (Two questions to be set, out of which the student will be required to answer one) 5 Marks
Question No V: (Combine the given sets of sentences to frame shorter and more effective sentences) 5 Marks
Question No VI: (Reading Comprehension) 5 marks
Question No VII: Report (Two questions to be set giving students a choice between two types of reports) 10 Marks
Question No VIII: Two questions to be set giving students a choice between a media transfer exercise and a letter 5 Marks

Guidelines for IA marking: 30 marks
Two tests: 15 marks
Attendance: 5 marks
Seminar/Assignment: 10 marks

IV Semester B A/BSc
Question Paper Pattern for 4th Semester B A/BSc and all other programmes (coming under the Faculty of Arts & Science) where the text books Experience and Expression are prescribed to conform to the changed CBCS adopted by Bangalore University( 70(Semester Examination + 30[IA])

Section A – Drama: 20 Marks
Text : Vijay Tendulkar : Silence! The Court is in Session
Question No I: (5 Mark Question) The student will be required to answer any two out of three: 2x5=10
Question No II: (10 Mark Question) The student will be required to answer any one out of two: 1x10=10

Section B – Poetry: 20 Marks
Question No III: (5 Mark Question) The student will be required to answer any two out of three: 2x5=10

Question No IV: (10 Mark Question) The student will be required to answer any one out of two: 1x10=10

Section C – Workbook Component: 30 Marks
Question No V: 1 mark question (Answer the given questions in two or three sentences or do as directed) 5 Marks

Question No VI: Dialogue Writing (based on a situation) 5 Marks
Question No VII: Two questions to be set, one on Presentation and one on Project Report writing, of which the student will be required answer any one (i.e choice between Presentation & Report)

Question No VIII: Letter Writing (Application Cover letter and Resume drafting)

**Guidelines for IA marking: 30 marks**

Two tests: (one test on* Basic Phonetics) =15 marks

*Basic Phonetics
- Articulatory, Acoustics, Stress, Intonation
- Attendance: 5 marks
- Seminar/Assignment:10 marks
QP Pattern
I Semester Integrated B. Sc. B.Ed Examination, January 2019
(CBCS) (2014-2015 and onwards)

English - Paper 1

Time: 3 h
Max Marks: 70

Part A – Literary Component: 40 Marks

Question No I: The student will be required to answer any five out of seven 5x2=10
Question No II: The student will be required to answer any three out of five 3x5=15
Question No III: The student will be required to answer any one out of three 1x10=10
Question No IV: Do as Directed 5 marks.

Part B – Workbook Component: 30 Marks

Question No V: (On Remedial Grammar) 7 Marks
Question No VI (Reading Comprehension) 5 marks
Question No VII (Paragraph Writing – Choice between two exercises)5 Marks
Question No VIII (Note Making) 05 Marks
Question IX (Do as Directed): 08 Marks
HINDI
DEPARTMENT OF HINDI
SYLLABUS and TEXT BOOKS under CBCS Semester Scheme

I Semester B.Sc. B.Ed. - Language under Part 1 for the years 2016-17 and 2017-18

Texts:
Max. Marks: 70 (Term end) + 30 (IA)

1. Collection of Prose: “Gadya Chayan” Edited by: Dr. B. Ganesh
(Printed and published by Prasaranga, Bangalore University, Bangalore)

2. Comprehension: (Arth Grahan) , sandhi

3. Translation: Scientific and Technical terminology

Reference books:
1. Hindi Vyakaran Prabodh Avam Rachana – Dr. Vijaypal Singh
2. Vyavaharik Hindi Vyakaran Anuvad Tatha Rachana – Dr. H. Parameswaran

II Semester B.Sc. B.Ed – Language under Part 1 for the years 2016-17 and 2017-18

Texts:
Max. Marks: 70 + 30

1. Collection of Poems: “Kavya Shilp” Edited by: Dr. Babitha B.M
Dr. Shoba L
(Printed and published by Prasaranga, Bangalore University, Bangalore)

2. Grammar: Vakya shudh Kijiye, Ling and vachan

3. Translation: Scientific and Technical terminology, News reporting and Interview

Reference books:
1. Hindi Vyakaran Prabodh Avam Rachana – Dr. Vijaypal Singh
2. Vyavaharik Hindi Vyakaran Anuvad Tatha Rachana – Dr. H. Parameswaran
III Semester B.Sc.Ed - Language under Part 1 Texts
Max. Marks: 70+30

1. Drama: “Bina Deewaron Ke Ghar” by Mannu Bhandari
(Printed and published by Radha Krishna Prakashan New Delhi)

2. Essays: Sahitya Karon Ka Parichay - Gajanan Madav “Mukthibodh”, Vishnu Prabhakar, Bhishm Sahani, Krishna Sobhathi

3. Sankshepan
Letter Drafting- Types of letters, E-mail language, letters of famous people

Reference books:
1. Pramanik Alekhan Aur Tippan – Prof. Viraj
2. Prayojanmulak Hindi – Dr. Naresh Mishra
2. Prayojanmulak Hindi Ke Vividh Ayam- Dr. Maya Singh, Dr. Siddeshwar Kashyap
3. Hindi Ka Anuprayukt Swarup- Dr. Ramprakash, Dr. Dinesh Kumar Gupt

IV Semester B.Sc.Ed–Language under Part Texts
Max. Marks: 70+30

1. Upanyas : “Sookhta Hua Talab” by Dr. Ramdarash Mishra
(Printed and published by Vani Prakashan New Delhi)


3. Translation: Passage, Technical writing- Report writing
QP PATTERN
I Semester Integrated B. Sc. B.Ed Examination, November / December 2018
(CBCS) (2014-15 and onwards)
Hindi Paper 1

Time: 3h
Max Marks: 70

DIVISION OF MARKS
I Semester B.Sc.B.Ed – Language Under Part- I
1. Objective type Questions - 10 x 1 = 10
2. 2 Annotations from prose - (2) out of (3) - 2 x 7 = 14
3. 1 main question from prose - (1) out of (2) - 1 x 16 = 16
4. 2 short notes from prose - (2) out of (3) - 2 x 5 = 10
5. Comprehension - - 1 x 10 = 10
6. Translation (Terminology) - 10 x 1 = 10

-----------------------------------------------
II Semester B.Sc.B.Ed-- Language Under Part- I
1. Objective type Questions - 10 x 1 = 10
2. 2 Annotations from Poetry - (2) out of (3) - 2 x 7 = 14
3. 1 main question from Poetry - (1) out of (2) - 1 x 16 = 16
4. 2 short notes from Poetry - (2) out of (3) - 2 x 5 = 10
5. Grammar - 10 x 1 = 10
6. Translation (Terminology) - 10 x 1 = 10

Theory Total = 70
Internal Assessment Marks = 30
Teaching hours per week – 4 CREDITS- 2 Total = 100

III Semester B.Sc.B.Ed-- Language Under Part- I
1. Objective type Questions - 10 x 1 = 10
2. 2 Annotations from Drama - (2) out of (3) - 2 x 7 = 14
3. 1 main question from Drama - (1) out of (2) - 1 x 16 = 16
4. 2 short notes from Drama - (2) out of (3) - 2 x 5 = 10
5. Sahityakar ka parichay - (1) out of (2) - 1 x 10 = 10
6. Sankshepan - 1 x 10 = 10

Theory Total = 70
Internal Assessment Marks = 30
Teaching hours per week – 4 CREDITS- 2 Total = 100

IV Semester B.Sc.B.Ed-- Language Under Part- I
1. Objective type Questions - 10 x 1 = 10
2. 2 Annotations from Upanyas - (2) out of (3) - 2 x 7 = 14
3. 1 main question from Upanyas - (1) out of (2) - 1 x 16 = 16
4. 2 short notes from Upanyas - (2) out of (3) - 2 x 5 = 10
5. Film Review - (1) out of (2) - 1 x10 = 10
6. Translation (Passage) - 1 x 10 = 10

Theory Total = 70
Internal Assessment Marks = 30
Teaching hours per week – 4 CREDITS- 2 Total = 100
Question No. 1 to 4 comes under part A for 50 marks and question no. 5 and 6 comes under part B for 20 marks.
KANNADA

I and II Semester

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III Semester Kannada

I. 

II. 

III. 

IV. 

IV Semester - Kannada

I.

II.

III.

IV.

QP PATTERN

I Semester Integrated B. Sc. B.Ed Examination, November / December 2018
(CBCS) (2014-2015 and onwards)

KannadaPaper 1

Time:3 h Max Marks:70
I. 6) ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಕೇಂದ್ರಗಳು ಎದುರಾಚ್ಯಾಗಿವೆ?
    ರಾಜ್ಯ ಅಭಿದೃಢಿಸಿದ್ದಾಗಿ, ಅಬ್ಬುರುವುದಾಗಿ?
    ರಾಜ್ಯದಲ್ಲಿ ರಿಕೆಂಡ್ಸ್‌, ಅಬ್ಬುರುವುದಾಗಿ?
    ಅಬ್ಬುರುವುದಾಗಿ? ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಕೇಂದ್ರಗಳು ಎದುರಾಚ್ಯಾಗಿವೆ?

   6) ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಕೇಂದ್ರಗಳು ಎದುರಾಚ್ಯಾಗಿವೆ?
        1) ರಾಜ್ಯದಲ್ಲಿ,
        2) ಅಬ್ಬುರುವುದಾಗಿ,
        3) ಅಬ್ಬುರುವುದಾಗಿ,
        4) ರಾಜ್ಯದಲ್ಲಿ.

   3) ಎನ್ನುವಲ್ಲಿ ರಾಜ್ಯದಲ್ಲಿ ಎದುರಾಚ್ಯಾಗಿವೆ?
        1) 'ಸಾಮಾಜಿಕ ಸಾಧನಪ್ರದೇಶ' - ರಾಜ್ಯದಲ್ಲಿ ಎದುರಾಚ್ಯಾಗಿ.
        2) ರಾಜ್ಯದಲ್ಲಿ 'ಸಾಮಾಜಿಕ ಸಾಧನಪ್ರದೇಶ' ಎದುರಾಚ್ಯಾಗಿ? ಎಲ್ಲೆಯ ಎದುರಾಚ್ಯಾಗಿ?

II. 4) ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಕೇಂದ್ರಗಳು ಎದುರಾಚ್ಯಾಗಿವೆ?
        1) ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಕೇಂದ್ರಗಳು ಎದುರಾಚ್ಯಾಗಿ.
        2) ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಕೇಂದ್ರಗಳು ಎದುರಾಚ್ಯಾಗಿ.
        3) ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಕೇಂದ್ರಗಳು ಎದುರಾಚ್ಯಾಗಿ.

6) ಎನ್ನುವಲ್ಲಿ ರಾಜ್ಯದಲ್ಲಿ ಎದುರಾಚ್ಯಾಗಿವೆ?
        1) ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಸಾಧನಪ್ರದೇಶ ಎದುರಾಚ್ಯಾಗಿ.
        2) 'ಸಾಮಾಜಿಕ ಸಾಧನಪ್ರದೇಶ' ಎದುರಾಚ್ಯಾಗಿ? - ರಾಜ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ ಸಾಧನಪ್ರದೇಶ ಎದುರಾಚ್ಯಾಗಿ.
III. 3) 

1) ರಾಜವಂಶದ ಭಾಷೆಯಲ್ಲಿ ಸಹಾಯಿಗೆ ಸಲೇಖಾ ಸಂದೇಶವನ್ನು ನೋಡಿ, ಭಾವಿಸಿ. 
2) ಇದರ ಕುಂಭಕಣಿಸಿ, ರೂಪ್ಯಗಳು ಹೊಂದಬೇಕಿ. 

(1×5=5)

4) 

1) ಕುಂಡನೆ ಸೂರ್ಯಾಸೇಂದ್ರರ ಪ್ರತಿನಿಧಿಗಳು ಹೋಲುವಂತೆ ಚಿತ್ರವನ್ನು ನೋಡಿ, ಭಾವಿಸಿ. 
2) 'ಹೇನೋ ನುಡಿ' ನಂತರಕ್ಕೆ ರೂಪ್ಯಗಳು ಹೊಂದಬೇಕು ಪ್ರಯಾಣ ಸಂದೇಶವನ್ನು ನೋಡಿ. 

(1×10=10)

IV. 5) 

1) ಕುಂಡನೆ ಭಾಷೆಯಲ್ಲಿ ರಚನೆಯ ರಾಜಸೂರ್ಯ ಕರಾರು ಬಿಡುವ ರೂಪದ ವಿವರಣೆಯನ್ನು ಪಡೆಯಬೇಕು. 
2) ಅರಿತಿಯ ವಿಜ್ಞಾನಧರೀ, ಸಹಾಯಿಗೆ ಸಲೇಖಾ ಸಂದೇಶವನ್ನು ನೋಡಿ, ಭಾವಿಸಿ. 

(1×5=5)

6) 

1) ಸಹಾಯಿಗೆ ವಸ್ತು ಸಂಯೋಜನೆಯ ಪ್ರತ್ಯೇಕ ಸಮಯಗಳಲ್ಲಿ ಸಹಾಯಿ ಸಲೇಖಾ ಸಂದೇಶವನ್ನು ನೋಡಿ. 
2) ಸಹಾಯಿಗೆ ವಸ್ತು ಸಂಯೋಜನೆಯ ಪ್ರತ್ಯೇಕ ಸಮಯಗಳಲ್ಲಿ ಸಹಾಯಿ ಸಲೇಖಾ ಸಂದೇಶವನ್ನು ನೋಡಿ. 

(1×10=10)
Part 2: Disciplinary Courses
## Scheme of Instruction & Examination for B.Sc. PHYSICS, CBCS

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Course Number</th>
<th>Course</th>
<th>Teaching Duration</th>
<th>Examination Duration</th>
<th>Maximum marks</th>
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**Note-I:**
- The paper number is a three digit number with ‘0’ in the middle
- The digit to the left of ‘0’ indicates the semester number
- Odd number to the right of ‘0’ indicates a theory paper
- Even number to the right of ‘0’ indicates a practical paper
- The prefix T indicates Theory paper and P indicates Practical
**Note-II:**
The marks distribution for the final practical examination is as follows:

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<th>Scheme</th>
<th>Marks</th>
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<tr>
<td>1.</td>
<td>Writing Principle / Statement/ Formula with explanation of symbols and units</td>
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<tr>
<td>2.</td>
<td>Diagram/Circuit Diagram / Expected graph</td>
<td>05</td>
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<tr>
<td>3.</td>
<td>Setting up of the experiment + Tabular Columns + taking readings</td>
<td>10</td>
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<tr>
<td>4.</td>
<td>Calculations (explicitly shown) + Graph</td>
<td>07</td>
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<tr>
<td>5.</td>
<td>Accuracy of results with units</td>
<td>03</td>
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<tr>
<td>6.</td>
<td>Class Records (to be valued at the time of practical examination)</td>
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<td></td>
<td><strong>35</strong></td>
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**Note:** Wherever explicit setting up of experiments does not exist like in the case of spectral charts or pre-acquired data is involved (astrophysics or atmospheric experiments), the marks for setting up of experiment may be provided for additional graphs and formulae.

**Note-III:**

1. A minimum of **EIGHT** (8) experiments must be performed in each practical paper from part A
2. One experiment must be performed from part B
3. Experiments marked “Mandatory” should be performed necessarily
Syllabus for I Sem BSc. Physics –I

MECHANICS – 1, HEAT AND THERMODYNAMICS – 1

UNIT – I

a) **MOTION** : Newton’s Laws of Motion (Statement and illustration), Motion in a resistive medium; Drag force & Drag Coefficient, Drag force with v dependence (only vertical) and v² dependence (only vertical) – derivation for velocity and position- graphs with and without resistance, concept of terminal velocity

4 hours

b) **FRICTION** : Static and Dynamic Friction – Friction as a self adjusting force, Coefficient of Static and dynamic friction; Expression for acceleration of a body moving along an inclined plane with and without friction, Free Body Diagrams for the following cases (i) Two masses connected by a string hanging over a frictionless pulley (ii) Two masses in contact and masses connected by strings (horizontal only) (iii) Two masses connected by a string passing over a frictionless pulley fixed at the edge of a horizontal table.

4 hours

(A) **PLANETARY & SATELLITE MOTION** : Motion along a curve - radial and transverse components of acceleration (derivation); Newton’s law of gravitation (vector form only),

Kepler’s laws (statements only); Gravitational Field and Potential – relation between them; Field and Potential due to a solid sphere (derivation); Orbital and Escape Velocity (derivation), Satellite in circular orbit and applications; Geostationary and Geosynchronous orbits.

5 hours

UNIT – II

1. **WORK & ENERGY** : Work done by a constant and variable force; Work energy theorem; Work and potential energy; examples of potential energy; Work done by gravitational force; Work done by a spring force; Conservative and non – conservative force Conservation of mechanical energy

4 hours

□ **SYSTEM OF PARTICLES** : Centre of mass of rigid bodies – General expression; Newton’s law for a system of particles; Linear momentum for a particle and a system of particles; Conservation of linear momentum; System with varying mass; Single stage Rocket motion – Velocity & Acceleration with and without gravity; Elastic and inelastic collisions (only 2D)

4 hours


5 hours
UNIT – III

KINETIC THEORY OF GASES : Basic assumptions of kinetic theory; Derivation of - deduction of perfect gas equation; Maxwell’s law of distribution of velocity (without derivation) - deduction of most probable velocity, mean velocity and root mean square velocity; Derivation of expression for mean free path ($\lambda = \frac{3}{4\pi a^2 n}$); Degrees of freedom and principle of equipartition of energy; Derivation of , Specific heats of an ideal gas, atomicity of gase

TRANSPORT PHENOMENA :
Viscosity and thermal conduction in gases (with derivation); Relation between coefficient of viscosity and coefficient of thermal conductivity of a gas

Real Gases : Derivation of van der Waal’s equation of state; Andrews experiments on Carbon dioxide; Derivation of the critical constants; Comparison of van der Waal’s isotherms with Andrew’s isotherms

UNIT – IV

Basic Concepts and the Zeroth law of thermodynamics
Macroscopic and microscopic descriptions of a system; Thermal Equilibrium - Zeroth Law of Thermodynamics; Concept of temperature; Thermodynamic equilibrium; Thermodynamic coordinates - extensive and intensive; Equations of state; Various processes - PV indicator diagrams

First Law of Thermodynamics
The first law of Thermodynamics; Sign convention for heat and work; Derivation of equation of state $PV = Const$; Work done in an isothermal and adiabatic process for an ideal gas; Internal energy as a state function; Application of the first law for (i) Cyclic Process (ii) Adiabatic Process (iii) Isochoric Process (iv) Isobaric Process and (v) Isothermal Process.

Second Law of Thermodynamics
Reversible and irreversible processes; Carnot Engine; Carnot Cycle and its efficiency (with derivation); Second law of thermodynamics (Kelvin’s & Clausius’ statements and their equivalence); Practical internal combustion engines - Otto and Diesel Cycles (qualitative treatment); Carnot theorem (proof); Refrigerator- Coefficient of performance

Entropy
The concept of entropy; Entropy of an ideal gas; Entropy - reversible process, Entropy - irreversible process; Entropy and the second law; Clausius inequality; Principle of increase of entropy; Entropy change in (i) adiabatic process (ii) free expansion (iii) cyclic process (iv) isobaric process; TdS diagram of a Carnot cycle; Entropy and disorder
References:

PRACTICAL PHYSICS – I

PART-A

**Note:** A minimum of **EIGHT (8)** experiments must be performed

1. Error Analysis – Data analysis techniques and graphing techniques to be learnt (**Mandatory**)
2. Atwood machine – with photogate
3. Determination of coefficients of static, kinetic and rolling frictions
4. Verification of principle of conservation of energy
5. Simple pendulum - dependence of T on amplitude
6. Determination of coefficient of viscosity by Stokes’ method
7. Determination the Acceleration due to Gravity and Velocity for a freely falling body, using Digital Timing Techniques.
8. Work done by variable force
9. Interfacial tension by drop weight method
10. Thermal behavior of a torch filament
11. Specific heat by Newton’s law of cooling
12. Verification of Newton’s law of cooling and Stefan’s law of radiation
13. Determination of Stefan’s constant by emissivity method
14. Determination of Solar constant
15. Calibration of Thermistor for Temperature measurement
16. Calibration of thermocouple for Temperature measurement

PART B

**LIST OF OPEN ENDED EXPERIMENTS**

**Note:** Atleast one experiments must be performed

1. Studying the collision of two spheres of equal mass/unequal mass.
2. Experiments on probability with dice/beads.
3. Studying the phenomena of energy conservation in crazy balls.
4. Studying The Drinking bird toy as a heat engine
5. Studying Galileo thermometer (or Galilean thermometer)
6. Experiments with slinky toys.
7. Experiments with newton’s cradle.

**References:**

1. B Saraf etc, - Physics through experiments, Vikas Publications (**2013**)
5. BSC, Practical Physics, CL Arora, SChand & Co, New Delhi, (**2007**) Revised Edition
UNIT – I

- **OSCILLATIONS**: SHM; Differential equation of SHM and its solutions, Kinetic and Potential energy, Simple and compound pendulum; oscillations of two masses connected by a spring; damped oscillations – over damped, under damped and un-damped oscillations; forced oscillations - concept of resonance; Coupled Oscillators - in phase and out of phase oscillations- energy transfer. **6 hours**

- **ELASTICITY**: Hooke’s law, Stress – Strain diagram, definitions of three elastic moduli; Relationship between three elastic constants (derivation); Poisson's ratio; Work done in stretching a wire; Bending of beams; Bending moment, Theory of single cantilever, Couple per unit twist, Torsional oscillations. **7 hours**

UNIT – II

- **Thermodynamic potentials**: Internal Energy; Enthalpy; Helmholtz free energy; Gibbs free energy and their significance; Maxwell's thermodynamic relations (using Thermodynamic potentials) and their significance; TdS relations; Energy equations and Heat Capacity equations; Third law of thermodynamics (Nernst Heat theorem) **4 hours**

- **Phase transitions of the first order**: Melting, vaporization and sublimation; Condition of equilibrium of phases in terms of Gibbs potential; Clausius-Clapeyron equation - elevation of boiling point, depression of freezing point; Equilibrium between phases - triple point **3 hours**

- **Low Temperature Physics**: Methods of producing low temperatures: (i) Joule Thomson (Joule Kelvin / Throttling / Porous plug) experiment, Joule Thomson Coefficient, inversion temperature (ii) Adiabatic demagnetization - working and Theory. **4 hours**

- **Liquefaction of gases**: Regenerative cooling coupled with Joule Thomson cooling; Adiabatic expansion with Joule Thomson cooling (qualitative) **2 hours**

UNIT – III

- **FRAMES OF REFERENCE**: Inertial and Non-inertial frames of reference - Importance of Inertial frame, Linearly accelerated frames, Concept of frame dependent forces; Galilean relativity - Transformation of Position, Distance/Length, Velocity (Non-relativistic velocity addition theorem), Acceleration; Principle of Invariance, Michelson – Morley Experiment, Search for ether **5 hours**
• **SPECIAL THEORY OF RELATIVITY**: Postulates of the special theory of relativity; Lorentz Transformations – Length Contraction, Time Dilation – twin paradox, Velocity Addition Theorem; Variation of mass with velocity; Mass – Energy equivalence; Relativistic momentum and kinetic energy

**8 hours**

UNIT – IV

• **MOMENT OF INERTIA**: Review of rotational motion of Rigid bodies; Kinetic energy of rotation-Moment of Inertia of a body; Theorem of Moment of Inertia-Parallel and perpendicular axes theorem with proofs (2-D case); Calculation of moment of inertia of a disk, annular ring, solid sphere and rectangular bar; Conservation of angular momentum with illustrations.

**9 hours**

• **WAVES**: Wave Equation, Speed of transverse waves on a uniform string; Speed of longitudinal waves in a fluid; Group velocity and Phase velocity – relation between them;

**4 hours**

References:

5. University Physics- F W Sears, M W Zemansky & H D Young, Pearson Education First ed. (**2014**)
8. Elements of Properties of matter – D S Mathur, S.chand(GL) 7 Co Ltd,Dehi 1ed (**2010**)
23. Physics of Waves, University Leadership Project, Prasaranga, Bangalore University
24. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill;
PART-A

Note: A minimum of **EIGHT (8)** experiments must be performed

1. Torsional pendulum – to determine C and Rigidity modulus
2. Bar pendulum – determination of g
3. Spring mass- (a) static case to determine ‘k’
   (b) dynamic case to determine ‘k’
   (c) ‘k’ as a function of L of spring
4. Rigid pendulum – T and decay of amplitude
5. Coupled oscillator – string coupled with change of tension
6. Rolling dumb bell - on parallel inclined rails
7. Verification of parallel and perpendicular axis theorem
8. Searle’s double bar
9. Cantilever of negligible mass to find Young’s modulus
10. q- by Stretching
11. q by uniform bending
12. q by single cantilever
13. q by Koenig’s method
14. n by dynamic method
15. Fly wheel
16. Verification of Clausius-Clapeyron equation using pressure cooker
17. Thermal conductivity of a bad conductor by Lee’s and Charlton’s method
18. Thermal conductivity of rubber
19. Determination of thermal conductivity of a good conductor by Angstrom method / Searle’s method
PART-B

LIST OF OPEN ENDED EXPERIMENTS

Note: Atleast one experiments must be performed

1. Determination of spring constant(k)
   a) Using different spring material
   b) Using different radius of the spring coil
   c) Using different radius of spring wire
   d) Arranging the springs in series and parallel.
2. Determination of time period of a pendulum
   a) Using different material
   b) Using a pendulum with hole- filled with liquid
   c) Using a pendulum with hole- filled with granular material
3. Study the phenomena of shear in corn flour with water/ shampoo
4. Study the phenomena of shear - spreading jam on bread
5. Studying the physics of Tippy top.

References:

1. B Saraf etc, - Physics through experiments, Vikas Publications
2. D P Khandelwal – A Laboratory Manual of Physics for Undergraduate Classes, Vani Publications
5. BSC, Practical Physics, C L Arora, S Chand & Co, New Delhi, 2007 Revised Edition
Syllabus for III Sem BSc Physics Course 3

ELECTRICITY and MAGNETISM

UNIT – I


8 hours

Transient currents: Self inductance – definition, explanation, expression \( L = \frac{\mu n^2 A}{I} \) Magnetic field energy stored in an inductor; Growth and decay of charge in series RC circuit, Growth and decay of current in series LR circuit, Decay of charge in series LCR circuit - Damped, under-damped and over-damped conditions

5 hours

UNIT – II

Magnetic Field and Forces: Force on a moving charge in a magnetic field, Lorentz force and definition of \( B \), force on a current carrying conductor in uniform magnetic field, Force between parallel conductors; Definition of ampere; Biot – Savart’s law, Magnetic field due to a straight current carrying conductor (Derivation for Finite/Infinite Length, Amperes swimming rule, Right hand palm rule), Magnetic field of a circular loop; Force and torque on a circular current loop in a magnetic field, magnetic dipole moment, Field on the axis of a solenoid (derivation and explanation), Principle and theory of a moving coil BG, Concept of dead beat galvanometer, determination of high resistance by leakage, theory of HTG, Ampere’s Circuital law (statement), Application of Ampere’s law to straight wire, solenoid and toroid

13 hours

UNIT III

Scalar and vector fields: Gradient of a scalar function (use of del operator), Divergence and Curl product rules (explanation with geometrical representation), Line, surface and volume integrals (explanation with examples), Fundamental theorem for divergence and curl (statements only).

3 hours

ELECTROMAGNETIC WAVES: Equation of Continuity, Displacement Current, Maxwell’s equations in differential form (Derivation and physical significance), Derivation of wave equation (for one dimension), Velocity of electrom waves in free space and isotropic dielectric medium (derivation), Relation between refractive index and permittivity (qualitatively), Transverse nature of Plane electrom waves, Poynting Vector, Energy density in electromagnetic field, Momentum and...
Pressure of em waves (derivation), Electromagnetic waves in a conducting medium – skin effect and skin depth

10 hours

UNIT IV

ALTERNATING CURRENT: rms and average value of ac-definition and expressions, Representation of sinusoids by complex numbers (brief explanation), response of LR, CR and LCR series circuit to sinusoidal voltage – j operator method, series and parallel resonant (LR parallel C) circuits (mention condition for resonance with expressions for impedance and current), expression for Q factor, band width, AC bridge - Maxwell bridge (derivation of condition for balance, determination of self-inductance of a coil).

6 hours

THERMOELECTRICITY: Seebeck effect (brief explanation, experiment and temperature dependence), Thermoelectric series, Neutral temperature, Laws of thermoelectricity (qualitative), Peltier effect, Peltier coefficient (qualitative analysis), Thomson effect, Thomson coefficient (qualitative analysis), Theory of thermoelectric circuits using thermodynamics (Application of thermodynamics to a thermocouple and connected relations with derivation), Thermoelectric diagrams and uses (in finding the Seebeck Coefficients, Peltier coefficient, Thomson coefficient, total emf of a thermocouple, neutral temperature) Applications of thermoelectricity - Boys' Radio-micrometer, thermopile and thermoelectric pyrometer (brief explanation with experimental setup).

7 hours

References

4. Electricity & Magnetism, NSKhare & SSSrivastava, AtmaRam & Sons, New Delhi
10. Electromagnetism by BB Laud 2ed
11. Electrical Networks, Theraja 3rd revised edition
PART A

Note: A minimum of EIGHT (8) experiments must be performed

1. To find L and C by equal voltage method
2. Energy consumption in an electrical circuit - to find power factor
3. Resonance in LCR series circuit
4. Resonance in LCR parallel circuit
5. Mirror galvanometer- figure of merit
6. High resistance by leakage using BG
7. Thermoelectric circuit - find Seebeck coefficients
8. Verification of Law of intermediate metals
9. Study of thermo emf as a heat pump
10. Load regulation of constant current source
11. Black box - identify & measure R, L and C
12. Verification of Thevenin’s theorem
13. Verification of Superposition theorem
14. Verification of maximum power transfer theorem
15. Maxwell’s impedance bridge
16. Desauty’s bridge
17. Anderson’s bridge

PART B

LIST OF OPEN ENDED EXPERIMENTS

Note: Atleast one experiment must be performed

1. Design experiment to measure R
2. Design experiment to measure C
3. Design experiment to measure EMF
4. Design experiment to measure inductance.
5. Using Plasma Globe design experiments study the phenomena of
   a) dielectric breakdown
   b) Principle of antenna
   c) Frequency of plasma

References:
1. Physics through experiments, BSaraf etc, Vikas Publications 1987
2. Advanced practical physics, Chauhan & Singh, Pragathi Publications 1ed
3. Practical Physics, D Chattopadhyaya et al, Central Publications
5. Practical Physics, D C Tayal 2002
UNIT I

WAVE OPTICS: Huygen’s wave theory of light; Huygen’s principle, construction Huygen’s wave front, Laws of reflection and refraction using spherical wave for at a plane surface (derivation of image distance = object distance using Huygen’s construction, derivation of Snells law).  

INTERFERENCE:
Coherent sources and their production; Conditions for observing interference (mention); Conditions for constructive and destructive interference (mention)  

Coherent sources by division of wave front
Biprism-theory and working, experiment to determine wavelength; Effect of thin film in the path of one of the beams; Calculation of thickness of the  

Coherent sources by division of amplitude:
Interference at thin films - reflected and transmitted light, Colours of thin films; Theory of air wedge; Theory of Newton's rings (Only reflected System). Determination of Refractive index of a liquid  

UNIT - II

Diffraction - Fresnel diffraction
Concept of Fresnel’s half period zones; Theory of rectilinear propagation; Fresnel diffraction, Construction and working of Zone plate; Comparison of Zone plate with lens; Cylindrical Wavefront (Half period strips – qualitative), Theory of diffraction at a straightedge  

Fraunhoffer diffraction
Theory of single slit diffraction; Theory of grating - normal and oblique incidence - Experimental determination of wavelength; Discussion of Dispersive power; Resolving power, Rayleigh’s criterion; Expression for resolving power of grating and telescope; Comparison of prism and grating spectra  

UNIT III

Polarization
Review of plane polarized light and method of production; Double refraction at crystals; Huygens’ explanation of double refraction; Theory of retarding plates - Quarter wave plates and Half wave plates; Theory of superposition of two plane polarized waves with perpendicular vibrations, Production and detection of
linearly, elliptically and circularly polarized light; Optical activity - Fresnel's explanation, Laurent's half shade polarimeter.

6 Hours

Lasers
Introduction; Spontaneous and stimulated emission; Einstein's coefficients and optical amplification; Population inversion; Main components of a laser; Lasing action; Ruby Laser - construction and working - energy level diagram; He-Ne Laser - construction and working - energy level diagram; Spatial Coherence and directionality, estimates of beam intensity, temporal coherence and spectral energy density

7 hours

UNIT IV

(i) \( f(x) = e^{ix} \) if \(-\pi < x < \pi\)
(ii) \( f(x) = \begin{cases} -1 & -\pi \leq x \leq 0 \\ 10 & 0 \leq x \leq \pi \end{cases}\)
(iii) \( f(x) = x^2 \) in the interval \([-1, +1]\)

Expansion of functions with arbitrary period.

(Concept of change of scale; Fourier Series for Periodic Rectangular Wave; Half – Wave rectifier; Trapezoidal wave:

\[
\begin{cases} 
0, & 0 \leq x < 1 \\
1, & 1 \leq x \leq 2 \\
3 - x, & 2 \leq x \leq 3
\end{cases}
\]

)Application to Square wave, triangular Wave and Saw Tooth Wave (superposition of first three components to be shown graphically).

9 hours

Optical Fibres
Optical fiber-principle, description and classification; why glass fibers? Coherent bundle; Numerical aperture of fiber; Attenuation in optical fibers - limit Multimode optical fibers; Ray dispersion in multi-mode step index fibers;

4 hours
References:
PRACTICAL PHYSICS – IV

PART-A

Note: A minimum of EIGHT (8) experiments must be performed

1. Verification of Brewster’s law
2. Refractive index of a liquid by parallax method
3. Focal length of combination of lenses separated by a distance
4. Biprism – determination of wavelength of light
5. Air wedge – determination of thickness of object
6. Newton’s rings – determination of radius of curvature of lens surface
8. Diffraction grating in minimum deviation position
9. Diffraction grating in normal incidence position
10. Resolving power of telescope
11. Resolving power of a grating
12. Diffraction at straight edge
13. Polarimeter – determination of specific rotation of a solution
14. Diffraction of LASER at a wire
15. Measurement of numerical aperture of an optical fibre.
16. Fraunhoffer diffraction of LASER at single slit
17. Diffraction of LASER at graduations of a metal scale

PART B

LIST OF OPEN ENDED EXPERIMENTS

Note: At least one experiment must be performed

1. Constructing a slide whistle (a wind instrument consisting of a tube with a piston in it.)
2. Study the interference pattern of soap films, oil film
4. Study the intensity of light using 3 polarizers
5. Study the intensity of light using dial polarizer.
7. Refraction at spherical surfaces

References:

2. Practical Physics, Experiments with He-Ne laser, R S Sirohi 2nd ed
3. Advanced Practical Physics, Worsnop & Flint Asia Pub.(1979)
4. BSc, Practical Physics, C L Arora, S Chand & Company, New Delhi, Revised Edition, 2007
STATISTICAL PHYSICS, QUANTUM MECHANICS – I, ATMOSPHERIC PHYSICS AND NANOMATERIALS

UNIT I : STATISTICAL PHYSICS (15 HOURS)
Specification of state of the system, Macro state, Micro State, Phase Space, Stirling’s Approximation, Thermodynamic Probability and its calculation (Description of each with an example); Entropy and Thermodynamic probability ( \( S = k \ln \Omega \) ). Basic postulates of Statistical Physics; Ensemble (Micro – canonical, canonical and grand canonical ensembles)

\[ \text{Maxwell – Boltzmann Statistics:} \text{ Max} \text{well – Boltzmann Distribution function} \] 
\[ \text{Energy distribution function} f(E) = \frac{n_i}{g_i}; \text{Maxwell – Boltzmann law of velocity distribution} \] 
\[ \text{(mention: most probable velocity, average velocity, rms velocity)} \text{ Limitations of M – B statistics} \] 

\[ \text{Bose – Einstein Statistics:} \text{ B-E distribution function} \] 
\[ \text{(Derivation of} n_i = \frac{g_i}{e^{\frac{\beta E_i} {kT}} - 1} \text{)} \text{Bose-Einstein condensation properties of liquid He} \] 
\[ \text{(qualitative)} \text{ [Mention of expression of Bose Temperature} T_B \text{– Concept BE Condensation – variation of N}_e \text{ (number of particles in Zero energy state) and } N_v \text{ (number of particles in non-Zero energy state)} \text{ with temperature- BE condensation properties of Liquid He}_4 \] 
\[ \text{(Qualitative description)} \text{]} \text{ Radiation as photon gas, Bose’s derivation of Planck’s law, Rayleigh-Jeans law, Wein’s law; Specific} \text{ Heat capacity of metals} \text{ [Einstein’s theory of specific heat capacity of solids} \] 
\[ \text{[Derivation of the equation where} \theta = \frac{\hbar \nu}{k} \text{]} \] 

\[ \text{Fermi – Dirac Statistics:} \text{ Fermi-Dirac distribution function; Fermi sphere and Fermi energy, Fermi gas; Electronic Specific heat Capacity in metals} \text{ (Mention of the contribution to specific heat capacity from free electrons)} \] Comparison of Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac distribution functions

\[ \text{5 hours} \]

UNIT II : QUANTUM MECHANICS – I
Failure of Classical Physics to explain the phenomena such as stability of atom, atomic spectra, black body radiation, photoelectric effect, Compton effect and specific heat of solids, Planck’s quantum theory, Explanation of the above effects on the basis of quantum mechanics [Experimental observation, failure of classical theory, quantum mechanical explanation, Photoelectric effect -Einstein’s explanation, Compton Effect – mention of expression for wavelength shift (no derivation), Specific heat of solids -Einstein’s and Debye’s explanation of specific heat

\[ \text{5 hours} \]
Stability of atom and atomic spectra, Black body radiation [Mention of Planck’s equation, arrive at Wien’s and Rayleigh-Jean’s equation for energy distribution from Planck’s equation]. **5 hours**
de Broglie’s hypothesis of matter waves (in terms of momentum, energy, temperature for monoatomic gas molecules); Thomson’s experiment; Davisson and Germer’s experiment – normal incidence method; Concept of wave packet, Group velocity and particle velocity (relation between group velocity and particle velocity) Heisenberg’s uncertainty principle - different forms; Gamma ray microscope experiment; Application to Non – existence of electron in nucleus **10 hours**

**UNIT III : ATMOSPHERIC PHYSICS**

Fixed gases and variable gases; Temperature structure of the atmosphere; Hydrostatic balance, Variation of pressure with altitude, scale height; Relative and Absolute humidity **4 hours**

Beer’s law (derivation); Global energy balance for earth – atmosphere system, Greenhouse effect; Atmosphere dynamics – Accelerated rotational frames of reference – Centripetal and Coriolis force (derivation), Gravity and pressure gradient forces (with derivation), Applications of Coriolis force – Formation of trade winds, cyclones, erosion of river banks **6 hours**

**NANOMATERIALS**

**Nanomaterials** – Introduction, classification–(0D, 1D, 2D). Quantum dots, nanowires and nanofilms, Multilayered materials- Fullerene, Carbon Nano Tube (CNT), Graphene (Mention of structures and properties); Synthesis techniques (Top down- Explanation of Milling & bottom up - Sol gel process). Characterisation techniques- (brief description of SEM, TEM, AFM). Electron confinement (0D, 1D, 2D- energy levels as a particle in a box ); Size effect-Surface to volume ratio; distinction between nanomaterials and bulk materials in terms of energy band. Distinct properties of nano materials (Mention- optical, electrical, mechanical and magnetic properties); Mention of applications: (Fuel cells, catalysis, phosphors for HD TV, next generation computer chips, elimination of pollutants, sensors) **5 hours**
References:

9. Basic of Atmospheric Physics, A Chandrasekar, PHI Learning Private Limited (EEE)
10. Weather, climate and atmosphere by Siddartha.
12. Introduction to Atmospheric Science by Turberick &Lutzens,Elsevier Publications
PRACTICAL PHYSICS – V

1. Applications of CRO in the (a) study of Lissajous figures (b) calculation of rms voltage (c) calculation of frequency of AC. (Mandatory)
2. Monte Carlo experiment & error analysis
3. Verification of Maxwell’s distribution of velocity
4. Maxwellian distribution of velocities for electron using EZ81 vacuum diode
5. Dice experiment – to study statistical nature of results
6. Study of statistical distribution on nuclear disintegration data (using GM counter as a black box)
8. Characteristics and spectral response (selenium photocell)
10. Temperature of atmospheric air - by using Thermograph (Bimetallic type)- Plotting the graph of temperature Vs time.
11. Relative humidity using hair hygrometer
12. Estimation of relative humidity using wet and dry bulb thermometer
13. Wind speed and direction by Hand held anemometer and wind wane
14. Estimation of height from the given pressure data
15. Regulated power supply (using zener diode).
17. Frequency response of a CE amplifier.
18. Transistor as a switch and active device.
19. Construction of RFO or AFO - using transistor
20. Emitter follower

Note: A minimum of EIGHT experiments must be performed.

References:
1. Worsnop and Flint, Advanced practical physics for students, Asia Pub. (1979)
5. Ramalingom & Raghuopalan : A Lab. Course in Electronics
ASTROPHYSICS, SOLID STATE PHYSICS AND SEMICONDUCTOR PHYSICS

UNIT-I : ASTROPHYSICS (15 hours)
Parallax and distance: Helio-centric parallax, Definition of parsec (pc), Astronomical unit (AU), light year (ly) and their relations.
Luminosity of stars: Apparent brightness, Apparent magnitude - scale of Hipparchus. Absolute magnitude - distance - modulus relationship. Distinction between visual and bolometric magnitudes, Radius of a star. 3 hours

Stellar classification: Pickering classification and Yerke’s luminosity classification. H-R diagram, Main sequence stars and their general characteristics.
Gravitational potential energy or self energy of a star based on the linear density model, Statement and explanation of Virial theorem.
Surface or effective temperature and color of a star: Wien’s displacement law. Expressions for average temperature, core temperature, hydrostatic equilibrium, core pressure of a star based on the linear density model of a star. Photon diffusion time (qualitative), Mass - Luminosity relationship and expression for lifetime of a star. 7 hours

Evolution of stars: Stages of star formation (GMC–Protostar- T-Tauri) and main sequence evolution, White dwarfs, Pulsars, Neutron stars and Black holes, Variable stars, Supernova explosion - its types, Chandrasekhar limit. Event Horizon, Singularity, Schwarzchild radius (qualitative)  5 Hours

Unit-2: Solid State Physics (15 hours)
Crystal systems and X-rays: Crystal systems-Bravais lattice; Miller indices- Spacing between lattice planes of cubic crystals, Continuous and characteristic X-ray spectra; Moseley’s law, Scattering of X-rays - Compton effect, Bragg’s law. 6 hours

Free electron theory of metals: Electrical conductivity- classical theory (Drude-Lorentz model); Thermal conductivity; Wiedemann - Franz’s law; Density of states for free electrons (with derivation); Fermi-Dirac distribution function and Fermi energy; Expression for Fermi energy and Kinetic energy at absolute zero (derivation). Hall Effect in metals 6 Hours

Superconductivity: Introduction- Experimental facts- Zero resistivity- The critical field- The critical current density – Meissner effect, Type I and type II superconductors- BCS Theory (qualitative); Applications - SQUIDs. 3 hours
Unit-3: Semiconductor Physics
Distinction between metals, semiconductors and insulators based on band theory. Intrinsic semiconductors - concept of holes - effective mass - expression for carrier concentration(derivation for both holes and electrons) and electrical conductivity – extrinsic semiconductors – mention of expressions for carrier concentrations and conductivity – impurity states in energy band diagram and the Fermi level.
Formation of P-N junction, depletion region, Biased P-N junction, variation of width of the depletion region, drift and diffusion current – expression for diode current.

6 hours

Special Diodes: Zener diode–characteristics and its use as a voltage regulator. Photo diodes, Solar cells and LED (principle, working and applications).

4 hours

Transistors: Transistor action, Characteristics (CE mode), DC Biasing, Load line analysis (Operating Point, Fixed Bias – Forward bias of Base – Emitter, collector – emitter loop, transistor saturation, Load line analysis ; Voltage divider bias – Transistor saturation, Load line analysis) Transistor as an amplifier (CE mode); . H-parameters 5 hours

References:

PRACTICAL PHYSICS – VI

1. Parallax Method – Distance of objects using trigonometric parallax.
4. Ramalingom & Raghupalan : A Lab. Course in Electronics
6. Analysis of stellar spectra.
7. Determination of temperature of a star (artificial) using filters.
8. Analysis of sunspot photographs & solar rotation period.
11. Resistivity of a material by four probe method.
12. Determination of Lorentz Number
13. Semiconductor temperature sensor.
14. Temperature coefficient of resistance and energy gap of thermistor.
15. LED characteristics and spectral response.
21. Analysis of X-ray diffraction pattern obtained by powder method to determine properties of crystals.
22. Determination of Fermi energy of a metal.
23. Determination of thermal conductivity of a metal by Forbe’s method.

Note: A minimum of EIGHT experiments must be performed.

References:

1. IGNOU : Practical Physics Manual IGNOU publications
2. Saraf : Experiment in Physics Vikas publicatios
3. S.P. Singh : Advanced Practical Physics
7. Ramalingom & Raghupalan : A Lab. Course in Electronics
UNIT I : ATOMIC AND MOLECULAR PHYSICS (15 HOURS)

Vector Model of the Atom


Molecular Physics: Pure rotational motion, Spectrum and selection rules; Vibrational motion, vibrational spectrum and selection rules; Rotation-Vibration spectrum; Scattering of light-Tyndall scattering, Rayleigh scattering and Raman scattering. Experimental study of Raman effect, Quantum theory of Raman effect - Applications. **5 hours**

UNIT II : RADIOACTIVE DECAY, DETECTORS AND ACCELERATORS (15 HOURS)

Alpha particle scattering:

Rutherford's theory of alpha scattering (assuming the path to be hyperbolic). **2 hours**

Radioactive Decay:

Laws of radioactive decay, half-life, mean life, decay constant; theory of successive disintegration (expression for number of atoms of n\textsuperscript{th} element in the chain - Bateman equations); radioactive equilibrium (secular and transient - cases of long lived parent, short lived parent, daughter and parent of nearly equal half-life). **3 hours**

**Alpha decay**: Range and energy, Geiger-Nuttal law, Characteristics of alpha spectrum, Gamow's theory of alpha decay [Barrier height, tunneling effect, \( \lambda = Pf \) is the frequency of collision of nucleon with the potential barrier; \( P \) is the probability of transmission through the barrier]; Barrier
UNIT III: NUCLEAR REACTIONS AND PARTICLE PHYSICS

NUCLEAR REACTIONS : Types of reactions, Conservation laws in nuclear reactions with examples, derivation of Q – value for reactions using the energy – momentum conservation, exoergic and endoergic reactions, threshold energy, reaction rate, reaction cross – section, concept of direct and compound reactions, resonance reaction; Power reactors

ELEMENTARY PARTICLES : Classification of elementary particles, Fundamental interactions (Gravitational, Electromagnetic, Weak, strong – range, relative strength, particle interactions for each); Symmetries and Conservation Laws (momentum, energy, charge, parity, lepton number, baryon number, isospin, strangeness and charm); Concept of Quark Model, Color quantum number and gluons;
Reference:
2. Introduction to Atomic Physics – H.E. White
PRACTICAL PHYSICS – VII

1. Study of hydrogen spectrum.
2. Sommerfeld’s fine structure constant determination.
3. Determination of e/m by Thomson’s method.
5. Determination of half-life of K\(^{40}\).
6. Millikan’s Oil drop experiment
7. Analysis of band spectrum of PN molecule.
8. Analysis of rotational spectrum of nitrogen.
9. Analysis of rotational vibrational spectrum of a diatomic molecule (HBr).
10. Absorption spectrum of KMnO4.
11. B – H Curve using Oscilloscope
12. Verification of Curie – Weiss Law
13. To verify and design AND, OR, NOT and XOR gates using NAND gates
14. To convert a Boolean Expression into Logic Gate Circuit and assemble it using logic gate ICs.
15. Digital Half-adder & Full-adder circuits using logic gate ICs.
16. Half Subtractor & Full Subtractor, using logic gate ICs

Note: A minimum of EIGHT experiments must be performed.

References:

1. IGNOU : Practical Physics Manual
2. Saraf : Experiment in Physics Vikas Publications
3. S.P. Singh : Advanced Practical Physics
4. Melissons : Experiments in Modern Physics
6. Gupta and Kumar, Practcal physics, Pragati prakashan, 1976
Syllabus for VIII Sem. B.Sc. Physics Course VIII

ELECTRONICS, MAGNETIC MATERIALS, DIELECTRICS AND QUANTUM MECHANICS – II

UNIT I: OPAMPS
Operational amplifiers
Block Diagram of an OPAMP, Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Open loop configuration - Limitations, Gain Bandwidth Product, Frequency Response, CMRR, Slew Rate and concept of Virtual Ground. 2 hours

Feedback concepts, Advantages of feedback, types of feedback, Expression for Gain; OPAMP as a feedback amplifier – Non – Inverting and Inverting amplifier, Modification of input and output impedances with feedback; Voltage follower; Differential amplifier with feedback; 2 hours

Linear Applications - frequency response of Low pass, high pass and band pass filters (first order), inverting summing amplifier, ideal Differentiator, Integrator; 2 hours

OPAMP Oscillators
Positive Feedback concept - oscillator operation – Barkhausen Criterion; Types of oscillator circuits (Qualitative); Phase shift oscillator and Wien bridge oscillator (using op amp). 2 hours

DIGITAL ELECTRONICS
Number Systems: binary, octal, hexadecimal (interconversions); Number codes: BCD, Gray Code (conversions to other systems); Signed Numbers; Arithmetic using Radix and Radix -1 complement. 2 hours

Logic gates and truth tables: OR gate, AND gate; Inverter (the NOT function); NAND and NOR; exclusive OR; exclusive NOR. 1 hour

Boolean laws and theorems – simplification of SOP equations; Realization of AND, OR, NOT using universal gates NAND and NOR; 2 hours

Combination logic: Adders (full and half adder) and Subtractors (half) 2 hours

UNIT II – Magnetic Properties of Matter and Dielectrics
Magnetic Properties of Matter
Review of basic formulae: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, magnetization (M), Classification of Dia – Para –, and ferro – magnetic materials; 3 hours

Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie’s law, Weiss’s Theory of
Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss, Hard and Soft magnetic materials

**Dielectrics** : Static dielectric constant, polarizability (electronic, ionic and orientation), calculation of Lorentz field (derivation), Clausius-Mosotti equation (derivation), dielectric breakdown, electrostriction (qualitative), electrets. Piezo electric effect, cause, examples and applications.

7 hours

UNIT-III : Quantum mechanics-II
The concept of wave function, physical significance of wave function. Development of time dependent and time independent Schrodinger’s wave equation. Max Born’s interpretation of the wave function. Normalization and expectation values, Quantum mechanical operators, Eigen values and Eigen functions. Applications of Schrodinger’s equation – free particle, particle in one dimensional box- derivation of Eigen values and Eigen function – extension to three dimensional box; Development of Schrodinger’s equation for One dimensional Linear harmonic oscillator, Rigid rotator, Hydrogen atom – mention of Eigen function and Eigen value for ground state.

15 hours

References

5. Introduction to solid State Physics, Charles Kittel, VII edition, (1996.)
PRACTICAL PHYSICS – VIII

1. Low pass filter using Op-amp
2. High pass filter using Op-amp
3. Band pass filter using Op-amp
4. Op-amp inverting and non – inverting amplifier – ac or dc
5. OPamp as a differential amplifier – COMMON MODE AND DIFFERENTIAL MODE
6. Op-amp-summing amplifier – ac and dc,
7. OPamp as integrator and differentiator.
8. Phase shift oscillator using op –amp
9. Wien-bridge Oscillator using op – amp
10. To design an Astable Multivibrator of given specifications using 555 Timer
11. Determination of dielectric constant.
12. Determination of dipole moment of organic liquid
13. Verification of inverse square law using GM counter (with a radioactive source).
14. Determination of mass absorption coefficient of gamma rays.

Note : A minimum of EIGHT experiments must be performed.

References :
1. IGNOU : Practical Physics Manual
2. Saraf : Experiment in Physics, Vikas Publications
3. S.P. Singh : Advanced Practical Physics
4. Melissons : Experiments in Modern Physics
QP Pattern
I Semester Integrated B. Sc. B.Ed. Examination, January 2019
(CBCS) (2014-2015 and onwards)
Physics Paper 1: Mechanics, Heat and Thermodynamics

Time: 3 h

Max Marks: 70

Instruction: Answer five questions from each part.

Part – A
Answer any five questions each question carries 8 marks – 5 x 8 = 40 marks
(5 out of 8 questions and each question can have sub-questions a, b, c)
1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 

Part – B
Solve any five problems each problem carries four marks – 5 x 4 = 20 marks
(5 out of 8 questions)
1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 

Part – C
Answer any five questions each question carries two marks – 5 x 2 = 10 marks
(3 out of 5 questions)
1. 
2. 
3. 
4. 
5. 
6. 
7. 
8.
BANGALORE UNIVERSITY PHYSICS TEACHERS’ FORUM

I SEMESTER B.Sc. MODEL PAPER

(2016 - 17 and onwards)

PHYSICS (Paper - I : 101)

MECHANICS - 1, Heat and THERMODYNAMICS - 1

Time : 3 hours

Max. Marks : 70

Instructions: Answer 5 questions from Part - A, 5 questions from Part - B and 5 questions from Part - C

PART - A

1. Answer any FIVE of the following. Each question carries Eight marks. (5 x 8 = 40)
   a. Define drag force and terminal velocity. Obtain an expression for instantaneous velocity and instantaneous position of a body falling freely under gravity where resistance varies directly as the velocity of the body.
   b. Distinguish between static friction and kinetic friction. (2 + 4 + 2)

2. a. Obtain expressions for radial and transverse components of velocity and acceleration of a particle moving in a plane.
   b. Show that the areal velocity of a planet is a constant (6 + 2)

3. a. State and explain work - energy theorem. Hence deduce an expression for work done by a variable force.
   b. What are conservative forces? Show that the work done by conservative forces are path independent. (5 + 3)

4. (a) Show that the linear momentum of a system of particles is equal to the linear momentum of the centre of mass of the system.
   (b) Deduce Wien’s displacement law and Rayleigh-Jeans law from Planck’s law. (4 + 4)

5. a. Using a suitable graph, explain the Maxwell’s law of distribution of molecular velocities in a gas at different temperature.
   b. Obtain an expression for the coefficient of thermal conductivity K of a gas in terms of the mean free path of its molecule. (4 + 4)

6. a. Compare and contrast Andrew’s and van der Waals isotherms.
   b. Derive the expressions for critical constants P_c, V_c and T_c in terms of the van der Waals constants a and b. (3 + 5)
7. a. Show that work done in a thermodynamic process is equal to the area under a $pV$ diagram.
   b. Obtain an expression for work done in an isothermal process

8. (a) Obtain an expression for change of entropy during the free expansion of an ideal gas.
   (b) Show that the entropy remains constant in a cyclic process

PART B

II. Answer any FIVE of the following. Each question carries FOUR marks. $(5 \times 4 = 20)$

9. A sphere of 0.02 kg falls through a resistive medium under the action of gravity. If the drag coefficient is 0.5, calculate the terminal velocity when the resistive force is proportional to the square of velocity

10. An asteroid of mass $2 \times 10^{-4}$ times the mass of earth revolves in a circular orbit around the Sun at a distance that is twice Earth’s distance from the Sun. (a) Calculate the period of revolution of the asteroid in years. (b) What is the kinetic energy of the asteroid revolving about the Sun?

11. The mass of the Moon is 1.2% of the mass of the earth. The distance between the centre of the earth and the Moon is $386.4 \times 10^6$ m. Find the centre of mass of the Earth-Moon system.

12. A cavity at 6000K has an energy distribution corresponding to a black body. Calculate the total power radiated through a hole of 1mm diameter made through the black body.

13. If the rms velocity of hydrogen molecule at NTP is 1.84 km/s$^{-1}$, find the rms velocity of oxygen molecule at NTP. Molecular weights of hydrogen and oxygen are 2 and 32 respectively.

14. For a gas, critical pressure is 12.8 atm. And critical volume for a mole is $70 \times 10^{-6}$ m$^3$. Calculate the van der waals constants and the critical temperature.
15. A cylinder of ideal gas is closed by an 8 kg moveable piston of area 60 cm\(^2\). The atmospheric pressure is 100 kPa. When the gas is heated from 30\(^\circ\)C to 100\(^\circ\)C the piston rises 20 cm. The piston is then fastened in the place and the gas is cooled to 30\(^\circ\)C. If \(\Delta Q_1\) is the heat added to the gas during heating and \(\Delta Q_2\) is the heat lost during cooling, find the difference.

16. Consider a system of water that consists of two parts: 1 kg initially at 90\(^\circ\)C and another 1.5 kg initially at 10\(^\circ\)C. Suppose the two are mixed together in an insulated container and come to equilibrium. Calculate the change in entropy of the system.
\[(\text{Given : } C_p = 4200 \text{ J kg}^{-1} \text{K}^{-1})\]

\[\text{PART C}\]

III. Answer any \textbf{FIVE} of the following. Each question carries \textbf{TWO} marks. \((5 \times 2 = 10)\)

a. Is a large brake on a bicycle more effective than a small one?

b. A satellite does not need fuel to circle around the earth. Why?

c. A car and a bus moving with the same linear momentum are brought to rest by applying equal retarding forces. Which body comes to rest in a shorter distance?

d. Earth is constantly receiving heat radiation from the Sun, yet it does not become as hot as the Sun. Explain

e. At very low pressures the viscosity of a gas is directly proportional to the pressure. Explain

f. What is the essential reason for the isotherms of real gases to deviate from ‘ideal’ gas behaviour below its critical temperature?

g. For an ideal gas, an adiabatic expansion curve is always steeper than the isothermal curve in a PV diagram for the same change in pressure and volume. Explain.

h. An ideal gas undergoes an isothermal expansion at 77\(^\circ\)C increasing its volume from 1.3 L to 3.4 L. The entropy change of the gas is 24 J K\(^{-1}\). How many moles of the gas are present?
## MATHEMATICS

Structure of B.Sc. BEd. – Mathematics Course

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Course</th>
<th>Instruction hrs/week</th>
<th>Duration of Exam (hrs)</th>
<th>Marks</th>
<th>Credits</th>
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<td>I Semester</td>
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<td>Mathematics Paper with Prac.</td>
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<td>V /VI Semester</td>
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<td>Mathematics Paper with practicals of 3 credits</td>
<td>VII sem Theory</td>
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MISSION AND VISION OF THE NEW SYLLABUS IN MATHEMATICS

**Mission**

- Improve retention of mathematical concepts in the student.
- To develop a spirit of inquiry in the student.
- To improve the perspective of students on mathematics as per modern requirement.
- To initiate students to enjoy mathematics, pose and solve meaningful problems, to use abstraction to perceive relationships and structure and to understand the basic structure of mathematics.
- To enable the teacher to demonstrate, explain and reinforce abstract mathematical ideas by using concrete objects, models, charts, graphs, pictures, posters with the help of FOSS tools on a computer.
- To make the learning process student-friendly by having a shift in focus in mathematical teaching, especially in the mathematical learning environment.
- Exploit techno-savvy nature in the student to overcome math-phobia.
- Propagate FOSS (Free and open source software) tools amongst students and teachers as per vision document of National Mission for Education.
- To set up a mathematics laboratory in every college in order to help students in the exploration of mathematical concepts through activities and experimentation.
- To orient students towards relating Mathematics to applications.

**Vision**

4. To remedy Math phobia through authentic learning based on hands-on experience with computers.
5. To foster experimental, problem-oriented and discovery learning of mathematics.
6. To show that ICT can be a panacea for quality and efficient education when properly integrated and accepted.
7. To prove that the activity-centered mathematics laboratory places the student in a problem solving situation and then through self exploration and discovery habituates the student into providing a solution to the problem based on his or her experience, needs, and interests.
8. To provide greater scope for individual participation in the process of learning and becoming autonomous learners.
9. To provide scope for greater involvement of both the mind and the hand which facilitates cognition.
10. To ultimately see that the learning of mathematics becomes more alive, vibrant, relevant and meaningful; a program that paves the way to seek and understand the world around them. A possible by-product of such an exercise is that math-phobia can be gradually reduced amongst students.

11. To help the student build interest and confidence in learning the subject.

**Support system for Students and Teachers in understanding and learning FOSS TOOLS:**

As a national level initiative towards learning FOSS tools, IIT Bombay for MHRD, Government of India is giving free training to teachers interested in learning open source softwares like scilab, maxima, octave, geogebra and others.

(website: http://spoken-tutorial.org ; email: contact@spoken-tutorial.org ; info@spokentutorial.org)
FIRST SEMESTER
MATHEMATICS – I

(4 lecture hours per week+3 hours of practicals/week per batch of
not more than 10 students)

(52 HOURS)

THEORY

1. ALGEBRA - I

Matrices

Elementary row and column transformations (operations), equivalent
matrices, theorems on it. Row- reduced echelon form, Normal form of a matrix,
Rank of a matrix, Problems.

Homogeneous and Non – Homogeneous systems of \textit{m} linear equations in
\textit{n} unknowns consistency criterion – criterion for uniqueness of solutions.
Solution of the same by elimination method.

Eigenvalues and Eigenvectors of a square matrix of order 2 and 3, standard
properties, Cayley-Hamilton theorem (with proof). Finding $A^{-1}, A^{-2}$ and
$A^{2}, A^{3}, A^{4}$

(13 lecture hours)

2. CALCULUS - I

Differential Calculus

Successive Differentiation - \textit{n}th derivatives of the functions: $e^{ax}$, $(ax + b)^n$,
log$(ax + b)$, sin$(ax + b)$, cos$(ax + b)$, $e^{ax} \sin(bx + c)$, $e^{ax} \cos(bx + c)$ – Problems
Leibnitz theorem (with proof) and its applications.

Partial differentiation –Function of two and three variables - First and
higher derivatives - Homogeneous functions – derivatives- Euler’s theorem
and its extension (with proof) - Total derivative and differential -
Differentiation of implicit functions and composite functions – Problems -
Jacobians – Properties of Jacobians problems.

Integral Calculus

Reduction formulae for $\int \sin^{2}x \, dx$, $\int \cos^{2}x \, dx$, $\int \tan^{2}x \, dx$, $\int \cot^{2}x \, dx$,
$\int \sec^{2}x \, dx$, $\int \cosec^{2}x \, dx$, $\int \sin^{m}x \cos^{n}x \, dx$, with definite limit. Differentiation under
integral sign by Leibnitz rule.

(28 lecture hours)
3. GEOMETRY

Analytical Geometry of Three Dimensions

Recapitulation of elements of three dimensional geometry - Different forms of
equations of straight line and plane.

Angle between two planes - Line of intersection of two planes - Plane coaxal
with given planes - Planes bisecting the angle between two planes - Angle
between a line and a plane - Coplanarity of two lines - Shortest distance
between two lines.

Equation of the sphere in general and standard forms - equation of a sphere
with given ends of a diameter. Tangent plane to a sphere, orthogonallity of
spheres.

Standard equations of right circular cone and right circular cylinder.

(13 lecture hours) Note: All the derivations (book works) must be through
vector methods with reduction to corresponding Cartesian equivalents.

Suggested distribution of lecture hours

1. Matrices: 1 hour per week
2. Differential Calculus and Integral Calculus: 2 hours per week
3. Analytic Geometry of three dimensions: 1 hour per week.

Text Books/open source materials

(B) Shanti Narayan and P K Mittal, Text book of Matrices, 5th edition, New
Delhi, S Chand and Co. Pvt. Ltd., 2013.
(C) Shanthi Narayan and P K Mittal, Differential Calculus, Reprint.
(D) Shanthi Narayan and P K Mittal, Integral Calculus, Reprint. New Delhi:
(E) Shanthi Narayan and P K Mittal, Analytical Solid Geometry. New Delhi:
(F) www.scilab.org.
(G) wxmaxima.sourceforge.net
(H) www.geogebra.org

Reference:

3. G B Thomasand R L Finney, Calculus and analytical geometry, Addison
   Wesley, 1995.

**Useful web links:**

- http://www.cs.columbia.edu/~zeph/3203s04/lectures.html
- http://www.themathpage.com/
- http://www.abstractmath.org/
- http://ocw.mit.edu/courses/mathematics/
- http://ocw.mit.edu/courses/mathematics/
- http://www.univie.ac.at/future.media/moe/galerie.html
- https://www.khanacademy.org/math-
PRACTICALS – I

Mathematics practicals with Free and Open Source Software (FOSS) tools for computer programs

(3 hours/ week per batch of not more than 10 students)

LIST OF PROBLEMS

- Introduction to Scilab and commands connected with matrices.
- Computations with matrices.
- Row reduced echelon form and normal form.
- Establishing consistency or otherwise and solving system of linear equations.
- Introduction to Maxima and commands for derivatives and n\textsuperscript{th} derivatives.
- Scilab and Maxima commands for plotting functions.
- n\textsuperscript{th} derivative without Leibnitz rule.
- n\textsuperscript{th} derivative with Leibnitz rule.
- Obtaining partial derivative of some standard functions
- Verification of Euler’s theorem, its extension and Jacobian.
- Maxima commands for reduction formula with or without limits.
- Implementing vector form of line.
- Implementing vector form of plane.

Note: The above list may be changed annually with the approval of the BOS inUG (Mathematics).
SECOND SEMESTER  
MATHEMATICS – II

(4 lecture hours per week + 3 hours of practicals /week per batch of not more than 10 students)  

(52 HOURS)

THEORY

1. ALGEBRA - II Group Theory

Binary operation, algebraic structure-problems on finding identity and inverse. Definitions of semigroup and group, abelian group – problems on finite and infinite groups. Properties of group with proof – standard problems on groups – A finite semigroup with both the cancellation laws is a group – Any group of order less than five is abelian – permutation groups.

Subgroups- theorems on subgroups (with proof)- problems.
(13 lecture hours)

CALCULUS - II

Differential Calculus

Polar coordinates - Angle between the radius vector and the tangent - Angle of intersection of curves (polar form) polar sub-tangent and polar subnormal- perpendicular from pole on the tangent - Pedal equations. Derivative of an arc in Cartesian, parametric and polar forms.

Curvature of plane curves - formula for radius of curvature in Cartesian, parametric, polar and pedal forms - centre of curvature - evolutes. Singular points


Integral Calculus

Applications of Integral Calculus: computation of length of arc, plane area and surface area and volume of solids of revolutions for standard curves in Cartesian and Polar forms.

(26 lecture hours)

DIFFERENTIAL EQUATIONS–I

• Solutions of ordinary differential equations of first order and first degree:
• Linear equations, Bernoulli equation and those reducible to these.
• Exact equations(excluding reducible to Exact)

Equations of first order and higher degree – non linear first order, higher degree – (Mention) solvable for p - solvable for y - solvable for x - Clairaut’s equation -singular solution - Geometric meaning. Orthogonal trajectories in Cartesian and polar forms.

(13 lecture hours)
Suggested distribution of lecture hours

- Algebra-II (Group theory): 1 hour / week
- Calculus-II (Differential calculus & Integral Calculus): 2 hours / week
- Differential Equations-I: 1 hour / week

Text Books/open source materials

- [www.sciilab.org](http://www.sciilab.org).
- [wxmaxima.sourceforge.net](http://wxmaxima.sourceforge.net).

Reference Books


**Useful web links:**

• [http://www.abstractmath.org/](http://www.abstractmath.org/)
• [http://ocw.mit.edu/courses/mathematics/](http://ocw.mit.edu/courses/mathematics/)
• [http://planetmath.org/encyclopedia/TopicsOnCalculus.html](http://planetmath.org/encyclopedia/TopicsOnCalculus.html)
• [http://mathworld.wolfram.com/Calculus.html](http://mathworld.wolfram.com/Calculus.html)
• [http://ocw.mit.edu/courses/mathematics/](http://ocw.mit.edu/courses/mathematics/)
• [http://www.univie.ac.at/future.media/moe/galerie.html](http://www.univie.ac.at/future.media/moe/galerie.html)
• [http://tutorial.math.lamar.edu/classes/de/de.aspx](http://tutorial.math.lamar.edu/classes/de/de.aspx)
• [https://www.khanacademy.org/math](https://www.khanacademy.org/math)
• [https://www.growingstars.com/tutoring/online-tutoring](https://www.growingstars.com/tutoring/online-tutoring)
PRACTICALS –II

Mathematics practicals with FOSS tools for computer programs (3 hours/ week per batch of not more than 10 students)

LIST OF PROBLEMS

- Creating a Scilab program (simple examples).
- Creating a Maxima program (simple examples).
  i. Verifying whether given operator is binary or not. ii. To find identity element of a group.
  iii. To find inverse element of a group.
- Finding all possible subgroups of a finite group.
- Plotting of standard Cartesian curves using Scilab/Maxima.
- Plotting of standard Cartesian curves using Scilab/Maxima.
- Plotting of standard Polar curves using Scilab/Maxima.
- Plotting of standard parametric curves using Scilab/Maxima.
- Scilab/Maxima programs for area and volume.
- Solution of Differential equation using Scilab/Maxima and plotting the solution-I.
- Solution of Differential equation using Scilab/Maxima and plotting the solution-II.
- Solution of Differential equation using Scilab/Maxima and plotting the solution-III.
- Solution of Differential equation using Scilab/Maxima and plotting the solution-IV.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics).
THIRD SEMESTER
MATHEMATICS-III

(4 lecture hours per week+ 3 hours of practicals /week per batch of not more than 10 students)

THEORY (52 HOURS)

1. ALGEBRA - III Groups
Order of an element of a group – properties related to order of an element- subgroup generated by an element of a group –coset decomposition of a group, Cyclic groups- properties- modulo relation- index of a group –Lagrange’s theorem- consequences.

(13 lecture hours)

ANALYSIS – I

a) Sequences Of Real Numbers
   Definition of a sequences-Bounded sequences- limit of a sequences-convergent, divergent and oscillatory sequences- Monotonic sequences and their properties- Cauchy’s criterion.

b) Series Of Real Numbers

CALCULUS – III

Differential Calculus
Recapitulation of Equivalence Class and partition of a set Definition of the limit of a function in ε-δ form –continuity- types of discontinuities. Properties of continuous function on a closed interval (boundedness, attainment of bounds and taking every value between bounds). Differentiability -Differentiability implies Continuity – Converse not true. Rolle’s Theorem- Lagrange’s and Cauchy’s First Mean Value Theorem (Lagrange’s form ) - Maclaurin’s expansion. Evaluation of limits by L’ Hospital’s rule (14 lecture hours)

Suggested distribution of lecture hours

1. Algebra – III (Groups): 1 hour / week.
2. Analysis-I (sequences of real numbers and series of real numbers):2 hours /week

Suggested distribution of lecture hours

- Algebra – III (Groups): 1 hour / week.
- Analysis-I (sequences of real numbers and series of real numbers):2 hours /week
- Calculus - III(differential calculus): 1 hour / week.
Text Books/open source materials

- (a) [www.scilab.org](http://www.scilab.org) (b) [wxmaxima.sourceforge.net](http://wxmaxima.sourceforge.net) (c) www.geogebra.org

Reference


Useful web links:

- [http://www.abstractmath.org/](http://www.abstractmath.org/)
- [http://ocw.mit.edu/courses/mathematics/](http://ocw.mit.edu/courses/mathematics/)
- [http://www.math.unl.edu/~webnotes/contents/chapters.htm](http://www.math.unl.edu/~webnotes/contents/chapters.htm)
- [http://www-groups.mcs.st-andrews.ac.uk/~john/analysis/index.html](http://www-groups.mcs.st-andrews.ac.uk/~john/analysis/index.html)
- [http://web01.shu.edu/projects/reals/index.html](http://web01.shu.edu/projects/reals/index.html)
- [http://www.mathcs.org/analysis/reals/index.html](http://www.mathcs.org/analysis/reals/index.html)
- [http://planetmath.org/encyclopedia/TopicsOnCalculus.html](http://planetmath.org/encyclopedia/TopicsOnCalculus.html)
- [http://mathworld.wolfram.com/Calculus.html](http://mathworld.wolfram.com/Calculus.html)
- [http://ocw.mit.edu/courses/mathematics/](http://ocw.mit.edu/courses/mathematics/)
- [https://www.freemathhelp.com/algebra-tutoring](https://www.freemathhelp.com/algebra-tutoring)
PRACTICALS –III
Mathematics practicals with FOSS tools for computer programs (3 hours/week per batch of not more than 10 students)

LIST OF PROBLEMS

- Examples to verify Lagrange’s theorem.
- Examples for finding left and right coset and finding the index of a group.
- Illustration of convergent, divergent and oscillatory sequences using Scilab/Maxima.
- Illustration of convergent, divergent and oscillatory series using Scilab/Maxima.
- Scilab/Maxima programs to find the sum of the series and its radius of convergence.
- Using Cauchy’s criterion to determine convergence of a sequence (simple examples).
- Using Cauchy’s criterion on the sequence of partial sums of the series to determine convergence of a series.
- Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
- Scilab/Maxima programs to illustrate continuity of a function.
- Scilab/Maxima programs to illustrate differentiability of a function and unequal left hand and right hand limits for discontinuous functions.
- Scilab/Maxima programs to verify Rolle’s theorem and Lagrange’s theorem.
- Scilab/Maxima programs to verify Cauchy’s mean value theorem and finding Taylor’s theorem for a given function.

Evaluation of limits by L'Hospital’s rule using Scilab/Maxima.

Note: The above list may be changed annually with the approval of the BOS inUG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.
FOURTH SEMESTER
MATHEMATICS - IV

(4 lecture hours per week+ 3 hours of practicals /week per batch of not more than 10 students)

(52 HOURS)

THEORY

1. ALGEBRA –IV: Groups

Normal subgroups-examples and problems –Quotient group-Homomorphism and Isomorphism of groups-Kernel and image of a homomorphism-Normality of the Kernel-Fundamental theorem of homomorphism- properties related to isomorphism- Permutation group-Cayley’s theorem.

(13 lecture hours)

2. ANALYSIS –II : Fourier Series

Trigonometric Fourier series of functions with period 2π and period 2L – Half range Cosine and sine series.

(8 lecture hours)

3. CALCULUS – IV: Differential Calculus

Continuity and differentiability of a function of two and three variables – Taylor’s Theorem and expansion of functions of two variables- Maxima and Minima of functions Of two variables. Method of Lagrange multipliers. (9 lecture hours)

4. MATHEMATICAL METHODS - I

Definition and basic properties Laplace transform of some common functions and Standard results –Laplace transform of periodic functions- Laplace transforms ,of derivatives And the integral of function- Laplace transforms, Heaviside functionconvolution theorem (statement only) Inverse Laplacetransforms.

(9 lecture hours)

5. DIFFERENTIAL EQUATIONS –II

Second and higher order ordinary linear differential equations with constant Coefficients- complementary function- particular integrals (standard types) Cauchy-Euler differential equation. Simultaneous linear differential equations (two variables) with constant coefficients. Solutions of second order ordinary linear differential equations with variables coefficients by the following methods.

(i). When a part of complementary function is given
(ii). Changing the independent variable
(iii). Changing the dependent variable
(iv). Variation of parameters
(v). Conditions for exactness and the solution when the equation is exact.

(13 lecture hours)

**Suggested distribution of lecture hours**

- Algebra – IV (Rings, Fields and Integral domains): 1 hour / week
- Analysis – II (Fourier series), Calculus-IV (Differential Calculus) and Mathematical methods-I (Laplace transform): 2 hours / week.
- Differential Equations II: 1 hour / week.

**Text Books/open source materials**

- wxmaxima.sourceforge.net
- www.geogebra.org

**Reference Books**


**Useful web links:**
- [http://www.abstractmath.org/](http://www.abstractmath.org/)
- [http://www.princeton.edu/~rvdb](http://www.princeton.edu/~rvdb)
- [http://ocw.mit.edu/courses/mathematics/](http://ocw.mit.edu/courses/mathematics/)
- [http://planetmath.org/encyclopedia/TopicsOnCalculus.html](http://planetmath.org/encyclopedia/TopicsOnCalculus.html)
- [http://tutorial.math.lamar.edu/classes/de/de.aspx](http://tutorial.math.lamar.edu/classes/de/de.aspx)
- [https://www.saylor.org/courses/ma241/](https://www.saylor.org/courses/ma241/)
- [tutorial.math.lamar.edu/Classes/DE/DE.aspx](tutorial.math.lamar.edu/Classes/DE/DE.aspx)
PRACTICALS – IV
Mathematics practicals with FOSS tools for computer programs (3 hours/ week per batch of not more than 10 students)

LIST OF PROBLEMS

- Illustrating homomorphism and isomorphism of groups.
- Verification of Normality of a given subgroup.
- Verifying Cayley’s theorem and isomorphism theorems.
- To plot periodic functions with period $2\pi$ and $2L$.
- To find full range trigonometric Fourier series of some simple functions with period $2\pi$ and $2L$.
- Plotting of functions in half-range and including their even and odd extensions.
- To find the half-range sine and cosine series of simple functions.
- Finding maxima/minima of functions of two variables.
- Finding the Laplace transforms of some standard functions.
- Finding the inverse Laplace transform of simple functions.
- Implementing Laplace transform method of solving ordinary linear differential equations of first and second order with constant coefficient.
- Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.
- Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.
FIFTH SEMESTER
MATHEMATICS V

(4 lecture hours per week+ 3 hours of practicals /week per batch of not more than 10 students)

THEORY  (52 hours)
1. ALGEBRA - IV Rings, Integral Domains, Fields

Rings, Types of Rings properties of rings – Rings of integers modulo n – Subrings – Ideals, Principal, Prime and Maximal ideals in a commutative ring – examples and standard properties following the definition – Homomorphism, Isomorphism – Properties – Quotient rings – Integral Domain- Fields - properties following the definition – Fundamental Theorem of Homomorphism of Rings - Every field is an integral domain – Every finite integral domain is a field – Problems.

(14 lecture hours)

2. CALCULUS - V
Differential Calculus Of Scalar And Vector Fields

Scalar field – gradient of a scalar field, geometrical meaning – directional derivative – Maximum directional derivative – Angle between two surfaces - vector field

(14lecture hours)

3. NUMERICAL METHODS - I

Finite differences – Definition and properties of $\Delta, \nabla, \delta, \mu$ and $E$, the relation between them – The nth differences of a polynomial, Factorial notations, separation of symbols, divided differences and related theorems.

Newton–Gregory forward and backward interpolation formulae – Lagrange’s and Newton’s interpolation formulae for unequal intervals - Inverse interpolation.

Numerical Integration: Quadrature formula – Trapezoidal rule - Simpson’s 1/3 and 3/8 rule(without proofs) and problems.

(14 lecture hours)
Suggested distribution of lecture hours.

- Algebra IV: 1 hour /week.
- Calculus-V (Differential calculus of scalar and vector fields): 1 hours/week
- Numerical Methods I : 1 hours/week

Text Books/open source materials

- [www.scilab.org](http://www.scilab.org).
- [wxmaxima.sourceforge.net](http://wxmaxima.sourceforge.net).

Reference


Useful web links:

- [http://www.abstractmath.org/](http://www.abstractmath.org/)
- [http://ocw.mit.edu/courses/mathematics/](http://ocw.mit.edu/courses/mathematics/)
- [http://planetmath.org/encyclopedia/TopicsOnCalculus.html](http://planetmath.org/encyclopedia/TopicsOnCalculus.html)
- [http://mathworld.wolfram.com/Calculus.html](http://mathworld.wolfram.com/Calculus.html)
- [http://www.univie.ac.at/future.media/moe/galerie.html](http://www.univie.ac.at/future.media/moe/galerie.html)
- [http://www.math.gatech.edu/~harrell/calc/](http://www.math.gatech.edu/~harrell/calc/)
- [http://www.amtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/index.htm](http://www.amtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/index.htm)
- [http://math.fullerton.edu/mathews/numerical.html](http://math.fullerton.edu/mathews/numerical.html)
- [www.maths.usyd.edu.au › Teaching program › Senior](http://www.maths.usyd.edu.au › Teaching program › Senior)
PRACTICALS –V

Mathematics practicals with FOSS tools for computer programs (3 hours/ week per batch of not more than 10 students)

LIST OF PROBLEMS

- Examples on different types of rings.
- Examples on integral domains and fields.
- Examples on subrings, ideals and subrings which are not ideals.
- Homomorphism and isomorphism of rings- illustrative examples.
- To demonstrate the physical interpretation of gradient, divergence and curl.
- Writing gradient, divergence, curl and Laplacian in cylindrical coordinates.
- Writing gradient, divergence, curl and Laplacian in spherical coordinates.
- Using cyclic notations to derive different vector identities.
- Using cyclic notations to derive some more vector identities.
- Scilab/Maxima programs on Interpolations with equal intervals.
- Scilab/Maxima programs on Interpolations with unequal intervals.
- Scilab/Maxima programs to evaluate integrals using Simpson’s 1/3 rule.
- Scilab/Maxima programs to evaluate integrals using Simpson’s ⅜ rule.

Note: The above list may be changed annually with the approval of the BOS inUG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.
SIXTH SEMESTER
MATHEMATICS – VI

(4 lecture hours per week+ 3 hours of practicals/week per batch of not more than 10 students)

(52 HOURS)

THEORY

1. MATHEMATICAL METHODS - II
Calculus Of Variation

(14 Lecture hours)

2. CALCULUS – VI
a). Line And Multiple Integrals
Definition of line integral and basic properties examples evaluation of line integrals. Definition of double integral – its conversion to iterated integrals. Evaluation of double integrals by change of order of integration and by change of variables – computation of plane and surface areas, volume underneath a surface and volume of revolution using double integrals.

Definition of triple integral and evaluation – change of variables – volume as a triple integral.

(18 lecture hours)

b). Integral Theorems
Green’s theorem (with proof) - Direct consequences of the theorem. The Divergence theorem (with proof) - Direct consequences of the theorem. The Stokes’ theorem (with proof) - Direct consequences of the theorem.

(10 lecture hours)

Suggested distribution of lecture hours
- Mathematical Methods II (Calculus of variation): 1 hour /week.
- Calculus VI (Line and Multiple Integrals and Integral theorems): 2 hours/week

Text Books/open source materials
- R Weinstock, Calculus of Variation, Dover, 1970.
- www.scilab.org
- wxmaxima.sourceforge.net
- www.geogebra.org
Reference Books

Useful web links:
- http://ocw.mit.edu/courses/mathematics/
- http://www.univie.ac.at/future.media/moe/galerie.html
- http://www.math.gatech.edu/~harrell/calc/
- nptel.ac.in/courses/111104025/
- www.shortcoursesportal.com/.../calculus-of-variations-and-advanced-calculus
- freevideolectures.com › Mathematics › MIT
- tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx
- www.onlinemathlearning.com/double-integrals-tutorial
PRACTICALS – VI
Mathematics practical with FOSS tools for computer programs (3 hours/week per batch of not more than 10 students)

LIST OF PROBLEMS
- Example on Euler’s equation in full form.
- Example on particular forms of Euler’s equation.
- Examples on minimum surface of revolution and Brachistochrone problem.
- Examples on Isoperimetric problems.
- Evaluation of the line integral with constant limits.
- Evaluation of the double integral with constant limits.
- Evaluation of the triple integral with constant limits.
- Evaluation of the line integral with variable limits.
- Evaluation of the double integral with variable limits.
- Evaluation of the triple integral with variable limits.
- Verifying Green’s theorem.
- Verifying Gauss divergence theorem.
- Verifying Stokes’ theorem

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.
SEVENTH SEMESTER
MATHEMATICS - VII

(4 lecture hours per week + 3 hours of practicals /week per batch of not more than 10 students)

(52 HOURS)

THEORY

1. ALGEBRA – V Linear Algebra


(14 lecture hours)

2. DIFFERENTIAL EQUATIONS III a).
Orthogonal Curvilinear Coordinates

Definition of orthogonal curvilinear coordinates. Fundamental vectors or base vectors, Scale factors or material factors - quadratic differential form. Spherical curvilinear system : Cartesian, Cylindrical – conversion of Cylindrical to orthogonal Spherical polar coordinates. Theorem: The Spherical coordinate system is orthogonal curvilinear coordinate system. (without proof) No problems on conversions of one system to another.

b). Partial Differential Equations

Total differential equations-Necessary condition for the equation $Pdx + Qdy + Rdz = 0$ to be integrable-Simultaneous equations of the form $dx = dy = dz$

Formation of partial differential equation .Equations of First Order Lagrange’s linear equation – Charpit’s method, Standard types of first order non-linear partial differential equation (By known substitution).

Solution of second order linear partial differential equations in two variables with constant coefficients by finding complementary function and particular integral

Solution of one – dimensional heat equations, Solution of one – dimensional wave equations using Fourier series.

(28 lecture hours)

Suggested distribution of lecture hours:
• Algebra-V (Linear Algebra) : 1 hours / week.
• Differential Equations III: 2 hours / week
Text Books/open source materials

- www.scilab.org
- wxmaxima.sourceforge.net
- www.geogebra.org

Reference

Useful web links:
- http://ocw.mit.edu/courses/mathematics/
- http://www.math.gatech.edu/~harrell/calc/
- https://www.khanacademy.org/math/linear-algebra
- https://www.quora.com
- https://www.udemy.com/linear-algebra
- www.athabascau.ca/syllabi/math/math476
PRACTICALS –VII

Mathematics practicals with FOSS tools for computer programs (3 hours/ week per batch of not more than 10 students)

LIST OF PROBLEMS

1. i. Vector space, subspace – illustrative examples.
   ii. Expressing a vector as a linear combination of given set of vectors.
   Examples on linear dependence and independence of vectors.

2. i. Basis and Dimension – illustrative examples.
   Verifying whether a given transformation is linear.
   i. Finding matrix of a linear transformation.
   ii. Problems on rank and nullity.

   - Plotting of cylinder, sphere and cone using orthogonal curvilinear coordinates.
   - Solutions to the problems on total and simultaneous differential equations.
   - Solutions to the problems on different types of Partial differential equations.
   - Solving second order linear partial differential equations in two variables with constant coefficient.
   - Solving some more second order linear partial differential equations in two variables with constant coefficient.
   - Solution of one dimensional heat equation using Fourier series with Dirichlet/Neumann condition.
   - Solution of one dimensional wave equation using Fourier series with Dirichlet/Neumann condition.

Note: The above list may be changed annually with the approval of the BOS inUG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.
VIII SEMESTER
MATHEMATICS - VIII

(4 lecture hours per week + 3 hours of practicals / week per batch of not more than 10 students)

(52 HOURS)

THEORY

1. ANALYSIS - III

Complex Analysis
Complex numbers-Cartesian and polar form-geometrical representation-complex Plane-Euler’s formula- $e^{i\theta} = \cos \theta + i\sin \theta$. Functions of a complex variable-limit, continuity and differentiability of a complex function. Analytic function Cauchy-Riemann equations in Cartesian and Polar forms-Sufficiency conditions for analyticity(Cartesian form only)-Harmonic function-standard properties of analytic functions-construction of analytic function when real or imaginary part is given-Milne Thomson method.

Complex integration-the complex integration -properties-problems.Cauchy’s Integral theorem-proof using Green’s theorem- direct consequences.Cauchy’s Integral formula with proof-Cauchy’s generalised formula for the derivatives with proof and applications for evaluation of simple line integrals - Cauchy’s inequality with proof – Liouville’s theorem with proof. Fundamental theorem of algebra with proof.

Transformations – conformal transformation – some elementary transformations namely Translation, rotation, magnification and inversion - examples.
The bilinear transformation (B.T.-)cross ratio-invariant points of a B.T.-properties-
(i) B.T. sets up a one to one correspondence between the extended z-plane and the extended w-plane.
(ii) Preservation of cross ratio under a B.T.
(iii) A B.T. transforms circles onto circles or straight lines.

Problems on finding a B.T., and finding images under a B.T.and invariant points of a B.T. Discussion of transformations $w = z^2$, $w = \sin z$, $w = \cosh z$ and $w = e^z$.

28 lecture hours

NUMERICAL METHODS – II


Solutions of initial value problems for ordinary linear first order differential equations by
Taylor’s series, Euler’s and Euler’s modified method and Runge-Kutta 4th ordered method.

(14 lecture hours)
Suggested distribution of lecture hours:

- Analysis-III (Complex Analysis): 2 hours / week.
- Numerical Methods-II: 1 hour / week

Text Books/open source materials

- www.scilab.org
- wxmaxima.sourceforge.net
- www.geogebra.org

Reference


Useful web links:

5. https://www.coursera.org/learn/complex-analysis
6. freevideolectures.com › Mathematics › IIT Guwahati
7. https://www.mooc-list.com/tags/complex-analysis
PRACTICALS – VIII

Mathematics practicals with FOSS tools for computer programs (3 hours/ week per batch of not more than 10 students)

LIST OF PROBLEMS

1. Some problems on Cauchy-Riemann equations (polar form).
2. Implementation of Milne-Thomson method of constructing analytic functions (simple examples).
3. Illustrating orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.
4. Verifying real and imaginary parts of an analytic function being harmonic (in polar coordinates).
5. Illustrating that circles are transformed to circles by a bilinear transformation.
6. Examples connected with Cauchy’s integral theorem.
7. Solving algebraic equation (Bisection method/Regular Falsi/Newton Raphson).
8. Solving system of equations (Jacobi and Gauss-Seidel methods).
10. Solving ordinary differential equation by modified Euler’s/Rungekutta 4th order methods.

Note: The above list may be changed annually with the approval of the BOS inUG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.
I Semester Integrated B. Sc. B.Ed Examination, January 2019

(CBCS) Mathematics – Paper I

Time: 3 h  Max Marks: 70

Instruction: Answer all questions.

PART-A

Answer any five questions. (5x2=10)

1.a) 

b)

c)

d)

e)

f)

g)

h)

PART-B

Answer any one full question. (1x15=15)

2.a) 

b) 

c)

or

3.a) 

b) 

c)
PART-C

ANSWER TWO QUESTIONS. \( (2 \times 15 = 30) \)

4.a) 

b) 

c) 
or 

5.a) 

b) 

c) 

6.a) 

b) 

c) 
or 

7.a) 

b) 

c) 

PART-D

ANSWER ONE FULL QUESTION. \( (1 \times 15 = 15) \)

8.a) 

b) 

c) 
or 

9.a) 

b) 

c) 

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## CHEMISTRY

### SCHEME OF EXAMINATION

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I Semester B. Sc Chemistry Course- I

UNIT-I

Mathematical Concepts for Chemistry

Logarithmic relations: Definition, some important relations like \( \log(m+n) \), \( \log\left(\frac{m}{n}\right) \), \( \log m^n \), change of base (\( \log_2 \rightarrow \log_\alpha \)). Application in the calculation of pH.

Curve sketching: How a curve is sketched with a set of points: linear and non-linear (asymptotic) with a set of points, sketching both linear and non-linear curves. Calculation of slope in the case of linear curve. Extrapolation of linear curve and arriving at a limiting value.

Parabolic curve - maximum and minimum. Differentiation: Meaning and derivative of functions like \( e^x \), \( \log x \), \( \sin x \), \( \cos x \), \( \frac{1}{x} \cdot x^2 \), \( x^2 \) and \( \sqrt[n]{n} \), \( \frac{dy}{dx} = 0 \) at maximum and minimum.

2nd order differentiation: for maximum and minimum (derivation from first principles not required). Rules of differentiation for \( y = u + v, y = uv, y = \frac{u}{v} \) and \( y = kv \), where \( k \) is constant.

Partial differentiation: Explanation, applications using the equation, \( H = U + PV \) and \( G = H - TS \).

Integration: Meaning and integrals of functions like, \( x, dx, x^2, \frac{1}{x}, \frac{1}{x^2}, \frac{1}{x^3} \cdot x^2, e^x, \sin x \) and \( \cos x \). Simple problems from I and II order kinetics.

Exact and inexact differentials: Examples from internal energy and enthalpy. Definite integrals. Probability: some definitions, examples from atomic orbitals, wave functions and entropy.

Gaseous state

9hours

Introduction: Need for Maxwell-Boltzmann distribution law, mathematical expression for both mole and molecule-explanation of the terms only. Explanation of velocity distribution curves based on this law (no derivation). Mean free path, collision frequency and collision number. Definition and expressions using SI units (no derivations). Derivation of expression for most probable speed from Maxwell-Boltzmann equation. Definitions and expressions for rms velocity and average velocity, relationships between them. Problems.

Andrew’s isotherm on carbon dioxide and explanation of the curves (no experimental details). Derivation of critical constants \( T_c \), \( P_c \) and \( V_c \) from van der Waal’s equation and their experimental determination by Cagniard de La Tour method for \( T_c \) and \( P_c \). Amagat’s mean density method for \( V_c \). Problems on the calculation of \( T_c \), \( P_c \) and \( V_c \), \( a \) and \( b \).

Law of corresponding states-statements, reduced equation of state and explanation, Joule-Thomson effect-explanation. Joule-Thomson coefficient, inversion temperature-definition (no derivation). The application of Joule-Thomson effect to the liquefaction of air and hydrogen by Linde’s process.
UNIT-II

**Photochemistry**


**Liquids and Solutions**

Properties of liquids - Viscosity, Surface tension and Parachor. Definition, mathematical expression, numerical problems and factors affecting them.

Viscosity - Definition, mathematical expression, Coefficient of viscosity, effect of temperature, size, weight, shape of molecules and intermolecular forces on it.

Surface Tension - Definition, mathematical expression, effect of temperature and solute on it. Parachor - Definition, Sugen equation, calculation and applications. Numerical problems.

Liquid Mixture: Review of Raoult’s law, ideal and non-ideal solutions.

- Completely miscible liquids - Fractional distillation. Tc curves for all the three types, azeotropic mixtures - examples.
- Completely miscible liquids - Critical solution temperature (Three types), examples. Effect of addition of salt on CST of phenol-water system.

- Immiscible liquids - Steam distillation and its applications.
- Distribution law - Statement, partition coefficient and condition for validity of distribution of distribution law. Application - solvent extraction.

- Dilute solutions - Review of colligative properties and concentration terms.

Determination of molecular mass of a solute by: (i) Berkeley-Hartley’s method (π); (ii) Beckmann’s method (ΔT) and (iii) Landsberger’s method. Numerical problems.

UNIT-III

**Periodic Table and Periodic properties**

*Review of the modern periodic table (with respect to classification of elements based on outer electronic configuration)*

Periodic properties: Atomic and ionic radii, ionisation energy, electron affinity and electronegativity. Trends in the periodic properties. Applications in predicting and explaining chemical behaviour. Factors affecting the values of ionisation energy. Determination of electronegativity by Pauling’s method. Diagonal relationship between beryllium and aluminium. Comparative study of elements of alkali and alkaline earth metals, chalcogens and halogens with
respect to electronic configuration, atomic and ionic radii, ionisation energy, and elecronegativity. Halides, oxides and carbonates of alkali and alkaline earth metals. Hydrides of chalcogens and halogens.

**AnalyticalChemistry**

Errors: Classification, minimization of determinate errors, accuracy and precision. Significant figures and their computations.


**UNIT-IV**

**Basic concepts inorganicchemistry**

Bond cleavage – homolytic and heterolytic. Types of reagents – electrophilic and nucleophilic reagents. Reactive intermediates - generation and relative stabilities of carbocation, carbanion, carbon free radicals and carbenes – explanation for stability and reactivity based on inductive, resonance and hyperconjugation effects.


**AliphaticHydrocarbons**

**Alkanes:** Sources, Nomenclature of branched chain alkanes, preparation of symmetrical and unsymmetrical alkanes- Corey- House reaction and Wurtz reaction - their merits and demerits.

Conformational analysis of n-butane - Sawhorse and Newman projection formulae to be used - Energy profile diagram.

**Cycloalkanes:** Nomenclature. Method of formation. Explanation for stability based on heat of hydrogenation data, Baeyer’s strain theory and its limitation, Sachse - Mohr theory of strain-less rings; cyclopropane ring - banana bonds.


**Dienes:** Classification- isolated, conjugated, cumulated. Structure of allene and butadiene.1,2 addition and 1,4 addition reactions. Diels Alder reaction- 1,3-butadiene with maleic anhydride.

**Alkynes:** Methods of preparation - Dehydrohalogenation of vicinal and geminal dihalides; and higher alkenes from terminal alkynes. Reactions - metal ammonia reduction – significance. Oxidation with KMnO4, acidic nature of terminal alkynes.
II Semester BSc Chemistry Course

UNIT-I

Quantum Mechanics and Atomic Structure 13 hours

Review of Bohr’s atomic model:
Derivation of expressions of for radius, energy and ionisation energies of hydrogen like atoms.
Numerical Problems.
New quantum mechanics-Sinusoidal wave (Explain sinusoidal wave.) equation (classical wave mechanics); Schrodinger wave equation - derivation. Postulates of quantum mechanics.
Significance of terms- (i) Hamiltonian operator; (ii) eigen function $\Psi$ (significance of $\psi$ and $\psi^2$); (iii) eigen values.
Application of Schrodinger equation: (i) to particle in one dimensional box (derivation required); (ii) to the hydrogen atom (detailed solution not required)
Expressing the solution as a product of $\psi_n, l, m (r, \theta, \phi) = \psi_n, l (r) \psi_l (\theta, \phi)$
Explanation of quantum numbers (only qualitative). Radial probability distribution and angular probability distribution. Orbitals

UNIT-II

Chemical bonding 13 hours

Ionic bond: Lattice energy, Born-Haber cycle, Born-Lande equation (derivation not required, problems on Born-Lande expression to be worked out). Calculation of lattice energies of NaCl and MgO, effect of lattice energy on solubility of ionic compounds.
Covalent bond: Valence bond approach: hybridization and directional characteristics of sp, sp$^2$, sp$^3$, sp$^3$d, sp$^3$d$^2$. Shapes of BeCl$_2$, BF$_3$, SiCl$_4$, PCl$_5$, SF$_6$, VSEPR theory: shapes of CH$_4$, NH$_3$, NH$_4^+$, H$_2$O, BrF$_3$, ICl$^-$, Molecular orbital theory: H$_2$, He$^{2+}$, Be$_2$, N$_2$, O$_2$, O$^{2-}$, O$_2^{2-}$, CO (bond order, stability and magnetic properties to be discussed). Polarization concept, Fajan’s rule, bond length, bond angle and bond energy, polar and non-polar molecules, dipole moment.
ii) van der Waal’s forces: Noble gases and molecular crystals (dry ice, Iodine and solid SO$_2$)
Metallic bond: Band theory, electrical properties of metals, semiconductors and insulators.

UNIT-III

Silicates 2 hours
Structure of SiO$_4^{2-}$, Classification of silicates based on the structure. Zeolites: their structure and applications.

Noble gases 3 hours
Introduction, isolation of Helium from Natural gas, applications of Noble gases. Preparation properties and structures of fluorides and oxides of Xenon (XeF$_2$, XeF$_4$, XeF$_6$, XeO$_3$, XeO$_4$).

General study of d and f block elements 8 hours
Transition elements: electronic configuration, atomic and ionic radii, ionisation energy, oxidation states, redox potentials, spectral and magnetic properties, catalytic activity, interstitial compound formation.
UNIT-IV

**Aromatic hydrocarbons** 9hours

General mechanism of aromatic electrophilic substitution. Mechanism of nitration of benzene including evidence for the formation of nitronium ion, energy profile diagram and isotopic effect. Orienting influence of substituents in toluene, chlorobenzene, nitrobenzene and phenol.

Aromatic nucleophilic substitution *via* benzyne intermediate, mechanism with evidences for the formation of benzyne by trapping with anthracene, Birch reduction. Side chain oxidation of toluene to benzaldehyde and benzoic acid. Oxidation of naphthalene, anthracene and phenanthrene. Diels-Alder reaction of anthracene with 1,2-dichloroethene.


**Organichalogencompounds** 4hours
Alkyl halides: Nomenclature. Nucleophilic substitution reactions - SN1 and SN2 mechanisms with energy profile diagrams. Effect of (i) nature of alkyl groups, (ii) nature of leaving groups, (iii) nucleophiles and (iv) solvents on SN1 and SN2 mechanisms. Elimination reactions - E1 and E2 mechanisms; Hofmann and Saytzeff eliminations with mechanism.

Aryl halides: Preparation by halogenation. Relative reactivity of alkyl, allyl, vinyl, aryl and aralkyl halides towards nucleophilic substitution.
III Semester BSc Chemistry Course

UNIT-I

Chemical Kinetics

Review of terms – Rate, Order and Reactivity.

Determination of expression for the rate constant of a second order reaction with \( a = b \) and \( a = b \).

Expression for half-life of a second order reaction. Mean life for first order reaction to be mentioned. Problems on rate constant, half-life period, mean life period and order of reaction.


**Determination of order of reaction:** differential method, method of integration, method of half-life period and isolation method.

**Theories of reaction rates:** Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Problems.

Simple collisions theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Steady state approximation and Lindemann’s hypothesis.

Experimental determination of kinetics of: (i) inversion of cane sugar by polarimetric method,

(ii) spectrophotometric method for the reaction between potassium persulphate and potassium iodide.

**Thermodynamics I**

6 hours

Exact and inexact differentials. Review of terms, I law of Thermodynamics.

Work done (derivation with problems) in isothermal and adiabatic expansion and compression of an ideal gas (IUPAC sign conventions to be used).

Heat capacity of a gas at constant pressure and constant volume: relation between \( P, V \) and \( T \) in an adiabatic process to be derived. Derivation of Kirchoff’s equation. Numerical problems.

**Spontaneous and non-spontaneous processes.**

**Second law of thermodynamics:** Limitations of I law of thermodynamics with illustrations. Need for II law of thermodynamics, different ways of stating II law with respect to heat and spontaneity. Other forms of II law of thermodynamics. Concept of entropy and its physical significance-illustrations with order, disorder, physical and chemical processes and probability.

**Heat engine**–Carnot’s cycle and derivation of the expression for its efficiency. Problems based on efficiency equation. II law in terms of efficiency (\( \square \)). Change in entropy in reversible and irreversible processes (derivations required). Calculation of entropy changes in reversible isothermal and reversible adiabatic processes. Phase transitions in terms of Entropy (Fusion, vaporization, sublimation and polymorphic changes) in terms of entropy. Limitations of the entropy concept of spontaneity. **Problem on Phase transitions**
UNIT-II

Thermodynamics II 4 hours

Derivation of van't Hoff reaction isochore and Clausius-Clapeyron equation. Its applications to $\Delta T$ and $\Delta T_f$ determination (thermodynamic derivation not required).
Qualitative treatment of Nernst heat theorem and III law of thermodynamics-statement only.
Elementary concept of residual entropy.
Surface chemistry 4 hours
Review of surface phenomena.
Theories of adsorption. Adsorption isotherms and BET equation (derivation included).
Adsorption indicators. Surface film on liquids.
Catalysis -Types and theories ((intermediate compound theory and adsorption theory).
Heterogeneous catalysis: surface reactions, unimolecular, bi-molecular surface reactions. pH dependence of rate constant of catalysed reactions. Autocatalysis.

Organic and Inorganic Polymers 3 hours
Differences between inorganic and organic polymers.
Polymerisation: types: addition and condensation polymerisation
Molecular weight of Polymers: Expression for Weight average and Number average (experimental determination is not required)
Preparation and applications of the following types of polymers
1. Plastics: i) thermosetting plastics (Phenol-formaldehyde)
   ii) thermo softening plastics (PVC)
2. Fibers: Acrylic, polyamide, polyester types: one example for each
3. Rubber: Neoprene,
4. Fluoro Carbons: Teflon
5. Silicones.

Compounds of some Nonmetals. 2 hours
i) Boron and its compounds: Synthesis, structure and applications of Diborane, Borazole and Boron trifluoride.
UNIT-III

Metallurgy 5hours

Ellingham’s diagrams: Salient features. Selection of reducing agents using Ellingham’s diagrams. Extraction of the following metals.

i) Nickel from sulphide ore
ii) Thorium from Monazite sand
iii) Uranium from Pitchblende
iv) Plutonium from Nuclear waste.

Alcohols and Thiols 8hours

Alcohols: Introduction and classification. Methods of preparation - (i) From carbonyl compounds - reduction of aldehydes and ketones (by Meerwein-Pondorff-Verley reaction);

(ii) from acids and esters (by reduction with LiAlH4); (iii) From alkenes (by hydroboration-oxidation with alkaline peroxide); (iv) hydration of alkenes. Reactions of alcohols: Acidic nature, esterification, oxidation of alcohols with KMnO4. Comparison of the reactivity of 1°, 2° and 3° alcohols- Lucas test, oxidation with K2Cr2O7.

Glycols: Preparation from alkenes using OsO4, KMnO4 and from epoxides. Oxidation of glycols by periodic acid and lead tetraacetate with mechanisms. Pinacol-pinacolone rearrangement.

Glycerol: Preparation from propene and from oils/fats. Uses. Reactions of glycerol: (i) nitration,

(ii) action of concentrated H2SO4 and (iii) oxidation by periodic acid.

Thiols: Nomenclature. Methods of formation and chemical reactions (with sodium, NaOH, metal oxides, formation of thioesters and oxidation with mild and strong oxidizing agents).

Uses of dithianes. Introduction of umpolung character (reversal of polarity) in carbonyl compounds.

UNIT-IV

Phenols 3hours


Industrial applications of phenols: Conversion of phenol to (i) aspirin, (ii) methyl salicylate, (iii) salol, (iv) salicyl salicylicacid.
**Ethers and Epoxides**

**Ethers:** Methods of preparation – (i) dehydration of alcohols, (ii) Williamson’s ether synthesis. Reactions – Ethers as Lewis bases (complexation with metal ions), cleavage and auto-oxidation. Ziesel’s method.

**Epoxides:** Preparation using per acids, Darzen’s reaction. Reactions of mono and 1,2- disubstituted epoxides with (i) carbon nucleophiles, (ii) nitrogen nucleophiles, (iii) reduction with LiAlH4.

**Fertilizers**


Fertilizer industries in India.

**Organometallic compounds**

Preparation and synthetic applications of Grignard reagents, Organolithium compounds and lithium dialkylcuprates.
IV Semester B. Sc Chemistry Course–IV

UNIT-I

Phase Equilibria 7hours
Statement and explanation of the terms with examples for phase (P), component (C) and degree of freedom (F), Definition and significance of phase rule. Derivation of phase rule. Application of phase rule to one component systems-water and sulphur, -modified form of phase rule to two component systems. Water–potassium iodide and lead-silver systems. Eutectic mixtures and their applications (examples: freezing mixtures, desilverisation of lead by Patterson’s method).

Solidstate 6hours

Liquid crystals-Types with examples. Applications
Superconducting solids-High temperature superconductors. Applications.

UNIT-II

Water Technology 3hours
Types of impurities present in water. Causes for the hardness of water. Permissible levels of ions present in water. Treatment of water for domestic and Industrial purposes by the following methods.

i) Demineralisation of water by ion exchange method.

ii) by reverse Osmosis method.

Nuclear and Radiochemistry. 8hours

Powder metallurgy 2hours
Advantages of powder metallurgy and its applications. Methods of production of metal powders. production of Tungsten powder from Wulframite.
UNIT-III

Steel  
5hours

Aldehydes and Ketones  
8hours
Nomenclature. Preparation of aldehydes: from acid chlorides (Rosenmund reaction), Gattermann-Koch aldehyde synthesis. Preparation of Ketones: From nitriles, from carboxylic acids with alkyl lithium, from acid chlorides with metal alkyls.

UNIT-IV

Carboxylic acids and their derivatives.  
5hours
Nomenclature. Preparation: Acid hydrolysis of nitriles with mechanism.
Acidic strength (pKₐ values) - Effect of substituents on the strength of aliphatic and aromatic carboxylic acids. (comparison of acid strength of formic and acetic acids; acetic acid and monochloro, dichloro, trichloro acetic acids; benzoic and p-nitrobenzoic acid; benzoic acid and p-aminobenzoic acid) Reactions: Formation of esters, acid chlorides, amides and anhydrides.
Hell-Vollhardt-Zelinski reaction, Decarboxylation and reduction (using LiAlH₄). (already included under preparation of alcohols from acid)
Di and tri carboxylic acids: Action of heat on dicarboxylic acids (Oxalic to Adipic acids) Reactions of tartaric acid and citric acid. (action of heat, reduction with HI).
Reactions of acid chlorides (hydrolysis, reaction with alcohol, ammonia and lithium dialkylcuprates)
Acid anhydrides (hydrolysis, reaction with alcohol, ammonia).Esters (alkaline hydrolysis, ammonolysis and alcoholysis).Amides (hydrolysis, reduction, Hoffmann rearrangement). Mechanism of ester hydrolysis - acid and base catalysed (acyl O-cleavage: BAC₂, AAC₂; alkyl O-cleavage: AAL₁mechanisms).
**Tautomerism and Enolates**

Tautomerism in carbonyl compounds – Keto-Enol tautomerism. Acidity of α-hydrogen atoms in aldehydes, ketones and active methylene compounds (example diethyl malonate, ethyl acetoacetate and acetyl acetone). Preparation of (from acetic acid) and synthetic applications of diethyl malonate (preparation of monocarboxylic acids - butanoic acid, dicarboxylic acid - Adipic acid, unsaturated acids - cinnamic acid, ketones - butanone, cyclic compounds - barbituric acid)

Preparation of ethyl acetoacetate (from ethyl acetate). Synthetic applications of ethyl acetoacetate (preparation of monocarboxylic acids - butanoic acid, dicarboxylic acid -succinic acid, unsaturated acids - crotonic acid, ketones -butanone).

**Environmental Chemistry**

UNIT-I
Stereochemistry 8hours

Elements of symmetry in chiral and achiral molecules, chirality, stereogenic centre. Fischer projection formulae.


Diastereomers: Threo and Erythro isomers.

Racemisation and resolution. Relative and absolute configuration.

Optical isomerism due to restricted rotation about single bonds- diphenyl systems.

Geometric isomerism: Determination of configuration of geometric isomers. Cis &trans, E, Z system of nomenclature. Geometric isomerism in oximes.

Alicyclic compounds: Conformations of four to eight membered cycloalkanes and disubstituted cyclohexanes.

Bicyclic systems: Nomenclature and conformations of decalins and norbornane.

UNIT-II
Amines 5hours

Classification. Preparation of alkyl and aryl amines-reductive amination of carbonyl compounds, Gabriel phthalimide synthesis. Basicity of amines in aqueous solution: Inductive, resonance, steric and solvation effects on the basicity of amines. Reaction of amines as nucleophiles – Methylation, quarternary salts, Hoffmann elimination with mechanism. Distinguishing reactions of 1Alpha, 2beta and 3gammaamines.

Diazotization and synthetic applications of diazonium salts.Sandmeyer’s reaction. (conversion to chlorobenzene, bromobenzene and benzonitrile), hydrolysis, reduction (to phenyl hydrazine and aniline), coupling reactions to give azo dyes (p-hydroxyazobenzene and 1-phenylazo-2- naphthol).

Heterocyclic compounds 4hours

UNIT-III

Chemistry of Natural Products  10hours

Carbohydrates: Introduction and classification.
Ketoses: Fructose, interconversion of glucose and fructose.
Terpenes and terpenoids: Occurrence, classification and isoprene rule. Elucidation of structure and synthesis of citral and zingiberene. Structures of limonene, menthol, \(\alpha\)-terpineol, camphor, \(\beta\)-carotene, Vitamins-A and their uses.

UNIT-IV

Spectroscopy of Organic compounds  8hours

UV-Visible spectroscopy: Introduction. Chromophores and auxochromes; blue shift and red shift. Graphical representation of spectra of 1,3-butadiene, benzene and lycopene. Influence of conjugation on UV absorption—Comparison of UV spectra of acetone and methyl vinyl ketone.
IR spectroscopy: Introduction. Stretching frequencies of \(-\text{OH (free and H-bonded)}, \text{alkyl } \text{C–H, C–C, C=C, C–C, C=O and C–O groups (by taking suitable examples). Graphical representation of IR spectra of benzoic acid and methyl benzoate.}
NMR spectroscopy: Basic principles of proton magnetic resonance: Nuclear magnetic spin quantum number I, influence of the magnetic field on the spin of nuclei, spin population, saturation using radio frequency. Nuclear magnetic resonance. Chemical shift (\(\delta\) values), uses of TMS as reference. Nuclear shielding and deshielding effects. Equivalent and non-equivalent protons. Effect of electronegativity of adjacent atoms on chemical shift values. Spin-spin splitting and spin-spin coupling (qualitative treatment only).
Applications of NMR spectroscopy including identification of simple organic molecules. Examples: Shielding and deshielding effects for (i) methane (ii) CH\(_3\)-Cl (iii) CH\(_2\)Cl\(_2\) (iv) CHCl\(_3\). Spin-spin coupling in (i) Cl\(_2\)CHCHO (ii) 1,1,2-trichloroethane (iii) CH\(_3\)CH\(_2\)Cl.

Industrial Organic chemistry  5hours

Drugs: Chemotherapy, classification of drugs. Synthesis and uses of paracetamol, diclofenac, ranitidine, sulphanilamide and chloramphenicol.

Introduction to Green Chemistry: Principles of Green chemistry and its application to the synthesis of paracetamol.
VI Semester B. Sc Chemistry Course VI

UNIT-I

Electrochemistry 1  10 hours

Review of electrolytes and Conductance related terms


Kohlrausch’s law and its applications: (i) evaluation of $\Lambda_\infty$ from $\Lambda_\infty$ and $\Lambda$ (ii) evaluation of degree of dissociation of a weak electrolyte (iii) evaluation of $\Lambda_\infty$ of a weak electrolyte (iv) determination of solubility from conductance of saturated solutions of sparingly soluble salts (AgCl and BaSO$_4$). Problems based on these.


Galavanic cell: conventions of representing galvanic cells-reversible and irreversible cells, derivation of Nernst equation for single electrode potential (free energy concept).

UNIT-II

Electrochemistry II  5 hours

Weston-cadmium cell: Determination of emf of a cell by compensation method. Determination of $E^\circ$ of Zn/Zn$^{2+}$ and Cu/Cu$^{2+}$ electrodes. Liquid junction potentials, elimination of liquid junction potential.

Types of electrodes: Metal and gas electrodes (chlorine), metal/metal insoluble salt electrodes, redox electrodes. Reference electrodes-standard hydrogen electrode, calomel electrode, quinhydrone electrode and glass electrode. Determination of pH using these electrodes. Numerical problems.

Concentration cells: (i) emf of concentration cells (ii) determination of solubility of sparingly soluble salts and numerical problems. Redox electrodes, emf of redox electrodes. Potentiometric titration involving only redox systems.

Ionicequilibria  3 hours


Common-ion effect, buffers, buffer action and buffer capacity. pH of buffers. Henderson’s equation and its derivation. Solubility product and ionic product in precipitation and in qualitative analysis.

Analytical and biological applications of buffers. Theories of indicators.
UNIT-III

Physical properties and Molecular structures  5hours

Polarization and orientation of dipoles in an electric field. Dipole moment. Induced dipole moment (experimental determination of dipole moment not included). Clausius-Mossotti equation (only statement). Dipole moment and structure of molecules (planar and non-planar).


Chemical Spectroscopy I  5hours

The interaction of radiation with matter. Regions of electromagnetic spectrum and associated spectroscopic techniques.

Origin of molecular spectra: Born-Oppenheimer approximation.


UNIT-IV

Chemical Spectroscopy II  4hours

Vibrational spectroscopy: Hooke’s law- Expression for the frequency of SHO-force constant and its significance. Expression for vibrational energy levels of SHO. Zero point energy., numerical problems. Degree of freedom of polyatomic molecules- modes of vibration for CO2 and H2O molecules.

Raman spectroscopy:  3hours

Concept of polarisability. Pure rotation, vibration, qualitative study. Stokes and anti-Stoke’s lines-selection rules.

Advantages of Raman spectroscopy over IR spectroscopy.


Electroanalytical Methods  5hours

Voltammetry at a dropping mercury electrodes (DME)-Types of current obtained at DME. Ilkovic equation and its applications. Current –potential relation for a cathodic process – half wave potential.

Cyclic Voltammetry-Principles-Experimental set up-Quantitative analysis, determination of diffusion coefficients.
UNIT-I

**Coordination and Organometallic compounds I**

Coordination compounds, ligands and their classification (mono, bi, tri, tetra, penta and hexa dentate ligands) and ambidentate ligands, coordination number, nomenclature of coordination compounds in detail. Theories of structure and bonding (Explanation for the formation of complexes by Werner’s Theory in detail and its limitations). EAN rule, Valence bond theory- postulates, low spin and high spin complexes with examples, limitations of VBT. Crystal field theory (octahedral, tetrahedral and square planar complexes). Crystal field splitting and crystalfield stabilization energies, limitations of CFT. Magnetic properties of \([\text{CoF}_6]^{3-}\), \([\text{Co(NH}_3)_6]^{3+}\), \([\text{Fe(CN)}_6]^4-\), \([\text{Fe(CN)}_6]^{3-}\). Spectral properties of \([\text{Ti(H}_2\text{O})_6]^{3+}\), \([\text{Co(H}_2\text{O})_6]^{3+}\), \([\text{CoCl}_4]^{2-}\). Isomerism-Structural: ionization, linkage, hydrate and coordination isomerism with examples. Stereoisomerism-geometrical and optical isomerism with examples. Organometallic compounds – ligands, classification (hapticity). Synthesis and structure of K[PtCl3(η²-C2H4)] and [Fe(η⁵-C5H5)2],

UNIT-II

**Coordination and Organometallic compounds II**

Metal carbonyls – Cr(CO)6, Co2(CO)8, Mn2(CO)10; eighteen electron rule and its deviations with examples.

Applications of coordination/organometallic compounds: cis-platin in cancer therapy, Na2Ca EDTA in the treatment of heavy metals (Pb, Hg) poisoning, Wilkinson’s Catalyst in alkene hydrogenation, Monsanto acetic acid process.

**Industrial Materials I**

**Refractories:** Properties, classification, determination of PCE values.

Abrasives – definition and classification with examples, applications, hardness, manufacture and importance of carborundum and tungsten carbide.

**Glass:** Properties, types, manufacture of soda glass. Composition and applications of borosilicate, metallic glass, optical glasses and polycarbonate glass, safety glass, fire and bullet proofglasses.

**Ceramics:** Raw materials and their roles, varieties of clay, production of ceramic ware, glazing, ceramic insulators.

**Cement:** Raw materials grades, manufacture of Portland cement (by wet process), setting of cement.
UNIT-III

Industrial Materials II  7hours

Paints and Varnishes: Constituents of oil and emulsion paints and their role, constituents of varnishes.

Fuels: Characteristics, Calorific value and its determination using bomb calorimeter, Coal- Varieties, Gaseous fuels-advantages, constituents and their significance, production of Coal gas and composition of LPG. Octane number.

Explosives: Classification, preparation of dynamite and TNT.

Propellants: Characteristics, classification and their applications.

Bioinorganic Chemistry  3hours

Essential and trace elements in biological systems with reference to Na$^+$, K$^+$, Ca$^{2+}$, Fe$^{2+}$, P, Cu, V and Ni. Metallo-porphyrins with special reference to haemoglobin, myoglobin and chlorophyll. Role of cobalamin (vitamin-B12coenzyme) in living systems.

UNIT-IV

Chemistry of Newer materials  10hours


Super conductors: Introduction, definition, type1, type 2 and atypical. Preparation of high temperature super conductor-Y1Ba2Cu3O$_{x+\delta}$, BCS theory (qualitative treatment only) and general applications of high temperature superconductors.


Nanomaterials: Introduction, definition and electronic structure. Different methods of production: Sol gel synthesis, inert gas condensation, mechanical alloying (ball milling), plasma synthesis, electrodeposition, and general applications.
UNIT-I

INTRODUCTION TO BIOCHEMISTRY 2hours


CARBOHYDRATES 4hours

Structure and biological importance of derivatives of monosaccharides.

Amino sugars: β-D-glucosamine, galactosamine and their N-acetylated forms: N-acetylmuramic acid (NAMA); N-acetylneuraminic acid (NANA)

Sugar acids—structure and biological importance of D-gluconic acid, D-gluconic acid and D-glucaric acid.

Sugar phosphates—structure and biological importance of Glucose-6-P, Fructose-6-P, Fructose-1,6-di-P, β-D-ribose-5-P and β-D-deoxyribose-5-P.

Structure and biological importance of oligosaccharides – isomaltose, cellobiose, trehalose. Polysaccharides – source, comparative account of partial structure and biological function of starch, glycogen, cellulose, chitin and insulin.

LIPIDS 4hours

Introduction, Classification.

Fatty acids – definition, classification as saturated and unsaturated with examples and structure (lauric, myristic, palmitic, stearic, oleic, linoleic, linolenic and arachidonic acids ). Essential fatty acids – definition with examples

Triglycerides – Structure of simple and mixed glycerides, properties of triglycerides- acid and alkali hydrolysis, saponification number and its significance, iodine number and its significance, rancidity (oxidative and hydrolytic), biological importance of triglycerides.

Phosphoglycerides – general structure of 3-Sn-phosphatidic acid, lipid bilayer (as in cell membrane), micelles, liposomes and its applications, structure and biological importance of lecithin, cephalin, phosphatidylserine, phosphatidylinositol.

Cholesterol – definition, types (HDL, LDL and VLDL)

Sphingolipids – structure and biological significance of ceramide.
UNIT-II

PROTEINS  

α-amino acids: Introduction, structure, classification on the basis of polarity of R-groups, essential and non essential amino acids, ionic properties and reactions of amino acids with alcohol, nitrous acid and Ninhydrin.

Levels of organizations of Protein: Primary structure, Secondary structure (α-helix, triple helix eg., Collagen and β-pleated sheet), tertiary structure and forces stabilizing it, quaternary structure.

Denaturation and renaturation: Thermal renaturation-Aufinsen’s experiment with ribonuclease.

Classification of proteins based on structure, composition and biological function (enzymes, hormones, transport agents, antibodies, structural materials with examples).

NUCLEIC ACIDS  

Types–Components of nucleic acids, bases, nucleosides and nucleotides with structures. Partial structure of polynucleotide.

Structure of DNA (Watson-Crick model) and RNA. Biological roles of DNA and RNAs. Protein-nucleic acid interaction- chromatin and viral nuclear capsid.

HORMONES  

Definition, Classification - a) amino acid derivatives (epinephrine and thyroxine); b) peptide (oxytocin and vasopressin) and polypeptide hormones (insulin and glucagon); c) Steroid hormones (progesterone, testosterone) with functions.

Role of insulin and glucagon in glucose homeostasis.

Mediators of hormone action – Ca^{2+}, cyclic AMP.

UNIT-III

ENZYMES  

Introduction, Holo enzyme (apo enzyme and co enzyme). Active site, specificity.

Classification of enzymes (EC code number not required).

Enzyme substrate interaction - Fischer and Koshland models.

Enzyme kinetics–factors affecting rate of enzymatic reactions – enzyme concentration, substrate concentration, pH and temperature (mention M. M. equation).

Allosteric enzymes–definition and example

Enzyme inhibitions–Competitive, noncompetitive and uncompetitive inhibition with one example for each.
**BIOLOGICAL OXIDATION**


**High energy phosphates** - definition, examples, structural features of ATP that makes ATP a high energy phosphate (electrostatic repulsion, opposing resonance, solvation of ATP).

Examples of high energy phosphates other than ATP. Energy coupling in biological reactions (explain the concept with suitable examples).

**Biological oxidation** – comparison of oxidation with combustion using glucose as an example. Redox potentials of some biological important half reactions. Calculation of energy yield from biological redox reaction (oxidation of NADH by oxygen, reduction of acetaldehyde by NADH). Mitochondrial electrotransport chain, oxidative phosphorylation. Substrate level phosphorylation.

**BIOCHEMICAL TECHNIQUES**

**Principle and applications of:**
- Paper chromatography and TLC.
- Electrophoresis – cellulose acetate membrane electrophoresis and PAGE.

**UNIT-IV**

**METABOLISM**

**Catabolism and anabolism** (explanation with an example) – Carbohydrate metabolism, glycolysis, fate of pyruvate. TCA cycle, energetic.

**Gluconeogenesis** – definition, synthesis of glucose from lactate.

**Fatty acid metabolism** – activation of fatty acids, role of carnitine, β-oxidation pathway, energetics.

**Protein metabolism** – general aspects of amino acid degradation – transamination, deamination and decarboxylation. Urea cycle.

**MOLECULAR BIOLOGY**

**Central dogma** of molecular biology – semi conservative replication and mechanism of DNA replication, transcription, translation.

**DNA finger printing** – Definition and its applications.
SUGGESTED BOOKS

Inorganic Chemistry

17. Industrial Chemistry, B. K. Sharma, Goel Publishing House

Organic Chemistry

5. Organic Chemistry, Maitland Jones, Jr., W. W. Norton & Company
Physical Chemistry

3. Physical Chemistry – A molecular Approach
5. Text Book of Physical Chemistry
7. Text Book of Physical Chemistry
8. Physical Chemistry
9. Physical Chemistry
11. Text Book of Polymer Science
    Billmeyer, Dr. F. W. John Wiley & Sons, 1984.
12. Basic Physical Chemistry

Biochemistry

8. General,
   Biochemistry Weil J.
   H., Wiley Eastern
Chemistry Practicals for B. Sc., Course

I Semester: Practical 1 (General Chemistry) 3 hours per week

1. Calibration of glass wares: (i) Pipette (ii) Burette (iii) Volumetric flask
2. Estimation of potassium permanganate using standard sodium oxalate solution.
3. Estimation of ferrous ammonium sulphate using standard potassium dichromate solution with potassium ferricyanide as an external indicator.
4. Estimation of ferrous ammonium sulphate using standard potassium dichromate solution with diphenyl amine as an internal indicator. (Change to ferroin indicator?)
5. Estimation of sodium thiosulphate using standard potassium dichromate solution.
7. Determination of the percentage of available chlorine in the given sample of bleaching powder.
8. Determination of percentage of manganese dioxide from pyrolusite ore.
10. Estimation of chloride by Volhard’s method.
11. Estimation of ferrous and ferric iron in a given mixture using standard potassium dichromatesolution.
13. Estimation of carbonate and bicarbonate in a given mixture.

Note: Standard solutions to be prepared for experiments 2 to 6.

Part B

1. Comparison of percentage of available chlorine in different brands of commercial bleaching powders and their efficiency. (or)
2. Determination of hardness of water (of different localities) using EDTA and understanding/interpretation of potability of the water sample.
II Semester: Practical II (Physical Chemistry) 3 hours per week

1. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald’s viscometer.
2. Determination of percentage composition of a binary liquid mixture by viscosity method.
3. Determination of molar mass of polymer by viscosity method.
4. Determination of the density using specific gravity bottle and surface tension of a liquid using Stalagmometer.
6. Determination of degree of dissociation of an electrolyte by ebullioscopic method.
7. Determination of transition temperature of a salt hydrate by thermometric method.
8. Determination of distribution coefficient of acetic acid between water and butanol.
9. Determination of distribution coefficient of benzoic acid between water and toluene.
10. Effect of surfactants on the surface tension of water (Stock solution to be given).

Part B
Application of zeolites in catalysis and water purification. (project/ experiment).

III Semester: Practical III (Organic Chemistry) 3 hours per week

Preparation and purification of organic compounds

1. Recrystallisation and determination of melting point of solids (mixed melting point determination and its importance may be mentioned).
2. Simple distillation and determination of boiling point of liquids.
3. Purification of solids by sublimation.

One stage preparation
(Preparation, recrystallization and melting point determination of the recrystallised sample)

4. Preparation of aspirin from salicylic acid.
   (Note: Acetic anhydride is to be prepared freshly by distilling acetyl chloride and sodium acetate mixture).
5. Preparation of paracetamol from p-aminophenol.
6. Preparation of dibenzalacetone from benzaldehyde (using acetone-alcoholic sodium hydroxide).
7. Preparation of p-aminobenzoic acid from p-nitrobenzoic acid.
8. Preparation of m-dintrobenzene from nitrobenzene.
9. Preparation of benzoic acid from benzaldehyde.

Two stage preparations
11. Preparation of p-nitroaniline from acetanilide.
12. Preparation of m-nitrobenzoic acid from methylbenzoate.
13. Preparation of methyl orange/methyl red by diazotization and coupling.

Chromatography
15. **Thin layer chromatography**: Separation of green leaf pigments/separation of a mixture of two organic compounds.

16. **Column chromatography**: Separation of a mixture of two organic compounds

**Part B**
1. Visit to essential oil extraction labs to understand how oils are extracted (eg: extraction of lemon grass oil).
2. Steam distillation of orange peel, lemon peel, mint leaves etc to get water soluble fragrances.
3. Visit to fertilizer/ paint manufacturing unit.

**IV Semester: Practical IV (Inorganic Chemistry) 3 hours per week**
1. Systematic semi-micro qualitative analysis of a mixture of two simple salts (with no interfering radicals).
2. Separation of metal ions (Cu$^{2+}$, Co$^{2+}$, Ni$^{2+}$, Fe$^{2+}$) using paper chromatography and calculation of Rf values (To be performed by the students).
3. Separation of Mg(II) and Fe(II) by solvent extraction technique.
4. Effluent analysis.

**Part B**
1. Project: Recent techniques/ methodologies employed in effluent treatment.
2. COD and BOD analysis of effluents from industries.

**V Semester: Practical V (Organic Chemistry) 3 hours per week**
2. Isolation of lycopene from tomatoes.
3. Isolation of caffeine from tea leaves.

**Part B**
- Interpretation of spectra
- Visit to pharmaceutical industry/ drug synthesis/ quality control.
- Preparation of paracetamol and limit tests

**VI Semester: Practical VI (Physical Chemistry) 3 hours per week**
1. Determination of velocity constant for acid catalysed hydrolysis of methyl acetate and determination of energy of activation.
2. Determination of velocity constant for the saponification of ethyl acetate ($a = b$).
3. The study of kinetics of potassium persulphate and potassium iodide colorimetrically.
4. Determination of equivalent conductivity of 0.1 N sodium chloride and verification of DHO equation.
5. Determination of dissociation constant of monochloroacetic acid by conductimetry method.
6. Conductometric titration of hydrochloric acid with sodium hydroxide.
7. Potentiometric titration of potassium dichromate with ferrous ammonium sulphate.
8. Determination of Critical Micellar Concentration (CMC) by conductivity method.
9. Determination of pKa of a weak acid by pH metric method.
10. To construct the phase diagram of two component system (Ex. diphenylamine-benzophenone) by cooling curve method.
11. Determination of percentage of sodium chloride by miscibility temperature method.
12. Estimation of Cu\(^{2+}\) colorimetrically and verification of Beer-Lambert’s law.
13. Determination of Oxidation and Reduction potential of K\(_4\)Fe(CN)\(_6\)/K\(_3\)Fe(CN)\(_6\) system by cyclic voltammetry.

**Part B**
Preparation of Buffers/precipitation titration

**VII Semester: Practical VII (Inorganic Chemistry) 3 hours per week**

1. Estimation of percentage of iron in haematite using barium diphenylamine sulphonate as an internal indicator.
2. Estimation of calcium in limestone.
3. Estimation of copper in brass.
4. Estimation of zinc using EDTA.
5. Estimation of total hardness of water using EDTA.
8. Preparation of cuprammonium sulphate and determination of \(\Delta_{\text{max}}\) and hence CFSE.
9. Preparation of sodium trioxalatoferrate (III) and estimation of iron.
11. Preparation of ferrous oxalate and its analysis (both iron and oxalate).

**Part B**
CFSE calculation for various complexes and comparison of their stability

**VIII Semester: Practical VIII (Biochemistry) 3 hours per week**

1. Preparation of buffers and determination of their pH values using pH meter.
2. Estimation of reducing sugars by Hegdorn-Jensen method.
4. Estimation of creatinine by Jaffe’s method.
5. Estimation of inorganic phosphate by Fiske-Subbarow method.
6. Estimation of total reducing sugars by DNS (dinitrosalicylic acid) method.
7. Isolation of lactose and casein from milk and estimation of lactose by colorimetric method.
10. Separation of Alpha-amino acids by paper chromatography.
11. Isolation of DNA from onions.

**Part B**
Estimation of ascorbic acid in fruit juices
Instructions: (1) The question paper has two parts. Answer both the parts.

(2) Draw diagram and write chemical equations wherever necessary.

Part A

Answer any eight questions. Each question carries two marks. \((8 \times 2 = 16)\)

(1) Xxxxxxx
(2) Xxxxxxx
(3) Xxxxxxx
(4) Xxxxxxx
(5) Xxxxxxx
(6) Xxxxxxx
(7) Xxxxxxx
(8) Xxxxxxx
(9) Xxxxxxx
(10) Xxxxxxx
(11) Xxxxxxx
(12) Xxxxxxx

Part B

Answer any nine of the following questions. Each question carries six marks. \((9 \times 6 = 54)\)

(13) Xxxxxxx
(14) Xxxxxxx
(15) Xxxxxxx
(16) Xxxxxxx
(17) Xxxxxxx
(18) Xxxxxxx
(19) Xxxxxxx
(20) Xxxxxxx
(21) Xxxxxxx
(22) Xxxxxxx
(23) Xxxxxxx
(24) Xxxxxxx
(25) Xxxxxxx

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UNIT I: INTRODUCTION TO MICROBIOLOGY AND VIRUSES

Introduction, aim, objectives, scope of microbiology and significance of Branches of microbiology - Industrial, Medical, Agricultural and Environmental microbiology. Contributions of scientists to the field of microbiology (Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming). Isolation of microbes from soil - brief account of culture media, serial dilution, pour plate method and colony characteristics of bacteria.

Applied Microbiology - A brief account of Biofertilizers, Biopesticides, Biogaproduction, Bioremediation, and Bioconversion of waste products.


Common plant diseases - Papaya leaf curl.

UNIT II: STUDY OF BACTERIA

Introduction, Brief account of Bergey’s system of bacterial classification. Occurrence, size and shape, arrangement of flagella and structure of Bacterial cell.

Reproduction - Binary fission and genetic recombination. A brief history of plasmids – definition, properties and types, structure and importance of Ti plasmid, bacterial nutrition, phototrophs and chemotrophs.

Economic importance - Role of bacteria in agriculture, medicine and industry.

Bacterial disease - Citrus canker.

General account of Mycoplasma - Sandal spike disease.

Immunology - Brief account of immune systems, application of immune techniques in agriculture and industry, monoclonal antibodies (ELISA, Hybridoma techniques).

UNIT III: STUDY OF CYANOBACTERIA AND PHYCOLOGY

Cyanobacteria: Introduction, general characteristics, outlines of classification, thallus structure, ultra structure of cell, photosynthesis, reproduction, economic importance of Cyanobacteria, SCP, Biofertilizers, role in water pollution and treatment.
**Type study** *Spirulina & Scytonema*

**Phycology-Part-I:** Introduction, general characteristics, outlines of classification (Fritsch – 1947), thallus structure, pigmentation, reproduction. Economic importance of algae in industry, agriculture and medicine. Toxic algae – Algal blooms, fish poisoning.

**UNIT IV: PHYCOLOGY- PART –II**

13hrs

**Occurrence, structure, reproduction and life cycle:** *Chlamydomonas, Oedogonium, Sargassum, and Polysiphonia*
PART- A

PRACTICAL – I

DIVERSITY OF NON VASCULAR PLANTS

INTRODUCTION TO MICROBIOLOGY, VIRUSES, BACTERIA, CYANOBACTERIA
AND PHYCOLOGY

Total Units - 13

Unit 1 2 units
Study of instruments: autoclave, inoculation chamber, hot air oven, incubator and inoculation loop.
Sterilization of glass ware and media preparation (Nutrient Agar, Martin Rose Bengal Agar).
Isolation of Bacteria from soil by pour plate method.

Unit 2 2 units
Colony characteristics of Bacteria to identify colonies obtained.
Bacterial diseases - Tomato Leaf curl disease, citrus canker, Mycoplasmasandalspike

Unit 3 2 units
Plant viral diseases- Little leaf of Tomato and Vinca rosea, Yellow Mosaic of Beans, and Papaya leaf curl
Gram staining: a) Rhizobium from root nodules b) Lactobacillus from curds.

Unit 4 2 units
Measurement of cell concentration – yeast cells / fungal spores using Haemocytometer. Type study of Cyanobacteria: Anabaena, Spirulina, Scytonema

Unit 5 5 units
Type study of algae: ChlamydomonasOedogonium, Sargassum and Polysiphonia

PART- B

A minimum of one from the list of explorative experiments/open ended problems have to be conducted (This is for internal evaluation)

1. Collection and documentation of Diseased plant material
2. Collection and documentation of Algal samples in and around Bangalore
1. Identify given specimens A, B, C & D with labeled diagrams and reasons
2. Describe colony characteristics of given colony E and tabulate your observations. 2
3. Prepare temporary slide of F, sketch, label and identify with reasons. Leave preparation for evaluation. 5
4. Stain given material G by gram staining write the procedure and identify with reasons. Leave preparation for evaluation 3
Or
Calculate the population of fungal spores / yeast cells G using haemocytometer
5. Identify Slide H and I with labeled diagrams with reason 2 x 2 ½ = 5
6. Record and Submission 5+3= 8

SCHEME OF VALUATION
1. Four specimens A, B, C, D- two from algae, one from Cyanobacteria and one specimen of diseases / Herbarium. (Identification – 1 mark, labeled diagram with reasons 2 marks)
2. Colony characters of the given colony E – 2 marks,
3. Specimen F from algae - mounting – 2 marks. Identification – 1 mark, sketch with reasons 2 marks)
4. Specimen G – Gram staining [Staining, Procedure and result – each 1 mark).
OR
Calculation of fungal spores / yeast cells using haemocytometer (Procedure 1 mark, calculation – 2 marks)
5. Two permanent slides H &I - from algae / Cyanobacteria (Identification – 1 mark, sketch with reasons 1 ½ marks)
6. a) Record – 5 marks
b) Submission of 3 algae / Cyanobacteria materials – 3 marks

REFERENCES

Web Sites
- http://www.phycology.net/
- http://www.algaebase.org/
II SEMESTER Course II
DIVERSITY OF NON-VASCULAR PLANTS – PART - II
MYCOLOGY, PLANT PATHOLOGY, BRYOPHYTES
AND PLANT ANATOMY

UNIT I: MYCOLOGY 13hrs

Economic importance: Role of fungi in Medicine, Agriculture and Industry

Lichens: General account, Structure and reproduction, Ecological and Economic importance.

Mycorrhiza: General account

Saccharomyces - A model genetic organism.

UNIT II: PLANT PATHOLOGY 12 hrs
General account of symptoms, pathogen etiology, mode of Infection. Management of fungal diseases: Koleroga, Coffee rust, Grain smut of Sorghum, Blast disease of Rice, Red rot of Sugarcane.

A brief account of Biopesticides: Neem, Trichoderma and Bacillus thuerngiensis

UNIT III: BRYOPHYTA 13 hrs
General characters. Study of distribution, structure, reproduction, classification and alternation of generation in Marchantia, Anthoceros and Funaria.

UNIT IV: PLANT ANATOMY 14 hrs
Meristematic Tissues: Structure, function, classification, Organisation of Apical Meristems: Tunica-carpus theory and Histogen theory.

Secretary Cells and Tissues: Structure, Classification and significance.

Simple and permanent tissues

Vascular tissues: A brief account

Normal & Secondary growth: Dicot stem.

Anomalous Secondary growth: A general account (Dracaena and Boerhaavia)
PART- A  
PRACTICAL – II  
DIVERSITY OF NON-VASCULAR PLANTS  
MYCOLOGY, PLANT PATHOLOGY, BRYOPHYTES  
AND PLANT ANATOMY  
Total units - 13

Units

I. Identification and classification of fungi members included in the theory 3 Units

II. Demonstration of mushroom cultivation  
Study of lichens,  
Study of Mycorrhiza 2 Units

III. Study of plant diseases included in the theory 2 Units

IV. Study of forms of Bryophytes included in the theory 3 units

V. Normal and Anomalous secondary growth in Stem ex. Tridax,  
Dracaena stem and Boerhaavia stem. 2 Units

VI. Field visit to study pathogen and host interaction 1 Units

VII. Report of Field visit:

PART- B

A minimum of one from the list of explorative experiments/open ended problems have to be conducted (This is for internal evaluation).


2. Visit to GKVK- Agricultural University

3. Mushroom culture
PRACTICAL QUESTION PAPER - II
DIVERSITY OF NON-VASCULAR PLANTS
MYCOLOGY, PLANT PATHOLOGY, BRYOPHYTES
AND PLANT ANATOMY

Time: 3 hours Max. Marks: 35
1. Identify the specimens A, B & C with labelled diagrams and reasons 3x3=9
2. Prepare a temporary Safranin stained T.S of the material D Sketch, label and Identify with reasons, leave the preparation for evaluation 4
3. Write critical notes on E 2
4. Identify the Slides F, G, H & I with labelled diagrams and reasons 4x3=12
5. Record and submission. 5+3=8

SCHEME OF VALUATION
1. Two specimens from Fungi and one from Bryophyta (Identification -1 mark, Labelled diagram with reasons 2 marks)
2. Any one of the following may be given-stem of *Tridax, Dracaena* or *Boerhaavia* (Staining and mounting- 2 marks, sketch and labelling- 1 mark, Identification with reasons- 1 mark)

10
3. One diseased plant/Lichens/Mycorrhiza (Identification-1 mark & critical points1 mark)
4. Two from Bryophytes, One from Fungi and One from Anatomy (Identification & Classification -2 mark, labelled diagrams with reasons-2 marks)
5. Record & Submission: 3 Herbarium sheets from Plant pathology (marks 5+3)

REFERENCES
III SEMESTER Course III
PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY

UNIT I: PTERIDOPHYTES
Introduction and general character with classification (As per Sporne).
Study of diversity in morphology, anatomy and reproduction of the following groups in representative forms
1. Psilotopsida – Eg: *Psilotum*.
2. Lycopsida – Eg: *Selaginella*.
3. Filicopsida – Eg: *Marsilea*.
(Developmental stages not required)
Brief account of Stelar evolution, heterospory and seed habit.

UNIT II: PALEOBOTANY
Contribution of Paleobotanist-Birbal Sahni.
Outline of geological time scale with emphasis on Paleozoic and Mesozoic Era. Process of fossilization – Compression, Impression and Petrification.
Type Study: *Rhynia*.

UNIT III: ENVIRONMENTAL BIOLOGY
Introduction and scope of Environmental Biology
Ecological Factors: Climatic – Light, Temperature, Rainfall, Wind and Atmospheric humidity.
Edaphic factors: Soil Profile, Soil air, Soil Microorganisms
Soil Erosion: Water and Wind.
Soil Conservation:
Biological – Contour farming, Mulching, Strip cropping, Terracing and Crop rotation.
Mechanical – Basin Listing, Construction of dams
Soil reclaims
Biotic Factors – Positive and negative interactions.
Ecosystem – Concept, Components, Study of Fresh water and Grass land Ecosystems.
Ecological Succession – Hydrosere and Xerosere.
Ecological Adaptations – Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.

UNIT IV: ECOSYSTEM MANAGEMENT

52 hrs

13 hrs

13 hrs

13 hrs
Water Shed Management.

**Conservation of natural resources:**
Over Exploitation of Natural resources – eg: Forest
Afforestation, Social Forestry .

**Conservation of plant diversity:**
*In-situ* and *Ex-situ* Conservation – National park, Sanctuaries and Bioreserves. Role of Seed Bank and Gene Bank.

**PHYTOGEOGRAPHY**
Phytogeographical regions of India, Vegetational types of Karnataka.

**PART-A**
**PRACTICAL – III**
**PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY**

**Total Units – 13**

1. Identification and Classification of Pteridophytes (examples studied in theory) **4 units**
2. Paleobotany – Study of specimen/ slide (fossil material/slide) **1 unit**
3. Ecological Adaptations – Study of one example for each adaptation **2 units**
4. Estimation of chloride and dissolved oxygen content in the given sample **2 units**
5. Study of Quadrat method in Ecology **3 units**
6. Marking of vegetation types of Karnataka on Karnataka map and Phytogeographical areas of India **1 unit**
7. Record & submissions: Submission of 3 slides of free hand sections (Pteridophytes / Ecological Specimens)

**PART-B**

**A minimum of one from the list of explorative experiments/open ended problems have to be conducted (This is for internal evaluation)**

2. Visit to National park – Bannerghatta
3. Estimation of Oxygen and Chlorine content in different water bodies in and around Bangalore.
PRACTICAL QUESTION PAPER–III
PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY

Time : 3 hours  Max Marks : 35

1. Identify and classify specimen A & B giving reasons.  \( 2 \times 3 = 6 \)
2. Identify the slides C, D, E with reasons and diagrams.  \( 3 \times 3 = 9 \)
3. Comment on slide/specimen/photocopy/photograph of F. 3
4. Identify and comment on Ecological adaptation of G and H (vegetation pattern of Karnataka).  \( 2 \times 2 \frac{1}{2} = 5 \)
5. Estimate the Oxygen / Chloride content of the given sample I. 4
6. Record and Submission.  \( 5+3 = 8 \)

SCHEME OF VALUATION

2. Pteridophytes - (Identification – 1 mark, Reasons – 1 mark, Diagram – 1 mark).
3. Fossil Material - (Identification – 1 mark, Comment – 2 marks)
4. Specimen/Slide / Map - (Identification – 1 mark, Comment – 1.5 marks)
5. Estimation – (Conducting experiment – 2 marks, principle, procedure & result – 2 marks)
6. Record and Submission : 3 permanent slides of free hand sections of Pteridophytes and ecological specimens (5+3 = 8 marks).

REFERENCES

IV SEMESTER Course IV
GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

UNIT I GYMNOSPERMS
General characters and classification.
Economic importance of Gymnosperms  Type study - Pinus and Gnetum
(Developmental stages not required)

UNIT II EMBRYOLOGY OF ANGIOSPERMS – I 13 hrs
Structure – Typical Angiosperm flower, Androecium and Gynoecium
Microsporogenesis - Microspore mother cells (mmc), cytokinesis, microspore tetrads
Abnormalities - Pollinia, compound pollengrains.
Microgametogenesis – Formation of vegetative and generative cells, structure of male gametophyte.
Abnormalities – Nemec phenomenon

UNIT III EMBRYOLOGY OF ANGIOSPERMS – II 15 hrs
Structure of Pistil – Placentation-definition and types.
Megasporangium – Structure of ovule - Integuments(endothelium), Micropyle (Obturator), Nucellus (crassinucellate and tenuinucellate conditions). Types of ovule- Anatropous, Orthotropous, Amphitropous, Circinotropous. Megasporogenesis.
Megagametogenesis – Types of development of Female gametophyte/embryosac- monosporic- Polygonum type, bisporic- Allium type, tetrasporic- Fritillaria type. Structure of mature embryosac - Structure and functions of synergids, egg, central cell and antipodals.
Double fertilization – pollen germination, growth of pollen tube through style (solid and hollow styles), entry of pollen tube into ovule (porogamy, mesogamy, chalazogamy), entry of pollen tube into the embryosac, pollen tube discharge, syngamy, triple fusion. Significance of double fertilization, post fertilization changes.
Endosperm – Types and its biological importance. Free nuclear (Areca catechu, Cocos nucifera), cellular (Cucumis), helobial types. Ruminate endosperm.

UNIT IV EMBRYOLOGY OF ANGIOSPERMS–III 12 hrs
Embryogenesis – Dicot (Capsella bursa-pastoris) and Monocot (Najas).
Parthenocarpy. Polyembryony- definition and types.
Seed – Structure of Dicot and Monocot seed.
PALYNOLOGY - pollen morphology – pollen wall, aperture, shape, size and architecture, NPC system, pollen wall stratification. Applied Palynology – Aeropalynology, Mellissopalynology
EXPERIMENTAL EMBRYOLOGY - Definition, Totipotency, basic steps in plant tissue culture technique. Nutrient media- basic components, composition of MS & White’s media.
PRACTICAL – IV

PART-A

GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

Total Units – 13

1) Study of materials and permanent slides of Gymnosperms included in Theory 5 units
2) Permanent slides of microsporogenesis and male gametophyte 1 unit
3) Mounting of Pollen grains – Grass, Mimosa, Pollinia of Calotropis and Pollen germination (hanging drop method) 1 unit
4) Permanent slides of types of ovules, Megasporogenesis & embryo sac development 1 unit
5) Permanent slides of types of placentation—Axile, Marginal, Parietal, basal types. Sectioning of ovary, for any two types of placentation. 1 unit
6) Mounting of embryo- Tridax and Cyamopsis. 1 unit
7) Mounting of endosperm - Cucumis. 1 unit
8) Mini project work in groups of 3-5 students, from the following list. 2 units
   a) Study of pollen morphology of different flowers with respect to shape, colour,
   b) Pollen germination of different pollen grains and calculate percentage of germination.

Mini project work may be carried out in groups of 3-5 students, supervised by the batch in charge. The mini project report, about 5-6 pages (type written), to be prepared in following format and certified by the teacher in charge and HOD to be submitted in practical examination.

PART-B

A minimum of one from the list of explorative experiments/open ended problems have to be conducted (This is for internal evaluation).

1. Project on Plant propagation – Tissue culture technique.
2. Project on Mellitopalynology.
PRACTICAL QUESTION PAPER–IV
GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

Time: 3 hours.                                                                 Max Marks: 35

1. Identify and classify specimens A, B, and C giving reasons - 3X3= 9
2. Identify the slides D, E, & F with reasons and labeled diagrams 3X3=9
3. Mount the embryo/Endosperm of specimen G & comment. 5
4. Mount the pollinia/perform pollen germination of specimen H & comment 4
5. Record & submission 5+3=8

SCHEME OF VALUATION
2. One Gymnosperm slide, one from T.S.of young anther/ mature anther, one from megasporogenesis/ stages of embryosac development, /placentation/ types of ovules included in theory. (Identification – 1 mark, Diagram-1 mark, reasons- 1 mark).
3. Endosperm /Embryo mounting (preparation- 3 marks, comment with diagram-2 marks).
4. Pollinia / pollen germination (preparation-2 marks,comment with diagram-2 marks)
5. Record & submission of mini project report (5 + 3 marks)

REFERENCES
V SEMESTER Course V
TAXONOMY AND ECONOMIC BOTANY

UNIT: I CLASICAL TAXONOMY 13 hrs
Aim and Scope of taxonomy, Brief History, Broad outline of classification proposed by Bentham & Hooker, Engler & Prantl and their relative merits and demerits. Species concept:


UNIT: II TAXONOMY – I 13 hrs
Taxonomic studies of following families, according to Engler & Prantl system of classification and their economic importance

Monocotyledoneae Families: Poaceae, Arecaee Musaceae, and rchidaceae

Dicotyledoneae Families:
Archichlamydeae - Magnoliaceae, Annonaceae, Brassicaceae, Rutaceae, Leguminosae (Subfamilies: Papilionatae, Caesalpinioideae and Mimosoideae) Rosaceae & Euphorbiaceae.

UNIT: III TAXONOMY – II 13 hrs
Metachlamydeae - Cucurbitaceae, Apiaceae Rubiaceae, Asteraceae, Asclepiadaceae, Acanthaceae & Lamiaceae.

Ethnobotany: A general account.

ECONOMIC BOTANY: 13 hrs
Study of the following plants with Botanical names, Family, part used, and economic uses.

Edible oils: Groundnut and Coconut
Cereals: wheat, paddy and ragi
Pulses: Green gram and Bengal gram
Sugar and Starch: Sugarcane, Potato
Fibers: Cotton, Jute & Coir
Paper & Pulp: Bamboo & Eucalyptus
Beverages: Coffee, Tea & Cocoa
Spices: Ginger, Cardamom, Clove, Cinnamon, Asafoetida, Turmeric Saffron & Nutmeg
Timber: Teak & Rose wood
Medicinal & Aromatic: Ashwagandha, Aloe vera, Holy Basil, Amla,
PRACTICAL – V

PART- A

TAXONOMY AND ECONOMIC BOTANY

Total Units: 13

1. Morphology of Angiosperms – Vegetative Structure and modifications of root, & leaf. 1 Unit
2. Morphology of Angiosperms – Inflorescence and flower 1 Unit
3. Morphology of Angiosperms – Fruits (Simple, aggregate & multiple) 1 Unit
4. Methods of identification of plants with Technical terms. 1 Unit
5. Study of taxonomic characters of families included in theory (Minimum one genus from each family) 6 Units
6. Study of economically important plants covered in theory to identify with Botanical names, families, parts used and Economic uses. 2 Units
7. Herbarium techniques. 1 Unit
8. Study of local flora by arranging local collection trips.
9. Record & Submission of 3 Herbaria with field notes of plants included in theory.

PART- B

A minimum of one from the list of explorative experiments/open ended problems have to be conducted (This is for internal evaluation).

1. Visit to Botanical garden- LAL BAGH.
2. Visit to FRLHT – learning of Herbarium technique.
PRACTICAL QUESTION PAPER- V
TAXONOMY AND ECONOMIC BOTANY

Time: 3 hrs Max marks: 35

1. Assign the specimens A, B & C to their respective families giving $3 \times 3 = 9$ diagnostic features.

2. Describe D in technical terms; draw the floral diagram with floral formula. 6

3. Identify the specimen E, F, G, H, I & J with their morphological, $6 \times 2 = 12$ Biological & Economic importance.

4. Record and Submission. (Herbaria with field notes) $5 + 3 = 8$

SCHEME OF VALUATION

1. One Archichlamydeae, one Metachlamydeae, one Monocot (Identification ½ mark, Classification 1 mark, Diagnostic features 1½ mark)

2. Dicot plant (Technical detail 2 marks, floral diagram 2 marks, floral formula 2 marks)

3. Root/ Stem/ Leaf modification/ Inflorescence/ Fruit and Economic Importance. (Identification ½ mark, diagram ½ mark, description 1 mark, for economic importance, identification with family 1 mark, part use ½ mark economic uses ½ mark)

4. Record: 5 marks.

5. Submission of Six herbaria with field notes of family’s studies, ½ marks each-3 marks

REFERENCES


VI SEMESTER COURSE VI
MOLECULAR BIOLOGY, GENETIC ENGINEERING,
BIOTECHNOLOGY AND PLANT PHYSIOLOGY 39 hrs

UNIT I MOLECULAR BIOLOGY 13 hrs
Introduction, Discovery, Chemical nature & replication of genetic material, genetic code, non genetic RNA, Biosynthesis of proteins, Regulation of gene action in prokaryotes (Lac operon concept only).


UNIT II MICROBIAL BIOTECHNOLOGY 13 hrs
Uses of microbes in industry and agriculture fermentation – production of ethanol, production of antibiotics – Penicillin.


Stress Physiology: Water stress, heat stress, salt stress and its importance.

UNIT III PLANT PHYSIOLOGY – II 13 hrs
Mechanism of ascent of Sap – Vital and physical force theories.


Mineral Nutrition In Plants - Major & Minor elements, their deficiency symptoms in plants.

Phloem Transport- Transport of organic solutes. Path of transport, vein loading and unloading. Transcellular or streaming hypothesis, contractive protein hypothesis, mass flow hypothesis, Source – Sink concept.
PRACTICAL –VI
PART - A
MOLECULAR BIOLOGY, GENETIC ENGINEERING,
BIOTECHNOLOGY AND PLANT PHYSIOLOGY

Total Units – 13
1. Qualitative Test for Starch, Protein, Reducing Sugars and Lipids. 2 Units
2. Determination of Osmotic potential of the cell sap by Plasmolytic method. 1 Unit
3. Determination of Stomatal Index. 1 Unit
4. Structures of Stomata in Hydrophytes, Mesophytes and Xerophytes. 2 Units
5. Streaming of Protoplasm to show Cyclosis. 1 Unit
6. Determination of pH of Plant Samples by using Indicators. 1 Unit
7. Study of Osmosis & Transpiration Experiments. 3 Units
8. Study of Phloem Transport by Ringing Experiment. 2 Units

PART- B

A minimum of one from the list of explorative experiments/open ended problems have to be conducted (This is for internal evaluation).

1. Project on Hydroponics.
2. Project on Mineral deficiency.
1. Conduct the biochemical test of sample A and B. \( 3 \times 3 = 6 \)

2. Determine the osmotic potential of the cell sap by plasmolytic method / stomatal index of material C \( 8 \)

3. Determine the pH of the given sample D. \( 2 \)

4. Set up and comment on the experiment E. \( 6 \)

5. Comment on experiment F and G. \( 4+4 = 8 \)

6. Record. \( 5 \)

SCHEME OF VALUATION

1. Samples – Starch, Protein, Reducing Sugar and Lipids (Positive Test - 1 mark, Negative Test – 2 marks).

2. Conducting the Experiment – 3 marks; Principle – 2 marks; Procedure – 1 mark; Result – 2 marks.

3. Extract from Root, Stem, Leaves of a Plant to be given (Determination of pH – 1 mark, Comment – 1 mark).


   b. Farmer’s Potometer.

   (Requirements – 1 mark, Principle – 1 mark, Procedure & Conducting Experiment – 3 marks, Result – 1 mark)


   b. Balsam Plant experiment.

   c. Bell Jar experiment.

   d. Transpiration Pull.

   e. Mass Flow Hypothesis.

   f. Ringing Experiment.

   (Identification – 1 mark, Comment – 3)

6. Record 5 marks.

References


Delhi.
UNIT 1 CELL & CHROMOSOME BIOLOGY 16 hrs

Cell as a fundamental unit of life and organism. Structure of eukaryotic chromosome; centromere, kinetochore and telomere. Nucleosome and its importance in the organisation of eukaryotic chromosome. Chromosomal aberrations (Numerical and structural)

Cell Division - Phases, mitotic apparatus, cytokinesis, mitotic inhibitors, significance of mitosis; Meiosis- phases of meiotic cycle cytological proof of crossing over, synaptonemal complex. Brief study on Apoptosis (PCD).

UNIT II MENDELIAN GENETICS 13 hrs

Biography of Mendel in brief: Mendel’s experiments: Monohybrid cross – law of dominance, law of segregation, purity of gametes. Homozygous, heterozygous, phenotype, genotype, monohybrid test cross, Dihybrid cross-law of independent assortment, dihybrid test cross, incomplete dominance (Mirabilis jalapa, Snapdragon).

Modification of Mendelian ratios: (With reference to plant examples).

Interaction of genes epistasis (dominant & recessive); supplementary factors, complementary factors: Polygenic inheritance in Maize (Self Sterility in Nicotiana), Linkage & Crossing over (in Maize).

SEX DETERMINATION: Sex determination in Melandrium

UNIT III EVOLUTION 10 hrs

Origin of life, theories of evolution, modern concepts of evolution, role of mutations in evolution,

PLANT BREEDING

Historical account and objectives of plant breeding. Vegetative propagation methods (underground plant parts and isolated plant parts - cutting, grafting, layering, gootee, clones) Hybridization (intergeneric and interspecific), maintenance of germplasm, pollen banks, quarantine methods.
PRACTICAL – VII

PART - A

CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING

Total Units - 13

1. Preparation of cytological stains - Aceto carmine & Aceto orcein. 1 Unit
2. Mitosis from *Allium* root tips—Aceto orcein. 3 Units
3. Meiosis from *Allium* flower buds- Aceto carmine. 3 Units
4. Karyotype and Idiogram : Camera Lucida drawing. 1 Unit
5. Permanent slides of Mitosis. 1 Unit
6. Permanent slides of Meiosis. 1 Unit
7. Genetic problems. 3 Units
8. Record and Submission- 6 Slides (3 Mitosis and 3 Meiosis.)

PART- B

A minimum of one from the list of explorative experiments/open ended problems have to be conducted (This is for internal evaluation).

2. Visit to St.John’s Hospital – Study of Chromosomal mapping of Humans.
PRACTICAL QUESTION PAPER- VII
CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING

Time: 3 hours Max Marks: 35

1. Prepare a temporary mitotic, slide from material A identify the stage with diagram. 6
2. Prepare a temporary meiotic slide from material B identify the stage with diagram. 6
3. Identify and comment on C along with a sketch (only Karyotype). 4
4. Identify and comment on slides D and E with suitable sketches 3+3=6
5. Solve the Genetic Problem F 5
6. Record and Submission 5+3=8

Scheme of Valuation
1. Preparation- 4 marks, identification of stage - 1 mark and diagram 1 mark
2. Preparation - 4 marks, identification of stage - 1 mark and diagram 1 mark
3. Karyotype - slide or sketch, identification-1 mark, diagram- 1 mark, comment- 2 marks
4. Slides from meiosis and mitosis identification 0.5 mark, sketch 0.5 mark and comment2 marks.
5. Genetic problems from
  i. Dihybrid cross and test cross
  ii. Incomplete dominance
  iii. Complementary factors
  iv. Supplementary factors
  v. Epistasis - 5 marks
6. i. Record - 5 marks
ii. 3 Mitotic and 3 Meiotic permanent slides ½ mark each - 3 marks

REFERENCES
   29
UNIT I ENZYMES 13 hrs
Nomenclature, classification, chemical composition, prosthetic groups, coenzymes, cofactors, properties of enzymes, mechanism of enzymes action, enzyme kinetics, factors affecting enzyme activity, Inhibition of enzyme action (Competitive, Non Competitive, feedback), Allosteric enzyme.

Nitrogen Metabolism:

UNITII BIOENERGETICS 13hrs
Photosynthesis – Introduction, ultra structure of the chloroplast, photosynthetic apparatus, principle of light absorption, Emerson’s enhancement effect, photosystems I & II, Light reaction – Hill reaction, photophosphorylation (cyclic, non-cyclic), carbon reactions (Calvin Cycle, C4 – Pathway, CAM), Factors affecting the process.

Photorespiration – Organelles involved, mechanisms and significance.
Respiration- Introduction, mechanism of aerobic respiration – glycolysis, TCA cycle, ETS and oxidative phosphorylation, mechanism of anaerobic respiration (alcoholic fermentation and lactic acid fermentation), Respiratory Quotient and its significance, factors affecting respiration.

UNIT III PLANT GROWTH AND GROWTH REGULATORS 13hrs
Definitions of growth, Kinetics, Factors affecting growth, Phytohormones, Metabolism, Physiological effects, mode of action of auxins, gibberellins, cytokinins, ethylene and ABA. Applications of these hormones in agriculture and horticulture.

Plant movements – A brief account on the classification and types of movements.

Photobiology – A brief account of dormancy, Photoperiodism, phytochrome and its role, Florigen concept, Vernalization,

Defence mechanisms – A brief account of Secondary metabolites (Phenolics, Flavonoids and alkaloids) and their role in plant defence.
PRACTICAL – VIII
PART – A
PLANT PHYSIOLOGY – III

Total Units : 13
1. Separation of Photosynthetic pigments by paper chromatography and measurement of Rf Values. 1 unit
2. Determination of rate of photosynthesis at different wavelengths of light. 1 unit
3. Determination of rate of photosynthesis at different concentrations of CO2 1 unit
4. Estimation of Ascorbic acid content in a plant sample. 1 unit
5. Determination of RQ of carbohydrates, fats and proteins. 1 unit
6. Study of geotropism, phototropism and hydrotropism. 2 unit
7. Evolution of O2 during photosynthesis. 1 unit
8. Evolution of CO2 during respiration. 1 unit
9. Kuhne's fermentation vessel. 1 unit
10. Moll's half leaf Experiment. 1 unit
11. Evolution of heat during respiration 1 unit
12. Qualitative test for Flavonoids, Phenolics and Alkaloids(Any one test) 1 unit
13. An industrial visit to study the manufacture of alcohol / antibiotics / enzymes. Bioinformatics/ Molecular biological lab.

PART- B
A minimum of one from the list of explorative experiments/open ended problems have to be conducted (This is for internal evaluation).
1. Project on effect of Auxins on germination.
2. Project on breaking of dormancy in Potato.
3. Project on Senescence by adding Cytokinins.
1. Separate the photosynthetic pigments from sample A by paper chromatography and measure their Rf values. 8 marks
2. Estimate the ascorbic acid content in the sample B. 8 marks
3. Set up and comment on experiment C. 6 marks
4. Identify and comment on physiological set up D. 2 marks
5. Qualitative Analysis of the given sample E 3 marks
6. Record and submission 5+3 = 8 marks

SCHEME OF VALUATION
1. A. Requirement- 1 mark, principle- 2 marks, procedure and conducting the experiment- 3 marks, Rf values- 2 marks.
2. B. Requirements- 1 mark, principle- 2 marks, procedure and conducting the experiment- 3 marks, Result- 2 marks.
3. C. Identification- 1 mark, set up- 2 marks, comments- 2 marks, labelled Diagram- 1 mark
4. D. Identification- 1 mark, comments- 1 mark
5. E. Samples – Flavonoid, Alkaloid, and Phenolic Test - 3 marks
6. Record and Submission of field report (hand written field report only) 5+3 Marks

LIST OF EXPERIMENTS FOR C.
i. Evolution of O2 during photosynthesis.
ii. Evolution of CO2 during respiration.
iii. Moll’s half leaf Experiment.
iv. Evolution of heat during respiration (Thermos flask Experiment)

LIST OF EXPERIMENTS FOR D&E.
i. Photosynthesis at different wavelengths of light
ii. Photosynthesis at different concentrations of CO2
iii. Respirometer experiment for RQ
iv. Kuhne’s fermentation vessel
v. Hydrotropism
vi. Phototropism
vii. Geotropism
viii. Qualitative test for Flavonoids, Phenolics, and Alkaloids (Any one test)
REFERENCES

I Semester Integrated B. Sc. B.Ed Examination, January 2019
(CBCS)
Botany- Paper 1

Time: 3 hours
Max. Marks: 70

I. Answer any TEN from the following: 10x2=20 Marks
1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 

II. Answer any FOUR from the following: 4x5=20 Marks
1. 
2. 
3. 
4. 
5. 
6. 

III. Answer any THREE from the following: 3x10=30 Marks
1. 
2. 
3. 
4. 
5. 

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ZOOLOGY

I SEMESTER
COURSE – I: NONCHORDATA: PART – I
- 52 hours

Unit I: Animal Architecture - 14 hours
(To be taught citing suitable examples and keeping in view of evolutionary trends and significance) -07 hours

1.1. Body symmetry: Definition, types – spherical symmetry, radial symmetry, biradial symmetry and bilateral symmetry. -01 hour

1.2. Body organisation: The hierarchical organisation of animal complexity – protoplasmic level of organisation, cellular level of organisation, tissue level of organisation and organ level of organisation. -01 hour

1.3. Germ layers: Definition, Types - diploblastic condition (apparent and absolute) and triploblastic condition. -01 hour

1.4. Body coelom: Definition, origin and types– acoelom, pseudocoelom, eucelom (enterocoelom and schizocoelom). -01 hour

1.5. Metamerism: Definition, types – pseudometamerism, true metamerism-homonomous and heteronomous. -02 hours

1.6. Cephalisation: Definition and its process (formation). -01 hour

Protozoa: The Animal-like Protista -07 hours

1.7. General characters of the phylum up to classes with examples. -01 hour

1.8. Nutrition: Holozoic, Holophytic, Saprozoic, Mixotrophic and Parasitic with an example for each. -02 hour

1.9. Locomotion: Locomotory organelle – Pseudopodia, Cilia and Flagella. Modes of locomotion – Amoeboid movement (Walking movement and Sol-Gel theory), Flagellar and Euglenoid movement, ciliary movement (Paddle stroke theory) and Metabolic movement (Gregarines and Euglena). -03 hours

1.10. Reproduction: Conjugation in Paramoecium caudatum, significance of conjugation. -01 hour

Unit II: Porifera: The Sponges – Nature’s dead end -06 hours

2.1. General characters of the phylum up to classes with examples. -01 hour

2.2. Sycon: Morphology, microscopic structure of body wall and sexual reproduction. -03 hours

2.3. Canal System and its evolution: Asconoid, Syconoid, Leuconoid and Rhagonoid types. -02 hours

Coelenterata -08 hours

2.4. General characters of the phylum up to classes with examples. -01 hour

2.5. Hydra: Externals, feeding and digestion, nerve net and reproduction -03 hours

2.6. Polymorphism: Meaning, significance and polymorphism in Halistema. -01 hour
2.7. Coral reefs: Meaning, types, theories on coral reef formation -01 hour

2.8. Ctenophores: General organisation and affinities. -02 hours

Unit III: Metazoa -14 hours

3.1 Geological Time Scale (eras, periods and epochs with major fauna of each period) and an account of phylogenetic tree. -02 hours

3.2. Origin of Mesozoa: Blastea and Gastrea theories and Hadzi’s theory. -02 hours

Helminthes -05 hours

3.3. General characters of the Phylum Platyhelminthes up to classes with examples. -01 hour

3.4. Planaria: Externals, digestive system, excretory system and nervous system. Regeneration, Axial gradient theory. - 03 hours

3.5. General characters of the Phylum Nematoda with examples. -01 hour

Annelida -05 hours

3.6. General characters of the phylum up to classes with examples. -01 hour

3.7. Type Study: Earth worm (Pheretima) - Morphology, digestive system and nutrition, excretory system, reproductive system, reproduction and development. - 04 hours

3.8 Trochophore larve and its significance

Unit IV: Economic Zoology & Parasitology -14 hours

Economic Zoology -04 hours

4.1. Protozoa in water supplies and soil. -01 hour

4.2 Beneficial and harmful sponges -01 hour

4.3. Economic importance of corals and coral reefs. -01 hour

4.4. Economic importance of leech, vermiculture and vermicomposting. -01 hour

Parasitology – -10 hours

4.5. Introduction: Definition of parasitism and types. -01 hour

4.6. Occurrence, disease caused, mode of transmission, life cycle and preventive measures of the following parasites:

Entamoeba histolytica, Plasmodium vivax (mentioning of other species of plasmodium is necessary), Taenia solium, Fasciola hepatica, Ascaris lumbricoides and Wuchereria bancrofti. -08 hours

4.7. Parasitic adaptations- Parasitic flat worms and leech. - 01 hours
REFERENCES:
7. Sedgewic Volumes
8. Parker and Haswel Vol. I
9. Kotpal Volumes Protozoa through Echinodermata
10. A manual of Zoology by Ekambarnath and Vishwanathan
11. Economic Zoology by Shukla and Upadayana
12. Economic Zoology by Reena and Mattur
13. Invertebrate Zoology by S.N. Prasad.
I SEMESTER B.Sc., ZOOLOGY PRACTICAL

NON-CHORDATA: PART I
-15 Units

1. **Use of microscopes** – Simple, Compound, Oil immersion and Stereozoom -01 unit

2. Preparation and observation of plankton culture (also Protozoans). -01 unit

3. **Protozoa**: Study of permanent slides of *Amoeba, Euglena, Noctiluca, Paramaecium, Vorticella* and *Radiolarian - Foraminiferon ooze (Elphidium)* -01 unit

4. **Porifera**: *Sycon, Euplectella, Hyalonema, Spongilla* and *Euspongia*. Permanent slides of T.S. of Sycon, spicules and gemmule. -01 unit

5. **Coelenterata**: *Hydra, T.S. of Hydra, Obelia colony, Obelia medusa, Physalia, Aurelia*, *Ephyra larva, Metridium* and T.S. of Metridium -01 unit

6. **Coelenterata and Ctenophora**: Corals – *Fungia, Corallium, Meandrina, Gorgonia and Pennatula, Ctenophora – Pleurobrachia W.M.* -01 unit

7. **Helminthes**: Planaria and its T.S, Liver fluke and Tape worm. *Ascaris* – Male, female as well as T.S of both. -01 unit


10. **Parasitology**: Permanent slides of *Entamoeba, Plasmodium, Liver fluke, Tapeworm* and *Ascaris* -01 unit

11. Dissection Visuals:

11.1 Earthworm dissection – Nervous system, Reproductive system. -02 units.

11.2 Leech dissection – Digestive system, excretory system -02 units
SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. I SEMESTER ZOOLOGY
NON-CHORDATA – PRACTICAL – 01

Duration: 3 hrs.
Max.Marks : 35 01

Taxonomy: Identify, classify and comment on A to E with labeled diagrams
15 marks

02 Project Report:
Economic Zoology*
07 marks

03 Dissection (Question set on dissection)**
08 marks

Or
Mount and stain the plankton culture given, identify and comment on any one specimen

04 Class Records
05 marks

Total 35 marks

*Economic Zoology:
1) Protozoa in water supply and soil
2) Economic importance of Sponges
3) Economic importance of Corals and Coral reefs
4) Parasitic adaptations and economic importance of Leech
5) Vermiculture and vermicomposting
6) Parasitology: Entomoebahistolitica, Plasmodium vivax, Taeniasollum, Fasciola hepatica, Ascaris lumbricoldes and Wucheneria bancrofti

**Dissection:
Draw a neat labeled diagram of the system given and describe.

Note: Earthworm : Nervous system
Leech : Digestive system
II SEMESTER ZOOLOGY
COURSE – II: NON CHORDATA: PART – II

- 52 hours

Unit I: ARTHROPODA - 14 hours

1.1. General characters of the phylum and classification up to classes with suitable examples, outline classification of the class Insecta with emphasis on orders and examples (1) Diptera (2) Coleoptera (3) Hymenoptera (4) Lepidoptera and (5) Hemiptera - 02 hrs

1.2. Peripatus - Unique features, affinities with Annelida and Arthropoda, systematic position. - 02 hrs

1.3. Type study - Prawn (Penaeus) - Morphology, appendages - structure of a typical appendage, concept of serial homology, structure and function of appendages, circulatory system, reproductive system and life cycle. - 08 hrs

1.4. Metamorphosis – Definition and types with suitable examples. Neuro-endocrine control of metamorphosis - 02 hr

1.5. A brief account of arthropods as a successful animal group

Unit II: - 14 hours

ARTHROPODA - 10 hours

2.1 Body wall – Structure and significance. - 01 hr

2.2 Respiratory organs – Gills, book gills, trachea and book lungs. - 02 hrs

2.3 Sense organs – Simple eye, compound eye, gustatory and tactile organs. - 02 hrs

MOLLUSCA - 09 hours

2.4. General characters of the phylum and classification up to classes with suitable examples (variation in foot) - 02 hrs

2.5. Type study - Unio: Externals, structure of shell (sectional view), digestive, circulatory, respiratory and reproductive systems, and life cycle. - 07 hrs

Unit III: - 14 hours

ECHINODERMATA - 10 hours

3.1. General characters of the phylum and classification up to classes with suitable examples - 02 hrs

3.2. Type study: Sea Star (Asterias) - Externals, digestive and water vascular systems, reproduction and life history. - 06 hrs

3.3. Echinoderm larvae: Structure and significance of the following larvae – Bipinnaria, Ophiopluteus, Echinopluteus and Auricularia. - 02 hrs

MINOR PHYLAE - 01 hour

3. 4 Rotifera: Salient features and biological significance.

HEMICHOARDATA - link between Non-Chordates and Chordates - 03 hours

3.5. Type study – Balanoglossus – Morphology, coelom, Tornaria larva. - 02 hrs

3.6. Affinities and systematic position of Hemichordata. - 01 hr.
IV ECONOMIC ZOOLOGY – 14 hours

**Arthropoda:** - 10 hrs

4.1. **Sericulture:** silk worm species, silk worm rearing and management practices, pests of silkworm, byproducts of silk industry. -4 hrs

4.2. **Apiculture:** honeybee species, bee keeping and management practices, bee products, pests of honey bees. -3 hrs.

4.3. **Prawn Fisheries:** prawn species, prawn rearing- inland (fresh water and brackish), salt water, products. -3 hrs.

4.5. **Insects and Human welfare** - General account of beneficial and harmful insects, control of insects – chemical and biological. - 01 hrs

4.6. **Parasitic Arthropods** -of crabs, mussels and fishes – Effects and control. - 01 hr

4.7. **Mollusca** - Beneficial and harmful molluscs. pearl culture, Mytilus culture, Oyster culture, chank and lime industries. -02 hrs.

**References**

7. Sedgewic Volumes
8. Parker and Haswel Vol. I
9. Kotpal Volumes Protozoa through Echinodermata
10. A manual of Zoology by Ekambarnath and Vishwanathan
11. Economic Zoology by Shukla and Upadayana
12. Economic Zoology by Reena and Mattur
13. Invertebrate Zoology by S.N. Prasad.
II SEMESTER B.Sc., ZOOLOGY PRACTICAL

NON-CHORDATA: PART II
-15 Units

1. **Arthropoda:** *Penaeus, Palaemon*, Lobster and Crayfish.
   Crustacean larvae – Nauplius, Zoea, Mysis -01 unit

2. **Arthropoda:** Scorpion, Spider, Limulus, Peripatus, Millipede and Centipede. -01 unit

3. **Arthropoda:** Apiculture - Honey bee – queen, drone and worker, trophi, legs -01 unit.

4. Mounting of prawn appendages- 01 unit

5. Mouth parts of Housefly, Butterfly and Mosquito

6. **Sericulture:** Life history of *Bombyx mori* -01 unit

7. **Dissection visuals /Demonstration of Cockroach:** -02 units
   a. Mounting of trophi
   b. Nervous system
   c. Mounting salivary apparatus

8. **Mollusca:** Mytilus, Chiton, Aplysia, Octopus, Sepia, and Glochidium larva. -01 unit

9. **Mollusca:** Shell pattern – Unio, Pila, Chiton, Cypraea, Murex, Nautilus, Patella, Dentalium and cuttle bone - 01 unit

10. **Dissection visuals of Unio:** - 02 units
    a. Digestive system
    b. Nervous system

11. **Echinodermata:** Sea star, Brittle star, Sea urchin, Cake urchin, Sea cucumber, Sea lily.
    Bipinnaria larva and Echinopluteus larva, and Pedicillaria -02 units

12. **Hemichordata:** Balanoglossus – specimen, T.S through proboscis, Tornaria larva -01 unit
SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. II SEMESTER ZOOLOGY

NON-CHORDATA – PRACTICAL – 02
Duration: 3 hrs. Max.Marks: 35 01

Taxonomy: Identify, classify and comment on A to E with labeled diagrams 15 marks

Project Report: Economic Zoology* 07 marks

Dissection : Honey bee – Mounting of pollen basket or sting apparatus Or Dissection : (Question set on dissection)** 08 marks

Class Records 05 marks

Total 35 marks

*Economic Zoology:
1) Sericulture, Apiculture, Prawn fisheries
2) Economic importance of Insects, Control of Harmful insects, Parasitic Arthropods
3) Economic importance of Mollusca, Pearl culture, Mytilus culture, Oyster culture, Chank and Lime industry

**Dissection:
III SEMESTER ZOOLOGY

COURSE – III: CHORDATA - 52 hours

Unit I: - 14 hours

PROTOCHORDATA - 07 hours
1.1. Basic Chordate characters and outline classification upto classes - 01 hr
1.2. Cephalochordata : Amphioxus – Morphology, feeding and circulatory system. - 02 hrs.
1.3. Urochordata : Ascidian – Morphology, Ascidian tadpole and retrogressive metamorphosis. - 02 hrs

AGNATHA – THE JAWLESS VERTEBRATES - 03 hours
1.4 General characters of Agnatha -01 hr
1.5. Salient features of Cyclostomata and Ostracodermi with examples. -01 hr
1.6. Ammocoete larva and its significance. -01 hr

PISCES
1.7. Salient features and classification upto subclasses - Chondrichthyes and Osteichthyes
-01 hr
1.8. Dipnoi : Interesting features and their evolutionary significance. -01 hr
1.9. Placodermi : Salient features with examples. - 01 hr
1.10 Origin of Amphibia : transition from water to land. - 01 hr

Unit II -14hrs

PISCES –
2.1. Type Study : Scoliodon – Morphology, digestive system, circulatory system, nervous system, neuromast organs (Lateral line sensory system and Ampullae of Lorenzini) and urinogenital system. - 07 hrs

AMPHIBIA –
2.2. General characters and classification of living Amphibians upto orders, with suitable examples - 02 hrs
2.3 Type study of frog: Section of skin, structure of heart and brain - 02 hrs
2.4 Metamorphosis- Neuro-endocrine control of metamorphosis in frog, Neoteny and Pedogenesis with example. - 02 hrs

REPTILIA –
2.3. General characters and outline classification of modern reptiles with suitable examples -02 hrs
2.4. Adaptive radiation in extinct and extant reptiles with suitable examples -01 hr
2.5. Temporal fossae in reptiles. -02 hrs

Unit III -14 hrs

3.1. Interesting features of Sphenodon. -01 hr

AVES –03 hrs
3.2. General characters, differences between Ratitae and Carinatae. -01 hr
3.3. Interesting features of Archaeopteryx. -01 hr
3.4. Flight adaptations in birds. -01 hr

MAMMALIA – - 10 hrs
3.5. General characters and classification upto subclasses (prototheria, metatheria and eutheria) with suitable examples. - 01 hr
3.6. Interesting features of mammalian orders (Insectivora, Carnivora, Chiroptera, Cetacea, Proboscidea, Ungulata – Perissodactyla and Artiodactyla, and Primates – Platyrhini and Catarhini) with examples. - 08 hrs
3.7. Dentition in Mammals, evolution of molar tooth. - 01 hrs

**Unit IV: -12 hrs**

**ECONOMIC ZOOLOGY –**

4.1. **Pisciculture**: -05 hrs.
   b. A brief account of fishing gears and crafts.
   c. Fish processing and preservation.
   d. Economic importance.

4.2. **Poultry**: -03 hrs.

4.3. **Dairy**: -04hrs.
   b. Improvements in cattle breeding – artificial insemination, MOET.
   c. Milk and its bi-products, pasteurization and gobar gas.
   d. Diseases in cattle- Causes and effects of Mastitis, Anthrax, Septicemia, Foot and mouth disease.

**REFERENCES:**

1. Sedgewic Volumes
2. Parker and Haswel Vol. II
3. Kotpal Volume- Vertebrates
4. A manual of Zoology by Ekambarnath and Vishwanathan
5. Economic Zoology by Shukla and Upadayana
6. Economic Zoology by Reena and Mattur
7. Protochordata by Bhatia
8. Asciidiant by Kurian and Sebastian
9. Comparative Anatomy by Romer
10. Comparative Anatomy by Eten and Kent
11. Vertebrate by Young
III SEMESTER B.Sc., ZOOLOGY PRACTICAL

CHORDATA
PART-III
- 15 Units

1. **Protochordata**: Ascidian and Amphioxus, T.S. of Amphioxus through pharynx and intestine.

2. **Cyclostoma**: Petromyzon, Ammocoete larva and Myxine. - 01 unit

3. **Pisces**: a. Cartilaginous Fishes – Narcine, Trygon, Pristis, Myolobatis (any two) - 02 units
   b. Bony Fishes – Hippocampus, Muraena, Ostracion, /Tetradon, / Pleuronectus, / Diodon and Echeneis
   c. Accessory respiratory organs – Saccobranchus, Clarias and Anabas.

4. **Amphibia**: a. Frog, Bufo, Ambystoma, Axolotl larva, Necturus and Ichthyophis. - 02 Units
   b. **Endoskeleton of frog**: Skull, lower jaw, vertebrae, pectoral and pelvic girdles.

5. **Reptilia**: Turtle, Tortoise, Varanus, poisonous snakes – Cobra, Krait, Russell’s viper and Hydrophis. - 01 unit

6. **Aves**: a. Endoskeleton – Skull, heterocoelous vertebra, synsacrum, sternum, pectoral girdle, pelvic girdle. - 01 unit
   b. Beak and feet modifications- Pigeon, parrot, crow, eagle or kite, king fisher, duck (any five).

7. **Mammalia**: a. Mongoose, Squirrel, Pangolin, Hedge Hog, Rabbit, Monkey and Loris (any four)
   b. **Endoskeleton of human** – Skull, mandible, vertebrae – first, second, typical cervical, thoracic, lumbar and sacrum with coccyx, girdles and limb bones (bones of wrist, hand, ankle and foot not required). - 03 units

8. **Dissection visuals**: - 05 units
   a. Shark: Afferent and efferent branchial systems, glossopharyngeal and vagus nerves, mounting of brain.
   b. Rat: Dissection (only demonstration) – Circulatory system (arterial and venous), urinogenital system.
### Scheme of Practical Examination under CBSS Onwards

**B.Sc. III Semester Zoology**

**Chordata – Practical – 03**

| Duration: 3 hrs. | Systematics: Identification classification & Comment on a) Specimens – A, B, & C | 09 marks |
| Max.Marks: 35 | b) Endoskeleton – D (Frog/bird) E (Human) | 06 marks |
| Max. Marks: 35 01 | Project Report: On Economic Zoology* | 07 marks |
| | Dissection: With a neat labeled diagram describe the given system* Note: Dissected Rat (or) Shark (or) Model may be used to set the Question 3. *a) Shark: - Afferent and efferent branchial systems b) Rat: i) Circulatory (arterial & venous) ii) Urinogenital system | 08 marks |
| 04 | Class Records | 05 marks |
| Total | 35 |
IV SEMESTER
COURSE – IV – COMPARATIVE ANATOMY, CELL BIOLOGY, IMMUNOLOGY AND HISTOLOGY

-52 hours

Unit I: -14 hrs
COMPARATIVE ANATOMY
1.1 Integument and its derivatives in fishes (cartilaginous and bony), amphibians, reptiles, birds and mammals/human. - 04 hrs
1.2 Circulatory system: - 06 hrs
   a. Evolutionary trends of vertebrate hearts.
   b. Trends in the evolution of aortic arches in vertebrates
1.3 Evolutionary trends in the structure of vertebrate brains: shark, frog, lizard, bird and rabbit/human
   -04 hrs

Unit II: -14 hrs
2.1. Respiratory organs in fishes- swim bladders and origin of lungs, respiratory organs of amphibians, reptiles, birds and mammals/human - 03 hrs
2.2. Evolution of excretory structures in animals: contractile vacuoles in fresh water Protozoans, protonephridia in Helminthes, metanephridia in Annelids, antennary glands/ green glands in Crustaceans, malpighian tubules in insects and pronephros, mesonephros and metanephros in different classes of vertebrates. - 04 hrs
2..3 Immunology: First, Second and Third line of body defences, Role of T and B lymphocytes Passive and active immunity Structure and types of antibodies, Monoclonal antibodies. -07hrs

Unit III: -14 hrs
CELL BIOLOGY
3.1. Ultra structure of an animal cell: - 07 hrs
   a. Plasma membrane: chemical composition, structure - Fluid mosaic model, role of lipids in maintaining fluidity of cell membrane. Cell to cell interactions, surface markers, functions – transport across cell membrane: passive transport (simple and facilitated diffusion; osmosis) and active transport (Na+, H+ and Ca2+ pumps, exocytosis, endocytosis -phagocytosis and pinocytosis); Cell junctions.
   b. Cytoplasm: properties, cell organelles and cell inclusions.
   C. Nucleus
3.2. Giant chromosomes: Polytene and Lamp brush chromosomes. - 02 hrs
3.3. Parthenogenesis: Definition, types with examples - 02 hrs
   a. Natural – Complete and incomplete parthenogenesis, Arhenotoky and Thelytoky (ameiotic and meiotic).
   b. Artificial parthenogenesis.
   c. Significance.
3.4 Cell senescence and Apoptosis - 01 hr
3.5. Biology of cancer: Introduction, general properties of cancer cells, carcinogens, prevention and regulation; chemotherapy, radiotherapy and gene therapy. -02hrs
Unit IV: HISTOLOGY - 14 hrs
4.1. Histological features of the following mammalian organs: Tongue, Stomach, Pancreas, Spleen, Kidney, Ovary, testis, Pituitary, Thyroid and Adrenal glands. - 10 hrs
4.2. Histochemistry: stains and staining – Types: natural and synthetic dyes, mordents and their mode of action. -02 hrs
4.3. Histopathology -Degenerative changes and histopathological manifestations in liver cirrhosis and nephrosis. -03 hrs

REFERENCES:
1. Comparative Anatomy by Romer
2. Comparative Anatomy by Eten and Kent
4. Cell biology by Tomer
5. Cellular and Molecular Biology Rastogi publication
9. Histology by Bailey
10. Histology by Bevelander
11. Histology by Ham
12. Histology by Berry
IV SEMESTER B.Sc., ZOOLOGY PRACTICAL

Comparative Anatomy, Cell Biology and Histology

PART- IV
- 15 Units

Comparative Anatomy

1. Comparative study of derivatives of integument in vertebrates: Scale of a fish – cartilaginous and bony, carapace and plastron of tortoise/turtle, contour feather of bird, horn of sheep/goat/cow, hoof of sheep/ goat/cow. -02 units

2. Comparative study of skin of Vertebrates – fish, frog and rat -01 unit

3. Comparative study of heart of Vertebrates: fish (shark), amphibian (frog), bird (hen) and mammal (rat/ human) - 01 unit

4. Comparative study of brain of Vertebrates: fish (shark), amphibian (frog), bird (hen) and mammal (rat/ human) -01 unit

5. Comparative study of mesonephric kidneys of frog and metanephric kidneys of rat (or human) -01 unit

Cell Biology:

1. Preparation of a whole mount and comments on the technique – any planktonic form, / larvae of parasitic helminthes like liver Fluke, / crustacean larvae, / obelia colony, / fish scale -01 unit

2. Preparation of Squash: Onion root tip for mitosis, grass hopper testis for meiosis. -02 units

3. Micro-technique: Preparation and submission of 2 permanent slides. -02 units

Histology:

Permanent slides of sections of mammalian organs- Tongue, stomach, pancreas, spleen, kidney, adrenal gland, ovary, testis and thyroid gland. -04 units
SCHEME OF PRACTICAL EXAMINATION UNDER CBSS ONWARDS

B.Sc. IV SEMESTER ZOOLOGY

COMPARATIVE ANATOMY, CELL BIOLOGY & HISTOLOGY – PRACTICAL - IV

| Duration: 3 hrs. | Comparative Anatomy: Identify A and B and comment on the Evolutionary trends with labeled diagrams | 08 marks |
| Max.Marks: 35 01 | Cell Biology / Microtechnique: |
| | a) Preparation of whole mount / Squash of the given material (procedure to be written for whole mount preparation. Identification as well as comment on the observed cell stage for Squash preparation). |
| | b) Submission of two permanent slides |
| | (one whole mount, and micro slide) |
| 02 | Histology: Identify, give histological features with neat labeled diagrams for the slides C, D and E. | 12 marks |
| 03 | Class Records | 05 marks |
| Total | | 35 marks |
V SEMESTER
COURSE – V – ENVIRONMENTAL BIOLOGY AND ETHOLOGY

-52 hrs
Unit 1 – -14 hrs
ENVIRONMENTAL BIOLOGY
1.1. Fundamentals of the Ecology: -04 hrs
a. Introduction, Sub-divisions and Scope of Ecology.
b. Concept of habitat: Micro-habitat and macro-habitat.
c. Concept of Ecological Niche: Spatial, Trophic and Multidimensional.
d. Abiotic factors: Light, Temperature and Soil.

1.2. **Concept of Productivity:** - Energy Flow in the Ecosystem: Laws of thermodynamics and Ecosystem. 02 hrs

1.3 **Population Ecology:** Population properties – Density, Natality, Mortality, Age distribution, Growth, Dispersion and Biotic Potential. - 02 hrs

1.4. **Community Ecology:** Intra and interspecific interactions – Negative (Antibiosis, Competition, Parasitism and Predatism) and Positive (Commensalisms, Proto co-operation and Mutualism) 02 hrs

1.5 **Pollution:** Causes, effects and control measures of -air, water, soil, noise, thermal and radiation pollution. 03hrs

1.6. **Toxicology:** -
   b. Mechanism of toxicity
   c. Concept of Biomagnification and Biotransformation -02 hrs

Unit II -13 hrs

2.1. **Current Environmental Issues:** - 03 hrs
d. Environmental risk assessment by EPA.

2.2. **Integrated pest management (IPM):** Definition, mechanical control, chemical control, biological control, genetic control, resistant plant varieties, environmental manipulations. -01 hr

2.3. **Environmental Biotechnology:** Concept, Sewage/ Waste water treatment, Microbial degradation of xenobiotics, Mineral recovery and Pollution control by genetic engineering, biological treatment of air pollutants. -02 hrs

2.4. **Energy Resources:**
a. Types: renewable and non-renewable.
c. Nuclear energy and Nuclear reactions: Introduction, The risk of nuclear accidents, Advantages and disadvantages of Nuclear power plants. -02 hrs

2.5 **Solid waste management**: Disposal and recovery (Collection centres, Land filling, Incinerations, Recycling of Wastes and construction of Sanitary Latrines). - 01 hr

2.6 **Wild life conservation and its management**: 
a. Red data book, Endangered species, 
b. In situ conservation: Wild life sanctuaries, National parks and Biosphere reserves. 
c. Ex situ conservation: Zoological gardens, Botanical gardens, Seed banks, Pollen storage, Tissue culture. -02 hr

2.7 **Remote sensing**: 
a. Principle, Types – passive and active, Satellite remote sensing, Microwave remote sensing, Applications of remote sensing. 
b. Geographic information system (GIS): Definition, Components and applications. - 01 hr

**Unit III – ETHOLOGY (Animal Behaviour) 13 hrs**

3.1 Introduction to animal behaviour, Historical perception, aims and objectives. - 01 hr

3.2 Stereotyped and Acquired behaviour: -02 hrs 
a. Stereotyped behaviour: Kinesis, Taxes, Reflexes, Instincts and Motivations with suitable examples. 

3.3 Pheromones and Behaviour (Chemical communication): Types, Pheromones in Insects, Vertebrates and Human. - 01 hr

3.4 Social behaviour: - 02hrs 
a. Social behaviour in Insects – Honey Bees, Termites and Ants. 
b. Social dominance. 
c. Territorality 
d. Social systems in Primates.

3.5. Migratory behaviour: Fish migration and Bird migration. -02 hrs

3.6. Biological rhythms: Circadian rhythms, Diagnostic features of Biological clock. - 01 hr.

3.7. Communication in Animals: Types of communication, Dances of Honey Bees, Alarm calls, Eco-location or Sonar in Bat, Releaser, Aggression and Bioluminescence. -02 hrs.

3.8. Courtship Behaviour: Mechanism and causes, Examples of mating in Animals (Birds and mammals) -01hr

3.9. Parental care: In Fishes, Amphibians ,Birds and Mammals.(any two examples for each) -01 hr

3.10. Colouration and Mimicry (Defensive Behaviour): -01 hr

a. Colouration and types of pigments in Animals. 
b. Predatory and Parasitic mimicry.
V SEMESTER B.Sc., ZOOLOGY PRACTICAL - 05
Environmental Biology and Ethology

-14 Units

I. Limnological studies: - 05 units
1. Examination of water samples from near by ponds and tanks for the identification of phytoplankton and zooplankton.
2. Estimation of DO by BOD.
3. Estimation of Salinity
4. Estimation of dissolved organic matter
5. Estimation of pH using pH meter/ pH paper/ Titrimetry
6. Estimation of Total hardness

II. Ecological Adaptations: - 03 units
1. Tubiculous worms: Arenicola and Chaetopterus.
2. Fossorial (Burrowing) forms: Dentalium,
3. Sedentary form: Sea anemone, Lepas and Balanus
b. Active fliers: Birds and Bat
5. Animal associations:
a. Polymorphic forms: Physalia
b. Facultative mutualism: Hermit crab and Sea anemone
7. Desert forms: Phrynosoma
8. Deep sea forms: Flat fish
9. Arboreal form – Hyla

III. Ethology: - 02 units
1. Demonstration: T- maze experiment on Earth worm: Conditioned learning behaviour

IV. Project report submission on - 04 units
a. Toxicology- Analysis of water (polluted), Solid waste management, Air pollution (Tie up with Pollution control Board, BWSSB, PG dept of Environmental Science, DST and NGOs may be useful)
b. Rain water harvesting (General talk)
c. Social organisation in Termites, Ants and Primates
d. Migration in Fishes and Birds.
e. Visit to Wild Life Sanctuary, National Park, Bio-reserve, Sacred Groove.
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<td><strong>Duration:</strong> 3 hrs.</td>
<td><strong>Limnology:</strong> Identification and comments on the Plankton in the given water sample or Any experiment from serial number 2 to serial number 6</td>
<td>08 marks</td>
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<td>Max.Marks : 35 01</td>
<td><strong>Ecological adaptations:</strong> Identification and commenting on the Ecological adaptations with labeled figures of A, B, C, D and E</td>
<td>15 marks</td>
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<td>02</td>
<td><strong>Project Report submission</strong></td>
<td>07 marks</td>
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<td><strong>Class Records</strong></td>
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VI SEMESTER
COURSE – VI – DEVELOPMENTAL BIOLOGY AND ORGANIC EVOLUTION – 52 hours

Unit I: -13 hrs Developmental Biology

1.1. Introduction: Definition and scope, Historical review – Preformation theory, Epigenetic theory, Baer’s Law and Biogenetic law. - 01 hr

1.2. Gametogenesis: Introduction, Spermatogenesis- formation of spermatids, spermiogenesis, sertoli cells and their role in spermatogenesis. Structure of a typical mammalian sperm, Oogenesis, Types of eggs – based on amount of yolk and distribution of yolk with examples. Mosaic and regulative eggs, Types of egg membranes with examples. Significance of egg membranes. Cleidoic egg (e.g., Hen’s egg) and its significance. - 04 hrs

1.3. Reproductive cycles: Estrous and Menstrual cycles and their regulation. Male and female infertility, Assisted conception and Contraception- 03 hrs

1.4. Patterns of development: Oviparity, ovoviviparity and viviparity with examples. -01 hr

1.5. Fertilization: Introduction, Types, Mechanism of fertilization, monospermic and polyspermic fertilization (pathological and physiological polyspermy) with examples, mechanism to block polyspermy in monospermic forms (fast block and slow block). Significance of fertilization. - 02hrs

1.6. Cleavage: Characteristics of cleavage, planes of cleavage – meridional, vertical, equatorial and latitudinal plane. Pattern of cleavage – radial type, biradial, spiral, bilateral, determinate and indeterminate cleavage with examples. Influence of yolk in cleavage. - 01 hr

1.7. Blastulation: Comparative account with reference to Amphioxus, Frog and Chick. -02 hrs

Unit II -14 hrs 2.1. Fate maps and cell lineage: Methods of preparation of fate maps, Cell lineage in Nereis, Presumptive organ forming areas and fate maps in Frog and Chick - 02 hrs

2.2. Gastrulation: a) Introduction, Gastrulation in Amphioxus, Frog and Chick. - 02 Hrs

b) Neurulation, post-neurular development and metamorphosis in Frog. -01 hr

2.3. Role of organizers in development: Transplantation experiments of Spemann and Mangold, Chemistry of Organiser. Homeotic genes-01 hr.

2.4. Foetal membranes in Chick - formation, structure and function. -01 hr.

2.5. Placenta: Types - Yolk sac and Chorio-allantoic placenta; Deciduate and non-deciduate placenta; morphological and histological placenta types with suitable examples. -01 hr

2.7. Environmental regulation of Animal development: Developmental symbiosis, larval settlement, sex manifestation, diapause and polyphenism (phenotypic plasticity) - 01 hr

2.8. Developmental constraints in Evolution:
Physical, Morphogenetic and Phyletic. - 01 hr

Unit III: Evolutionary Biology - 13 hrs

Chemical Evolution of Life: Contribution of Oparin, Haldane and Sydney Fox to be highlighted, Stanley Miller’s experiment. - 01 hr

3.1. Chemical Evolution of Life: Contribution of Oparin, Haldane and Sydney Fox to be highlighted, Stanley Miller’s experiment. - 01 hr

3.2. Neo-Darwinism: Critical analysis of Darwinism, Concept of Gene pool and Gene frequency, Hardy-Weinberg law – Definition and significance. - 02 hrs

3.3. Role of Evolutionary forces in speciation:

a. Sexual reproduction

b. Mutation

c. Genetic drift


e. Isolation: Isolating mechanisms –

i. Introduction, Geographical and Reproductive isolation.


3.5. Evolution of Man: Introduction, Salient features of important fossil stages of Human – Ramapithecus, Australopithecus, Homo erectus, Rhodesian man, Neanderthal man and Cromagnon man. – 02 hrs
VI SEMESTER B.Sc., ZOOLOGY PRACTICAL - 06 Developmental Biology and Organic Evolution - 14 Units

I Developmental Biology: -08 units

1. Early development of Frog: Cleavage, Blastula, Gastrula with yolk plug stage and Neurula.
2. Late development of Frog: Metamorphosis (Tadpole to young Frog)
3. Development of Chick: 18 hrs, 24 hrs, 36 hrs, 48 hrs and 72 hrs stages
4. Study of different stages of Chick development through ‘Window pane’ technique (Demonstration only)
5. Mammals: T.S. of uterus and fallopian tube

II. Organic evolution: - 06 units

1. Study of Homologous organs:
   a. Fore limb and Hind limb bones of terrestrial Vertebrates (Frog, Lizard, Bird, Rat or Rabbit or Human).
   b. Mouth parts of Cockroach, House fly, Butterfly and Mosquito.
2. Study of Serial homology: Appendages of Prawn.
3. Study of Analogous organs:
   a. Vertebrate eye and Cephalopod Eye
   b. Wing of Insect and Bird
5. Study of Connecting links: Peripatus and Tornaria larva.
Scheme of Practical Examination under CBSS 2014-15 onwards B.Sc VI
Semester Zoology Comparative Anatomy, Cell, Biology & Histology – Practical – VI

Duration: 3 hrs.                                      Max.Marks : 35

01 Developmental Biology: 04x04 16 marks
Identify and comment on
A, B, C and D with
supportive labeled
diagram. (Note: D –
Metamorphosis or Late
development of Frog.)

02 Organic Evolution: 06 marks
Identify and comment on
the Evolutionary trends
of E and F with labeled
diagrams.

03 Organic Evolution: 08 marks
Identify and comment on
‘G’ & ‘H’ (Note: Any one
from 3, 4, 5)

04 Class Records 05 marks

Total 35 marks
VII SEMESTER
COURSE VII – GENETICS AND BIOTECHNOLOGY

- 40 hours

Unit I: 13 hrs.

GENETICS

1.1. Heredity and Environment: Concept of genotype, phenotype, phenocopy, Norm of reactions (Experiments on Potentilla glandulosa, Fur colour in Himalayan Rabbit, studies of Human twins). - 02 hrs

1.2. Introduction to Mendelism - Mendelian principles - 02 hrs.

1.3. Deviation from Mendelism: - 05 hrs
a. Multiple allelism (Ex: Inheritance of ABO and MN blood groups), Rh factor and its inheritance (Gene complex and Multiple allele theories), Erythroblastosis foetalis and Applications of Blood groups.
b. Interaction of genes: Concept and Example - Inheritance of comb shape in poultry.
c. Multiple factor inheritance: Concept and Example - Inheritance of skin colour in man.
d. Sex linkage: Concept and types. X – linked inheritance: Eye colour in Drosophila, Colour blindness and Haemophilia (inheritance and construction of pedigree charts); and Y – linked inheritance : Hypertrichosis in man.

1.4. Chromosomal basis of sex determination: Types with examples. Genic balance theory, Gynandromorphs and Free Martins. - 02 hrs

1.5. Concept of gene: Classical concept, Fine structure of gene: Cistron, Recon and Muton, Operon concept: Inducible Operon (E.g. Lac Operon) and Repressible Operon (Tryptophan Operon). - 02 hrs

Unit-II 13 hrs.

2.1. Cytoplasmic inheritance: Kappa particles in Paramecium, Coiling of shells in Snail. - 01 hr

2.2. Chromosomal aberrations: Types – Structural (Duplication, Deletion, Inversion and Translocation) and Numerical (Aneuploidy) – Cri du Chat syndrome, Down’s syndrome, Edwards’s syndrome, Turner’s syndrome and Klinefelter’s syndrome. - 03 hrs

2.3. Gene mutations: Spontaneous and induced mutations, ClIB method of detection of mutations, Physical, Chemical and Biological mutagens, Molecular basis of mutation. - 05 hrs

2.4. Eugenics: Definition, Positive and negative aspects, Genetic counselling, Euthenics and Euphenics. - 02 hrs

Unit III: BIOTECHNOLOGY - 14 hrs

3.1. Genetic Engineering / Recombinant DNA (rDNA)Technology: - 03 hrs
a. Introduction.
b. Components of rDNA technology:
   i. Molecular tools: Restriction enzymes, DNA ligases, Alkaline phosphatase.
   ii. Host cells: Prokaryotic hosts and Eukaryotic hosts.
   iv. Bioreactors.
c. Methods of gene transfer in animals: Transfection – microinjection, electroporation, of DNA, lipofection and direct transfer of DNA.

3.2. Applications of Biotechnology:

a. Transgenesis: - 02 hrs
   i. Introduction – Meaning and significance.
   ii. Transgenesis in mice, Gene targeting in mice, Knock out and Knock in technology.

b. Animal improvement: - 02 hrs
   i. Super ovulation and Embryo transfer: Steps, Difference between surgical and non-surgical transfers, Benefits and limitations of embryo transfer.
   ii. Artificial insemination
   iii. Sperm sexing.

c. Gene therapy: - 02 hrs
   i. Introduction.
   iii. In vivo and ex-vivo gene therapy.

d. Stem cells: Introduction, features, types, sources and applications -01 hr

e. Bioinformatics: Meaning, Scope and applications. -01 hr.

f. Hybridoma technology: Monoclonal antibodies and their applications. -01 hr.

g. DNA fingerprinting or Profiling: RFLP, VNTR, Microsatellites (Simple tandem repeats and Single nucleotide polymorphisms (SNPs) techniques. Application of DNA fingerprinting. - 02 hrs
VII SEMESTER B.Sc., ZOOLOGY PRACTICAL - 07

Genetics and Biotechnology

1. Drosophila Genetics:
   b. Mounting of Polytene chromosomes (Salivary gland chromosomes)
   c. Mounting of Sex comb and Genital plate.

2. Human Genetics:
   d. Blood typing
   e. Preparation of Buccal smear for sex chromatin
   f. Preparation of Blood smear for identification of Cell types and to comment on the types of leucocytes.
   g. Differential counting of blood cells using haemocytometer.
   h. Micrometry of cell types.

3. Biotechnology:
   i. Staining and identification of Bacteria (Gram staining)
   j. Biochemical analysis to determine the interaction of bacteria with different substrates.
   k. Isolation of plasmid DNA

4. Isolation of DNA from animal tissue (Sheep, Goat, Cow or Hen)

5. Qualitative detection of acetic acid in Yeast culture (Student is required to prepare the culture)

6. Study of polyploidy in Onion root tip using Colchicine

7. Translocation in Rheo.
SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. VII SEMESTER ZOOLOGY

GENETICS AND BIOTECHNOLOGY – PRACTICAL - VII

Duration: 3 hrs.
Max.Marks : 35 01

Drosophila Genetics: 07 marks
a) Mounting : 05 marks
  Polytene
  Chromosome
  (Salivary Gland
  Chromosome) or Sex
  comb or Genetial
  Plate

Or

Two Genetic
problems
b) Identify and
comment with a neat
labeled diagram.
Drosophila male,
female and mutants
(any two)

Human Genetics : 06 marks
from d to f

Biotechnology: 06 marks
a) From i, j and k
(any one)

b) From 4, 5, 6 and 7
(any one)

Class Records 05 marks

Total 35 marls
VIII SEMESTER

COURSE – VIII – ANIMAL PHYSIOLOGY AND TECHNIQUES IN BIOLOGY

-40 hrs.

Unit I – 13 hrs.

ANIMAL PHYSIOLOGY

Vegetative functions:

1.1. Digestion: - 02 hr
i. Neural-Hormonal control of digestive glandular secretion.
ii. Symbiotic digestion in Ruminants.

1.2. Circulation: -02 hrs
i. Respiratory pigments: Major types and their features.
ii. Transport of respiratory gases.
iii. Theories of blood clotting: Best and Taylor’s theory, Fuld and Spiro’s theory, and Howell’s theory. Mechanism of blood clotting.

1.3. Respiration: -02 hrs
i. Regulation of respiration.
ii. Oxygen dissociation curves: Definition and factors affecting the Oxygen dissociation curve (Oxygen, Carbon Dioxide, Temperature and pH; Body size and Organic phosphate compounds – Bohr effect, Haldane effect and Root Effect to be highlighted).

1.4. Excretion: - 02 hrs
i. Introduction.
ii. Ammonotelism, Ureotelism and Uricotelism with examples.
iii. Formation of Ammonia (Deamination of amino acids), Urea (Ornithine cycle) and Uric acid (Purine degradation)

1.5. Energy metabolism: - 02 hrs
i. Metabolism and Metabolic rate.
ii. Basal metabolic rate (BMR)
iii. Measurement of metabolic rate: Methods – Calorimetry, Oxygen consumption method, amount of Carbon dioxide liberated, calculation of energy difference in food consumed and excreta.
iv. Factors affecting metabolic rate- Body size, Sex, Age, Disease, Food and Hormones.

1.6. Muscle Physiology: - 03 hrs
i. Ultrastructure of skeletal muscle.
ii. Chemical composition of muscle.
iii. Physico-chemical aspects of muscle contraction.
iv. Sliding filament theory of muscle contraction.

Unit-II -14 hrs.

2.1. Physiology of Nerve: - 02 hrs.
i. Propagation and conduction of nerve impulse – Axonal and Synaptic.

2.2. Physiology of Sense organs: - 02 hrs
i. Vision
ii. Hearing
iii. Equilibrium
iv. Olfaction

2.3. Homeostatic functions:
a. Concept of Homeostasis and role of feed back mechanism- Positive – Oxytocin secretion and Negative – Thyroid, Parathyroid and Adrenal secretion (details of regulation required) - 02 hrs
b. Endocrinology: -03 hrs
   i. Introduction, Chemical nature of hormones.
   ii. Endocrine glands: secretions and their actions, effect of hyposecretion and hypersecretion- Pituitary, Thyroid , Adrenal and Pancreas.
   c. Osmoregulation: Introduction, Types of osmoregulatory mechanisms with examples, and osmoregulation in Migratory fishes. - 02 hrs.
   d. Thermoregulation in Homeotherms: Methods of heat loss and heat gain, Role of Hypothalamus in thermoregulation. - 01 hr.
2.4. Common disorders in Humans: Jaundice, Hyperacidity, Peptic Ulcer, Hypertension, Anaemia, Diabetes mellitus and Angina pectoris, Myocardinal Infarction, Bypass surgery -02 hrs.

Unit III – TECHNIQUES IN BIOLOGY - 13 hrs
3.2. Immuno assay: Principle and applications.
3.3. Separation techniques: Principle and applications of Centrifugation, Chromatography, Fractionation and Electrophoresis (Details of types and techniques to be avoided).
3.4. Autoradiography: Principle and applications.
3.8. Statistical tools and their applications – Mean, Median and Mode, Standard Deviation (SD), Regression, Correlation co-efficient and Probability.
Physiology and Techniques in Biology

I. Physiology Experiments:
1. Qualitative analysis of Carbohydrates, Proteins and Lipids in Hen’s egg.
2. Qualitative analysis of Nitrogenous wastes – Ammonia, Urea and Uric acid.
3. Effect of temperature on heart rate of Unio.
4. Quantitative estimation of Oxygen consumption by fresh water Crab.
5. Quantitative estimation of salt gain and salt loss by fresh water Crab.
6. Detection of glucose, albumin and ketone bodies in urine.
7. Osmotic relations in animals (E.g., Earthworm).
8. Qualitative analysis of digestive enzymes in the alimentary canal of Cockroach.

II. Techniques in Biology:
1. Paper Chromatography for separation of amino acids and proteins.
2. Demonstration of Rocket Electrophoresis technique for detection of specific antigens.
3. Scientific drawing : To draw microscope specimens using a prism type camera lucida.

III. Project report on: Dialysis, Diabetes mellitus, Obesity, Cardio vascular diseases and Anaemia.
SCHEME OF PRACTICAL EXAMINATION
PHYSIOLOGY AND TECHNIQUES IN BIOLOGY – PRACTICAL - VIII

Duration: 3 hrs.
Max.Marks : 35

01

a) Physiology Experiment(with crab) 09 marks
b) Analysis of organic constituents 07 marks

02 Biological Techniques* 07 marks

03 Project Report submission 07 marks

04 Class Records 05 marks

Total 35 marks

Note:

i) Differential counting of blood cells using haemocytometer
ii) Micrometry of cell types
iii) Paper chromatography for separation of amino acids and proteins
iv) Scientific drawing :- using Camera Lucida
I Semester Integrated B. Sc. B.Ed Examination, January 2019
(CBCS) (2014-2015 and onwards)

Zoology- Paper 1

Time: 3 h

Max Marks: 70

Scheme of end semester examination for I, II, III, IV, V and VI Semesters

B.Sc. Zoology – Theory

Duration of examination: 3hrs

1. PART A
Comprising of TEN compulsory questions, requiring one word or one sentence answers of ONE mark each. (Questions should be from all units) 10x1=10

2. PART B
Comprising of SEVEN questions, with internal choice of any FIVE, requiring short answers of fifty words of THREE marks each. (Questions should be from all units) 5x3=15

3. PART C
Comprising of SEVEN questions, with internal choice of any FIVE, requiring descriptive answers of one hundred and fifty words, of FIVE marks each. (Questions should be from all units) 5x5=25

4. PART D
Comprising of FOUR questions, with internal choice of any TWO, requiring essay type answers of two hundred and fifty words, of TEN marks each. (Questions should be from all units) 2x10=20

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TOTAL: 70 Marks

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## SCHEME OF PRACTICAL EXAMINATION
### B.Sc. I SEMESTER ZOOLOGY
#### NON-CHORDATA – PRACTICAL – 01

**Duration:** 3 hrs.  
**Max. Marks:** 35

| 01 | Taxonomy: Identify, classify and comment on A to E with labeled diagrams | 15 marks |
| 02 | Project Report: Economic Zoology | 07 marks |
| 03 | Dissection (Question set on dissection) | 08 marks |

**Or**

Mount and stain the plankton culture given, identify and comment on any one specimen

| 04 | Class Records | 05 marks |
| 05 | Total | **35 marks** |
Part 3: Education Courses
### Bengaluru Central University B.Sc.B.Ed Programme

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Nature and Purposes of Education</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course Number</strong></td>
<td>HC 01</td>
</tr>
<tr>
<td><strong>Semester</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Credits</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Instructional Hours</strong></td>
<td>52</td>
</tr>
<tr>
<td><strong>Total Marks</strong></td>
<td>100</td>
</tr>
</tbody>
</table>

#### Rationale for the course:
This course initiates student-teachers to study and analyse significant educational concepts, engage with theoretical formulations and grapple with philosophical and sociological issues. These range from understanding the knowledge, skills, competences and value orientation gained through the process of schooling to harmonising the dialectics of individual needs and societal needs/preserving culture and transforming it. While drawing from the related disciplines of philosophy, sociology and history, the issues and concepts are positioned in the context of education wherein they acquire meaning for teachers.

This course will also help student-teachers think through issues of aims of education, what is considered ‘good’ or ‘desirable’ for individuals/society at large and who decides these. Student-teachers have to appreciate the complex nature of education and the importance of a critical approach to the study of education. Given the complexity of education, no single thinker’s ideas can provide the basis for formulating educational aims and evolving processes. Student-teachers therefore have to be provided with opportunities to explore a range of perspectives and seek out multiple rather than singular explanations/solutions to issues/problems.

Student-teachers need to revisit what they learn in this course throughout the four year programme so as to gain a more nuanced understanding of nature and purposes of education and how these play out in practice.

#### Objectives of the course:
- Gaining a broad perspective of education
- Understanding the normative and cognitive aspects of education
- Understanding the aims and purposes of education from multiple perspectives
- Studying different thinkers’ conceptualisations of education
- Engaging with the role of education in promoting values
- Appreciating that education is a complex and contested domain of study and practice
Course Organisation:

UNIT 1: Meaning and nature of education – Normative and cognitive aspects of education; Education as cultural transmission; Education and Development; Sites of education; Processes of education; Conceptual distinction between schooling and education; Education as a right.

UNIT 2: Aims and purposes of education – Individual development, Societal Progress; Place of freedom and discipline; Beliefs about abilities and intelligence; What constitutes common good; Role of schooling in exclusion and oppression; Inclusive education to further the cause of social justice; Aims of education as articulated in Indian policy documents.

UNIT 3: Introduction to thinkers who have influenced education – Rousseau, Dewey, Montessori, Freire, Swami Vivekananda, Tagore, Gandhi, J Krishnmurthy, Gijubhai Badheka, Ambedkar: Study of 4 thinkers - each of the thinkers’ ideas of what is ‘good’ for individual and society. critique of the education system that existed during their time, and the alternatives they offered.

UNIT 4: Education and Values - What are Values; How Values are acquired; Value Concerns at School Stage; The Whole School Approach; Peace as a value; Education for peace.

Critical questions to reflect:

- What is meant by education? What does education involve? Why is education important?
- Is education a process or a product?
- Who is considered an educated person?
- Why must education, in the form of schooling, needs to be provided to all children?
- What are the structures and processes of schooling?
- What are the aims of education?
- How can education meet aims such as equality, justice, peace, self-reliance and environmental sustainability?
- What are the normative aspects of education? How does this relate to value formation?
- What kind of values does 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?
- How can schools nurture a culture of peace?

Tasks:
1. Compile definitions of education from different sources, such as vachanas, sayings of thinkers, vision statements of schools run by different managements, academic writings of educationists, and analyse them for similarities and differences. What could be the reasons for the differences?
2. In groups, choose a set of 2 critical questions from among the ones listed above. Each group to present their reflections on the questions to the rest of the class.
3. Study the aims of education in the all the National Curriculum Framework documents (1975, 1988, 2000 and 2005). How have they evolved to meet the current societal concerns and political climate of the country?
4. Prepare a module to integrate teaching learning of a value of your choice into a unit of any subject. Pilot this unit while on internship.

**Suggested mode of transaction:**
Pre-reading exercises to get STs to reflect on some of their own observations and experiences, perceptions and beliefs, around the themes of this course; Sharing and discussing the individual reflections in small groups to be taken up for all four units of study.

**Suggested Mode of Assessment:**
Participation in reading, reflections and discussing critical questions; Presentation of tasks.

**Essential Readings:**

**Unit 1:**

**Unit 2:**

**Unit 3:**
- Rabindranath Tagore. (1906). The Problem of Education in *Rabindranath Tagore,Universal Man*.

**Unit 4:**
Additional Readings:

- Ivan Illich, Deschooling Society, from www.arivindguptatoys.com
QP Pattern
I Semester Integrated B.A/B.Sc. B.Ed. Examination, January 2019
EDUCATION
HC – 1: Nature and Purpose

Time : 3 Hours                      Max. Marks:70

Instruction:

PART- A (3x10=30)
Answer any three questions. Each answer not exceeding three pages.
All questions carry equal marks:

1. a) 
   b) 
   c) (2+4+4)

2. a) 
   b) 
   c) (2+4+4)

3. a) 
   b) 
   c) (1+9)

4. a) 
   b) 
   c) 10

5. a) 
   b) 
   c) (2+5+3)

Part-B

II. Answer any eight questions. Each answer not exceeding one and half pages.
All questions carry equal marks:

6. 5

7. 5

8. a) 
   b) (2+3)

218
9. 

10. 

11. a) 
   b) 

12. a) 
   b) 

13. a) 
   b) 

14. a) 
   b) 

15. 

16. 

17. 

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Bengaluru Central University  
B.Sc.B.Ed Programme

Course Title  ICT in Education
Course Number  HC 02
Semester  1
Credits  1

Instructional Hours  26
Total Marks  50

Rationale for the course:
The material culture associated with the way the information is handled by Human societies have had significant impact on various other aspects of our societies like shared beliefs, attitudes; social organisation, and also the way goods and services are produced and consumed. For instance invention of printing during 15th century democratised learning and triggered the faster propagation of ideas. The technology of printing is historically known to have facilitated many social and cultural movements including India’s independence movement which has since then changed the landscape of social organisation in our society. The nature and changes in material culture has the potential to change our very notion of knowledge and learning. Teachers, who are fundamentally concerned with knowledge and learning should understand the current material culture. The current material culture is associated with information and is popularly labelled ICT (Information and communication technology). ICT includes everything from internet, computers, television, radio, books etc., which help us in storing, retrieving, manipulating and propagating all kinds of information.

Note: Tools for ICTs here should not only be viewed as use of computers but also use of latest digital technologies such as mobile phones, recorders, tabs etc for both collaborative resource creation, assessment, use of technology in classroom etc.

Objectives of the course:

- Situating the role of ICT in education within broader aspirations of the society.
- Developing a critical understanding of ICT in Education in relation to building inclusive societies.
- Appreciating the role of participation and knowledge sharing in virtual communities.
• Understanding the role of ICT in administrative and academic support systems.

Course Organisation:

UNIT 1:

Theory: Understanding children growing up in information age; Rise of the digital society; Education before the information age; Democracy in the digital society; Social inequalities and the digital divide; Gender, race and class in information age; Knowledge sharing in the virtual communities; ICT for everyday problem solving in education

UNIT 2:

Theory: Exploring and showcasing examples of ICT tools and interventions in Education; Harnessing machine translation & speech recognition for inclusive language education and teaching multilingual classroom; Widening the scope for regular feedback on teaching and learning through ICT; Building portfolio for both teacher and students using ICT tools; Taking teaching beyond classroom through social networking sites; Shifting focus of learner assessment from information retention to critical utilisation of information; Resource creation for teaching learning as collaborative a effort.

Critical questions to reflect:

How are children growing up in the information age different from the ones before? What does it mean to teach such children?

What does the digital society mean for the democratic practices? How are identities pertaining to ethnicity, race, religion, gender and language taking shape in the digital society?

How was education before information age? How would this help a teacher?

Can we teach machines to teach humans?

Are the traditional forms of learner assessments relevant for the children growing up in information age?

Tasks:

1. Students will read the essential readings suggested, write reviews on them, present their understanding in the class and will hold discussions. Students will also proactively post their writings on the institute's blog and share that with their friends and community.

2. Students will systematically document their observations in their home or in the neighbourhood about children interaction with ICT and present the same in the class.

3. Students will explore and showcase the finest examples of ICT in education to their peers and faculty.
4. Students will identify the various processes in the educational institute and map the corresponding ICT tools that help in improvising those processes.

5. Students will explore, identify and use relevant ICT tools for building portfolios of themselves and children.

6. Students will join the groups on social networking sites which are created based on ethnicity, race, religion, region, language, gender etc and study the dynamics of such groups over a course of time.

**ICT Practice**

**ICT for connecting and learning**

1. Familiarisation and basic troubleshooting with the ICT infrastructure and various devices - installing operating system on the computer - accessing and adding various software applications, basic troubleshooting

2. Equitable access to ICTs including for learners with special needs - ethical use of ICT - Public digital technologies including Free and Open Source Software (FOSS) and Open Educational Resources (OER)

1. **ICT for connecting** - communicating and forming teacher communities of practice for collaboration and peer learning – web browser for accessing the internet - participation in online, email and mobile-based forums - internet safety and privacy

2. **ICT for self learning** - developing personal digital libraries (PDLs) with different kinds of digital resources – processes of evaluation of digital resources

**ICT for Creating Resources**

1. Handling multiple devices, tools and applications to create and represent resources in multiple digital formats - appreciation of the pedagogic possibilities for a given context and purpose so as to include all learners

2. Creation of concept maps - use of concept mapping as a learning resource

3. Text editors, image editors, screencast recording applications to create resources in text and image formats - learning to organize and present a textual resource - combining to produce an output, extending learning beyond the text book

4. Combining audio, print and images to tell a story - possibilities of digital stories for communicative and learning purposes, using slides to make multimedia presentations

**References**


QP PATTERN
I Semester -Integrated B.A.B.Ed Examination-January 2019
(CBCS) Education
ICT in education

Time 35 min Max Marks 35

Part A

Answer any two questions. Each answer not exceeding three pages. All questions carry equal marks. (2x10=20)

1a
b
c

2.a
b
c

3a
b
c

Part B

Answer any three questions. Each answer not exceeding one and half pages. All questions carry equal marks. (3x5=15)

4
5
6
7
8
Critical Reading and Expository Writing

Rationale:
Being critical, means understanding with careful considerations of facts, opinions, intentions and sources. It entails looking at a text from multiple perspectives. A reading of this kind enhances the meaning making process. This course introduces student teachers to engage in critical reading of a variety of texts.

Critical reading of a text involves analysing the texts one reads. Sharing one’s own understanding helps in putting thoughts together to make it coherent for others and opens it up for multiple perspectives. To initiate student teachers in this journey, opportunities for student teachers to articulate in different forms their carefu judgment or judicious evaluation. This judgment or evaluation shall be based on evidence, logic and reason for expository texts and for narrative texts it would be a consideration of what the reading ‘evokes’ when seen from the reader’s perspective.

The student-teachers will also write essays and narratives to explore their arguments further and evoked feelings in their own way. This will bring out the essence of their reading. They will put forward what is in the text and take a particular position based on the range of positions available. They will be supporting their position with evidences. This process of trying to articulate their understanding will give clarity into their own thoughts about the topic and will encourage them to go beyond their own personal experience and look at the use of recognised sources of knowledge. All the essays student teachers write will involve reflection on their own style, thinking and research.

Objectives:
After completion of the course, student-teachers will:

- Develop the skill of critical reading by way of engaging with a variety of texts
- Analyse what they read and share the readings in different forms
- Develop the skill of writing for different purposes
- Become aware of their own thinking process
Course Organization:

This course intends to use the essential readings of their education courses and language courses. The course is designed so that reading will act as a springboard for writing projects and writing will be used to understand and interpret reading. The student teachers will be encouraged to critically read their own writing and engage in the process of drafting and re-drafting. They will also be doing peer reviews to support each other’s learning experience.

Unit 1 Critical Reading

Reading of narrative text - Understand that literature is a unique form of human knowledge. Look at the text from the perspectives of the narrative style, tone and imagery. Judge if the elements worked together with the text’s content to make an impression on the reader.

Interpreting the text - understand that the text does not contain the meaning ‘perse’, but reading is a creative process and meaning is derived by readers based on socio-cultural backgrounds and assumptions. Multiple interpretations do not mean anything “goes”, as each text will have to be read within the frame in which it is set.

Evaluating the text – Critical reading demands that the text needs to be evaluated in terms of rationality, credibility of sources/arguments/analyses and clarity of thinking in what is presented in the text.

Unit 2 Expository Writing

Writing for different purposes
- Vignettes of personal experiences, blogs
- Reports, articles, reviews
- Journal entries
- Presentations/graphic organisers

Writing for sharing involves thinking about the reader. Writing process involves drafting and revising. The process of revision makes it possible to bring in more clarity and add new perspectives. The iterative process sharpens one’s thinking.

Suggested modes of transaction:

This course has to be co-taught by English language faculty and the concerned discipline faculty.

Each reading assignment in this course will explore questions and issues through response exercises, essay draft, and a finished essay built upon the previous activities. For the first essay, student teachers will read a narrative text and share the feelings that it evoked. They will explore reasons for such a reaction and share an essay critiquing the text based on narrative style, tone and imagery. They will Judge if the elements worked together to make an impression on them. The essay draft will be written with their peers as audience. They share each other's essays, give suggestions for improvement and the final will be submitted to the teacher educator along with a note on the process.

While writing the essay student teachers will provide key information necessary to understand their reading. They put forth their understanding of the subject matter coherently. They support their arguments with evidence and cite sources
report will be produced as a draft and then will be made final. Draft is not an outline, incomplete report or notes about the report. It is a complete report with all the arguments made coherently.

The second essay will be based on the expository reading they take up in their field can use a graphic organiser to separate facts and opinions for a given essay. They will cross reference information to argue that the information is credible. They will look for clarity in the arguments made in the text and present their understanding. Here again, the student teachers will prepare a draft and present it to the expert in that field viz., a science essay would be submitted to a science teacher educator. Based on their comments a final version should be submitted.

Based on their preference of readings, student teachers create a response to one of the themes discussed in their reading. Student teachers take up this response/concept and consider various forms for presentation. The presentation should consider using a combination of actions, materials and artifacts for communicative purposes, whether produced physiologically (voice modulation, songs, facial expressions and gestures) and/or technologically (with chalk, pen and ink, or computer). Student teachers will come up with ways in which these resources can be organized for effective communication. The aim is to draw the attention of student teachers to the various possible meaning-making resources, and the ways in which specific choices work together to achieve the desired communicative goals.

**Note: Teacher educators to give two deadlines – first submission and submission after revision.**

**Suggested Assessment methods:**

Self-assessment, peer assessment, feedback based on the rubrics that are already shared with the students; maintenance of portfolios and journals.

**Essential Readings:**


**Additional Readings:**


II SEMESTER
Bengaluru Central University
B.Sc.B.Ed Programme

Course Title: Childhood, Adolescence and Growing Up
Course Number: HC 03
Semester: 2
Credits: 2
No. of instructional hours: 52
Total marks: 100

Rationale for the course:
This course is meant to provide an introduction to the conceptions of childhoods and adolescence and theories of development from psychological, social and cultural dimensions. The main focus in the course is to enable student teachers to arrive at an understanding of how different socio-cultural realities construct different childhoods, within children’s lived contexts: family, schools, neighbourhoods and community. The course should also engage student teachers in close observation and interaction with children from diverse socioeconomic and cultural backgrounds. The course builds an interdisciplinary framework to interpret and analyse these observations and interactions, drawing from cross-cultural psychology, sociology and anthropology to bring together theories of child development and crucial aspects from the construct of childhoods and adolescence.

Objectives of the course:
- Understanding theories of child development and socio-cultural constructs of childhoods & adolescence
- Appreciating how the identity of a child/adolescent is shaped by representations of gender, class, caste in society
- Interpreting the lived experiences of children and adolescents vis-à-vis the universalistic normative notions of childhood and adolescence
- Developing an understanding of the issues relating to marginalization, difference and diversity
- Evaluating the role of teachers in terms of the needs of diverse learners in school
Course Organisation:

UNIT 1: Perspectives on Childhood and Development - Normative ideas of childhood and child development; Theories of child development; Critical periods in development; Nature-Nurture debate on development; Moral development.

UNIT 2: Socio-cultural constructs of childhoods - Socio-cultural ideas and experiences of childhoods and adolescence; Assumptions of notions of childhood and stereotypes; Children and work.

UNIT 3: Agencies and Processes of Socialisation – State, family, peer group, school and mass media; Lived experiences of children and adolescents; Processes of enculturation and socialization.

UNIT 4: Learner in school - Role of school in preservation and promotion of culture; Learner diversity; Learners with special needs: Learners with disabilities/culturally, socially, economically disadvantaged learners/gifted and talented learners; Hidden curricula; Role of teacher.

Critical questions to reflect:
Do children across different cultures experience adolescence similarly?
How does urbanisation and economic changes impact the construction of childhood and adolescence?
How do representations of gender, class, poverty in media shape our assumptions on the behaviours of children and adolescents?
What are children’s lived experiences in different social, cultural and economic settings? What are the commonalities and what are the differences across settings?
How do schools perpetuate stereotypes in forging identities? How can a teacher be aware of these stereotypes and what can be done to mitigate them?
In what ways can schools cater to diverse learning needs? Why is it important to celebrate learner diversity?

Tasks:
1. Observe two children at play (or in a community setting), and interact with them. Prepare a report relating your observations to the ideas discussed in Units 1 & 2.
2. Refer to http://developingchild.harvard.edu/science/key-concepts/brain-architecture/ for write-up on brain architecture. Discuss in groups the various strands that the article highlights, for example, the importance of providing rich and varied learning experiences at early years of learning to help shape the developing brain; how cognitive, emotional, and social capacities are intertwined and develop throughout one’s life time. Each group
to share their reading with the rest of the class.

3. Prepare a photo exhibition of children from different socio-economic backgrounds engaged in activities outside school. Discuss children's lived experiences.

4. Study the representations of gender, class and poverty in media and prepare a collage. Critically reflect on these representations in terms of breaking or perpetuating stereotypes.

5. Read any book depicting children from two different historical periods in similar contexts (for example Dickens and JK Rowling or Kipling and RK Narayan) and analyse the constructs of childhood/adolescence depicted in the books.

6. Observe one child each in a Government school, a low-fee private school and an affluent private school, for an entire day. Interpret the role of school in perpetuating stereotypes and compare your observations and interpretations with those of the other student teachers in the class.

Suggested mode of transaction:

Critical reading and discussions of the essential reading texts; Sharing of student teachers’ experiences of their own childhood and adolescence in a non-threatening atmosphere; Readings about childhood from diverse contexts; Engaging with children in different contexts, writing reports on the engagement, sharing with the rest of the class and reflections; Reading and discussing about children's lived realities in many ways: through biographies, stories, narrations of growing up in different cultures, observations about children by parents and teachers, children’s diaries, testimonies and the media.

Suggested Mode of Assessment:

Assessing student-teachers’ capacities to observe, understand and interpret notions about children and childhood; Nature of critique of the universalistic normative notions of childhood and children and adolescents; Ability to interpret how gender, caste and social class may impact the lived experiences of children.

Essential Readings:

Unit 1:

Unit 2:


Unit 3:


● Saraswathi, T.S. (1999). Culture Socialization Human Development: Theory, Research and Application In India. Sage Publications India. (Chapter 7)

● Saraswathi, T.S. (1999). Culture Socialization Human Development: Theory, Research and Application In India. Sage Publications India. (Chapter 17)

Unit 4:


● Meighan, Roland. A Sociology of Educating. Oxford University Press. (Chapter 10)

Additional Readings:


Bengaluru Central University
B.Sc.B.Ed Programme

Course Title | Language Across Curriculum
Course Number | HC 04
Semester | 2
Credits | 1
No. of instructional hours | 26
Total marks | 50

Rationale:
"The world in language is half someone else's. It becomes 'one's own' only when the speaker populates it with his own intention, his own accent, when he appropriates the word, adapting it to his own semantic and expressive intention" – Bakhtin

Language across curriculum focuses on the importance of language in everything that the students learn in school. Students come with a diverse set of language experiences. Readiness for learning a ‘subject’ and making better sense of the world through that not only depends on the student’s prior knowledge, understanding and skills in that particular subject but also on her ability to participate in the learning process with the language that she has. To make school knowledge her ‘own’ student has to make sense of what is ‘said’ and what she ‘reads’. She should also be able to use the school language intentionally in her own style to express her understanding.

There is no doubt that the students need to build academic language structures to actively engage in learning. Just memorising the complex structure of a sentence as definition in science neither enhances the language skill nor the understanding of science.

So, it becomes imperative for every teacher to understand the student’s language, recognise the gaps she might have and provide opportunities to bridge the language gap in every subject rather than compartmentalising language learning to the language classroom. In essence, every teacher is a language teacher.

In order to do this, the teacher has to be aware of the distinguishing features of conversational and academic use of the language in terms of structure and elements. This awareness will lead to taking a closer look at the dimensions that have to be considered to set the academic apart from the conversational register. This in turn will help the teacher to include all children in learning and cope with the language of interaction, textbook and assessment.
Objectives:
After completion of the course, student-teacher will:

- Developing sensitivity towards the language background of students
- Appreciating the nature of classroom discourse and develop strategies for use of oral language
- Develop an understanding of the nature of reading comprehension in different content areas

Unit 1
Understanding language background of learners and the nature of classroom discourse
Multilingualism in the classroom (language and power), home and school language, (understand that languages are different as opposed to deficient).
Nature of classroom discourse – idea of dialogue between teacher and student, strategies to support dialogue; factors that restrict dialogue in the classroom; strategies to include all in the classroom.

Unit 2
Understanding the nature of reading comprehension and writing in different content areas
Academic language – Meaning and nature (elements and patterns); Discipline based language- meaning, nature, variety; Analysis of readings from different subjects.
Critical reading of the language of textbook content; Reading comprehension in the content areas (reading for conceptual understanding) - social sciences, science, mathematics; strategies to develop reading comprehension (summarising, clarifying, generating questions, predicting, skimming, scanning)
Writing in specific content areas; strategies to develop writing with a sense of purpose – writing to learn and understand (note making, diary writing, recording observations/procedures, process writing, graphic organisers); making reading-writing connections; analyzing children’s writings to understand their conceptions
Understand the relation of language of the learner and the requirement in the content; strategies to bridge the gap at multiple levels.

Tasks
1. Review the language in a wide range of texts, learning resources, journals, periodicals, newspaper, bulletins and such other items; Interpretation of pictures, diagrams, graphs, maps, and other illustrative devices
2. Undertake a project involving listening to children,s reading, misuse analysis, developing a reading test and administering it.
3. Analysis of textbooks and other materials used in different subjects from the point of view of registers and styles used in them.
Suggested mode of Transaction
Reading and discussions, presentations, writing assignments. A small group project to develop strategies to improve reading comprehension and try it out with students.

Suggested mode of Assessment
Self-assessment, peer assessment, feedback based on the rubrics that are already shared with the students; maintenance of portfolios and journals.

Essential Readings:

Bengaluru Central University
B.Sc.B.Ed Programme

<table>
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<th>Health and physical education</th>
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**Rationale**

It is well acknowledged that health is a multidimensional concept and is shaped by biological, physical, psychological, social, economic, cultural and political factors. This subject area adopts a holistic definition of health within which physical education and yoga contribute to the physical, social, emotional and mental aspects of a child’s development. Given the multi-dimensional nature of health, there are many opportunities for cross-curricular learning and integration in other subject areas like science, social science and languages also.

The organisation of activities should ensure a wide range, so that each and every student-teacher can participate according to his/her interest and need. The focus should be on what as a student-teacher should I learn and what should I expect that the children should learn and practise so as to acquire habits of healthy living and participate in games, sports and athletics for maintaining fitness.

**Objectives**

- Understanding the concept of holistic health, its various dimensions and determinants and the importance of sports and yoga for development of holistic health
- Developing positive attitude towards health as individual and be collectively responsible to achieve it
- Ability to identify students’ health status, health problems and take up remedial measures
- Becoming aware of the rules of safety in hazardous situation (illness, accident and injury) and ability to use first aid measures
- Learning to form right habits about exercise, games and sports, sleep, rest and relaxation
• Acquiring skills for teaching physical fitness, correct postural habits and activities for their development
• Creating interest for the practice of yogasanas and meditations through which they learn the skills/art of self-control, concentration, peace and relaxation to avoid ill effects of stress, strain and fatigue of routine life
• Understanding various policies and programmes related to health, physical education and yoga; and
• Understanding the process of assessment of health and physical fitness.

Course Content
Given the applied nature of the course, the content should consist of both theory and practical. It should focus on experiential learning.

- Concept of health, importance, dimensions and determinants of health; Health needs of children and adolescents, including differently-abled children
- Food and nutrition, food habits, timing of food, nutrients and their functions, diversity of Indian food, seasonal foods and festivals, economics of food, preservation of food value during cooking, indigenous and modern ways to persevere food, shift in food practices and its globalisation, practices related to food hygiene, malnutrition, including obesity, food and waterborne and deficiency diseases and prevention
- Safety and security — disasters in and outside schools, ways of prevention, safety from snake and dog bites, animal attacks, prevention and treatment
- Physical fitness, strength, endurance and flexibility, its components, sports skills, indigenous and self-defence activities
- Games and sports — athletics (general physical fitness exercises), games (lead-up games, relays and major games) rhythmic activities, gymnastics and their impact on health
- Yoga — importance of yoga, yogasanas, kriyas and pranayams
- Role of institutions (school, family and sports), health services, policies and major health and physical education-related programmes, blood banks, role of media.
Rationale for the course:

The objective of this course will be to bring about an understanding of the ‘cultures, policies and practices’ that need to be addressed in order to create an inclusive school, as spelt out by Booth and Ainscow in *The Index for Inclusion* (2000). This course will explore the definition of ‘disability’ and ‘inclusion’ within an educational framework so as to identify the dominating threads that contribute to the psychosocial construct of disability and identity. While analysing the policy and programme initiatives in the area of inclusion, the course will look at models of disability as well as the dominant discourse on ‘the other’ in the narratives of all concerned. It will attempt an identification of the ‘barriers to learning and participation’ while formulating a policy of good practice and review.

The National Policy of Education, (GOI, 1986) Article 4.9 stated: ‘The objective should be to integrate the physically and mentally handicapped with the general community as equal partners, to prepare them for normal growth and to enable them to face life with courage and confidence.’ Shortly thereafter the UN Convention on the Rights of the Child (UNESCO, 1989) and the United Nations Convention on the Rights of Persons with Disabilities (UNESCO, 2006) brought inclusion into the discourse, with a focus on the advantages not just to those with disability but also to the ‘others’, viewing inclusion as a ‘dynamic approach of responding positively to pupil diversity and of seeing individual differences not as problems, but as opportunities for enriching learning.’ (p. 12) However, the RTE Act (GOI, 2009) states that ‘the appropriate Government and local authorities shall endeavor to promote the integration of students with disabilities in the normal schools’ (Article 26), while the Sarva Shiksha Abhiyan Framework for Implementation under RTE recommends that quality inclusive education will be ensured and the ‘ultimate aim would be to mainstream all CWSN in neighbourhood schools’ (GOI, 2011, p. 46). While the consequences of this shifting approach in state documents, on ‘integration’ or ‘mainstreaming’ into ‘normal’ schools, confuse the popular understandings of ‘inclusion’, this course will require students to interrogate their own beliefs and also of school teachers, to see how those influence the implementation of inclusion.
Objectives of the course:

● Understanding the national commitments towards the education of children with diverse needs.
● Develop an understanding of the concept, principles and models of inclusive education in the context of education for all.
● Identify and address diverse needs of all learners.
● Familiarise with the trends and issues in inclusive education
● Develop an understanding of the role of facilitators in inclusive education.
● Identify and utilise existing resources for promoting inclusive practice.

Course Organisation:

Unit 1: Introduction to Inclusive School
Concept and importance of inclusive education- its merits and limitations, Inclusive education strategies for children with diverse needs, school education of the disadvantaged groups and girl’s education, Provisions for Inclusive Education as per RTE, Barriers in Inclusive Education: Attitudinal, Social and Educational.

Unit 2: Creating Learner friendly Environment
Universal Design for learning- Multiple means of access, expression, engagement and assessment, Co-teaching methods- one teach one assist, station teaching, parallel teaching, alternative teaching and team teaching; Differentiated Instructions-Content, process and product; Peer mediated instructions-class wide peer tutoring, peer assisted learning strategies; ICT for instructions

Tasks:

1. Visit any inclusive school and report about school settings - A study of barrier free environment
2. Conduct survey about barriers in social inclusion
3. Develop teaching learning materials for children with special needs
4. To make a list of available curricular support services for children with special needs
5. Conduct awareness programme for public about early intervention/detection
Essential Readings

Unit 1:


Unit 2:


Additional Readings:


Rationale for the course:
In order to teach science, it is important to understand one’s own notion of science. The teachers view on nature of science gets reflected in the teacher practices. The questions on how does knowledge gets validated in science are important to engage with. It is also important for the teachers to examine the relationship between science and society and understand social impact of science and vice versa.

Also as teachers it is important to understand the aims of teaching science, engage with the secondary curriculum and the key concepts. They should be able to analyse the relevance and limitations of various curricular resources including textbooks. Teachers need to engage with children’s ideas in science and teach in ways that bring about deeper conceptual understanding about the natural world. In order to make the curriculum relevant and engaging, teachers need to be able to plan flexibly keeping the children’s context in mind. As teachers they need to plan assessment in ways that check for genuine understanding of scientific concepts, while also meeting curriculum requirements. Above all teachers need to continuously reflect on their practice in order to ensure meaningful learning for all children.

Objectives of the course:

- Analysing one's own notions of science and gaining an understanding of the meaning, nature and scope of scientific knowledge and method
- Understanding the purposes of teaching science and its place in the school curriculum
- Developing an awareness of the aims of science education
- Analysing relevance, limitations and rationale of school science curriculum.
UNIT 1: Nature of science
- What is science?
- Notions of science and scientists
- Nature, scope and branches of physical science
- What constitutes scientific knowledge? Is there a scientific ‘method’?
- History and philosophy of science and its implication for classroom teaching

Unit 2: Concepts and concept change
- What are scientific concepts?
- Conceptual change
- How children learn concepts
- Implications for pedagogy

UNIT 3: Science in the school curriculum
- Aims and Objectives of teaching Physical Science
- Considerations and approaches in Science curriculum
- Textbooks and teaching learning resources
- Science for All

UNIT 4: Pedagogic Content Knowledge of Science
- Nature of science and its influence in teaching science
- Subject matter knowledge for teaching
- Socio-cultural context and learning of science
- Components of PCK
- Developing PCK

Tasks
- Interview school students to understand their notion of science and scientists. A set of questions could be used to interview students on their view of science.
- Interview few teachers of a school on the purposes of teaching science.
- Observe a child learning a concept / performing a task in science class and prepare a report.

Suggested mode of transaction:
The classrooms could help foster discussions, critical enquiry, debates, reading and sharing of views and texts.

Some examples:
The students could be asked to read parts of the text and debate/ present the summary based on few questions which might help close reading of texts.
The students could interview each other on notions of science and present the views.
The teacher educator could initiate a discussion based on few readings or explain complex ideas using graphic organisers/concept maps and help students read the text later.
The students could view related film clips. Teacher educator to provide reflective questions for discussions post the viewing.
Newspaper articles based on science and society could be collected by students and review/present the same in groups.

Guest faculty/scientists could be invited to present a seminar/guest lecture.

Teachers could be invited to classroom to share their experience of teaching of science and curricular approaches.

**Suggested mode of assessment:**
Short reflective pieces or assignments

Some examples:
Analyse a lesson from the science textbook of classes 6 to 10. Elicit how science is presented in the textbooks based on your understanding of nature of science.

Examine a recent debate on issues of science and sustainability, or science and technology and write a note on its implication on the society.

Analyse the aims of teaching science in the state curriculum with respect to the NCF 2005 Position Paper on Teaching of Science. Write a report of the analysis.

**Essential Readings**

**UNIT 1: Nature of science**

**Unit 2: Concepts and concept change**

**UNIT 3: Science in the school curriculum**
UNIT 4: Pedagogic Content Knowledge of Science


Additional Readings

Bengaluru Central University
B.Sc.B.Ed Programme

Course Title: Pedagogical content knowledge – English (Part-1)

Course Number: SC01

Semester: 3

Credits: 2

Instructional hours: 52

Total marks: 100

Objectives:
After completion of the course student teachers will:

• Acquire an understanding of the nature and structure of English language and its component skill.
• Acquire the theoretical knowledge of different methods and approaches and apply them in their classroom teaching.
• Develop core skills and reference skills among them.
• Understand the role and importance of language.
• Appreciate different forms of literature and inculcate the same in students teachers
• Learn and use different aspects of testing and e-evaluation (using digital platforms)
• Prepare and use different audio-visual aids and e-learning tools and use them in their class room teaching effectively.
• Develop professional competencies among teachers in the making.
• Learn and use different techniques to design language games in teaching-vocabulary pronunciation, spelling, grammar and composition.
• Use innovative practices in teaching of English.
• To understand the importance of instructional objectives and taxonomy.
• To design/write a unit plan and lesson plan based on evaluation approach.
• Acquire knowledge of the sound system of English and to familiarize them with the appropriate terminology, to describe the sounds in English.
• Understand need and function of language lab.
• Use multilingualism as a strategy in the classroom situation.
• Understand constructive approach to language teaching and learning.
• To develop an insight into the relationship between curriculum and textbooks.
UNIT-1: Content – Aspects of language. (Content from 6th, 7th and 8th standard of Karnataka

1.1 Introduction to language – Meaning, definition, functions, linguistic principles of learning language

1.2 Structure of English language – phonological structure- mechanism of speech, Received Pronunciation (RP), General Indian English (GIE), phonemes, vowels and consonants, stress intonation, rhythm, consonant clusters, minimal pairs - their meaning and practice.

1.3 Morphological structure of English – meaning and importance – meaning of morphemes, Types – free and bound: affixes, prefixes and suffixes- derivational suffixes, verb forms, adjectives and adverbs.

1.4 Syntactic structure of English – meaning and importance – basic sentence patters; phrases and clauses.

Unit 2: Nature, Objectives and Taxonomy

2.1: Objectives of teaching English– instructional objectives, classification based on Blooms-Anderson taxonomy-stating of instructional objectives and learning outcomes,

2.2. Lesson plan format, regular and unit lesson plan teaching of prose, objectives, steps,(demonstration lessons are to be given by the faculty) based on Karnataka English Textbooks.

2.2. Teaching of Poetry-Objectives and steps (demonstration lessons are to be given by the faculty) based on Karnataka English Textbooks. figures of speech, diction and images.

2.3: Teaching composition-objectives, types-guided, controlled and free composition, steps inteaching guided composition, activities and exercises to develop composition, remedial work (demonstration lesson to be given by the faculty)

2.4: English language teaching situation in India and its historical background

2.5: Need and importance of teaching English.

2.6: Aims-literary, cultural, utilitarian and creativity

2.7: Use of mother tongue in acquisition of English language with reference to syntax, pronunciation, spelling, tense and articles

UNIT 3: Approaches and Methods of teaching English

3.1. Bilingual method – meaning- principles-merits and limitations

3.2. Direct method – meaning – principles-merits and limitations


3.5. Eclectic Approach.

3.6. Suggestopedia– meaning, principles, merits and limitations,

3.7. Constructivism in ELT (NCF 2005)

UNIT 4: Development of language skills (Linguistics) and Evaluation

4.1. Listening: components – barrier in listening, activities to develop listening comprehension.

4.2. Speaking– components– objectives– barriers to speaking– need for correct pronunciation– activities to develop correct speech habits

4.3. Reading skills– objectives of teaching reading; Mechanics of reading; Methods of teaching reading; Types of reading, reading aloud and silently, intensive and extensive reading; Types of reading comprehension – activities to develop testing reading comprehension.

4.4: Writing– its components, objectives of teaching written expression.


4.6: Steps of designing lesson plan in English for power point and multimedia applications and their advantages.

4.7: Evaluation in teaching of English. Concept of unit test, blueprint, construction of objective based test (practical activity– question paper)

4.8: e-testing– meaning– steps, advantages, use of E– question Bank, online tutoring and testing.

Seminar Topics: (any one)

Prepare and present seminar paper on the following topic.

1. Activities to develop linguistic skills – listening, speaking, reading and writing
2. Use of educational technology in teaching and evaluation of English language.
3. Study skills – Gathering, Storage and Retrieval– their importance and use in Language learning
5. Psychological principles of learning language (Behavioristic and Cognitive Approach)
6. Language games– (Activity Based learning) (ABL)
7. Constitutional provisions and policies of language education.
8. Different forms of English Literature and their relative importance.
10. Use of library resources in teaching and learning of English.
Reference Books:

1. AIELTA-Voices-journal-London
2. BalasubramanyanT.-Introduction to phonetics for Indian students MacMillan publication Hyderabad
3. BansalR.K -Outlines of phonetics -CIEFL Hyderabad
5. Bhatia&Bhatia-Methods of teaching English
6. ELT-(journal) ELTAI-Chennai
10. Gimson, Introduction to pronunciation-OUP
11. Gleason S-Descriptive linguistics-OUP
16. Pitcoder, Introduction to linguistics-CUP
18. Strengthen in your English in Bhaskaran and Horsburjg Oxford University Press
Bengaluru Central University  
B.Sc.B.Ed Programme

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1. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು ಮಾರ್ಕ್ಸುಗಳು.
2. ಸಾಮರ್ಥ್ಯ ಮಂತ್ರಿ ಮಂತ್ರಿಯನ್ನು ಮಾನದವು ಮಾರ್ಕ್ಸುಗಳು ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.
3. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.
4. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು 200 ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.
5. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.
6. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.
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8. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.
9. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.
10. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.

ಫ್ಯಾಲ್ಸ್-1: ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು: (12 ಮುಡಿಸಬಲ್ಲದ)  

1. ಸಮರ್ಥ ಮಾತ್ರಾದ ಕೊಂಡಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದವು ಇಪ್ಸಿಯನ್ನು.
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ಫ್ಯಾಲ್ಸ್-2: ಸಮರ್ಥದಿಗೆಯನ್ನು ಮಾನದವು ಮುಡಿಸಬಲ್ಲದ (14 ಮುಡಿಸಬಲ್ಲದ)
2.1 ಹುಡುವಿಕೆಗಳು: ಹುಡು ಕೆಲಸವನ್ನು ಹುಡುವಿಕೆಗಳಿಗೆ ವಿಭಾಗಗಳು.
2.2 ಹುಡುವಿಕೆಗಳು: ಮಠಾಯುಕ್ತ ಹುಡುವಿಕೆಗಳು, ಜಿಂಪಾನಾ: ಹುಡುವಿಕೆಗಳು - ಜಿಂಪಾನಾ: ಏಪಿಯಾಂಜರೆ, ಅತಿಥಿಯರ ಉದ್ಯಮಗಳು, ಹುಡುವಿಕೆಗಳು.
2.3 ಹುಡುವಿಕೆಗಳು: ಹುಡು ಚಿಕ್ಕ ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳಿಗೆ ವಿಭಾಗಗಳು. ಹುಡುವಿಕೆಗಳು - ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು - ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು.
2.4 ಹುಡುವಿಕೆಗಳು: ಹುಡುವಿಕೆಗಳು - ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು.
2.5 ಹುಡುವಿಕೆಗಳು: ಹುಡು ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು - ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು. ಹುಡುವಿಕೆಗಳು - ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು.

ಭಾಗ-3: ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು ಸರ್ವಜನಾತೀಯ (14 ವಿಭಾಗಗಳು)

3.1 ಸರ್ವಜನಾತೀಯ ಹುಡುವಿಕೆಗಳಿಗೆ ವಿದ್ಯುತ್ ಸರ್ವಜನಾತೀಯ ಹುಡುವಿಕೆಗಳು, ತೆರೆಬಿಡುವುದು, ಹುಡುವಿಕೆಗಳು, ತೆರೆಬಿಡುವುದು, ಹುಡುವಿಕೆಗಳು, ತೆರೆಬಿಡುವುದು, ಹುಡುವಿಕೆಗಳು, ತೆರೆಬಿಡುವುದು.
3.2 ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು.
3.3 ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳಿಗೆ ಹುಡುವಿಕೆಗಳು.

ಭಾಗ-4: ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು (12 ವಿಭಾಗಗಳು)

4.1 ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು - ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು.
4.2 ಹುಡುವಿಕೆಗಳು ಹುಡುವಿಕೆಗಳು - ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು, ಹುಡುವಿಕೆಗಳು.
4.3. ವೇಳೆ ನೇರವಾಗಿ, ಸಾಗಿದೆ ಇನ್ನೊಂದಿಗೆ ತುಪ್ಪಾಯಿಸಿ, ಬಿಸ್ತಿಪರಿ ಪರಿಸರವು ಸಂಬಂಧಿಸಿ. ಸುಂದರ್ವಂಗ, ಕೇಂದ್ರದ ಅಂಗಗಳಿಗೆ, ಪದ್ಧತಿಯ ಸುಧಾರಣೆ. ತಃ ಮನುಷ್ಯ (ಕ.ಬಿ) ಅನಿರ್ಧಾರಿತ–
ಅನುಭವವು ಅಂದರೂ ಮಾಡಬಲ್ಲು. ಮುಖಾಂಕಿ.

ಪ್ರಕಾಶ ನೋಡಿಕೆ ಮತ್ತು ಸಂಖ್ಯೆ ಸಂಬಂಧಿಸಿ:

(ಕೇಂದ್ರವಿನ ಕಚೇರಿಯಲ್ಲಿ ಅಧ್ಯಾತ್ಮಾವಂತೆ)

1. ನುಡಿ ನೆಲಗಳ ಅನುಕೂಲ ಮಂದಿಯುದ್ದ.
2. ಮಹಾಭಾರತದ ಸಾಲು ಅಧ್ಯಯನವನ್ನು ಮಾಡಲು.
3. ಪಟ್ಟಣದ ಮೂಲಕೂ ಪ್ರತ್ಯೇಕ ಅಧ್ಯಯನ ಮಾಡಲು.
4. ಮಹಾಭಾರತದಲ್ಲಿ ಯೋಗು ನೂಡಿಗೊಂಡಿದ್ದರು ತನ್ನದ ಸುಂದರ್ವಂಗದಲ್ಲಿ ಅನುಗುಹ್ಯವನ್ನು ಮಾಡಬಲ್ಲು.
5. ತುಂಬಿ ಮನುಷ್ಯ ನೆಲಗಳ ಮುಂತಾದರು ಅಧ್ಯಯನ ಕಾರ್ಯವನ್ನು ಮಾಡಬಲ್ಲು.
6. ಪ್ರತ್ಯೇಕ ಪ್ಯಾಗೆ ನೆಲಗಳನ್ನು ಸುಂದರ್ವಂಗದಲ್ಲಿ ಅಧ್ಯಯನಗಾಗಿಸಲಾಗುವ ವರ್ಷ. 10. ಸುಂದರ್ವಂಗದಲ್ಲಿ ವರ್ಷದ ಸಮಯ.
Bengaluru Central University  
B.Sc.B.Ed Programme

<table>
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<th>Course Title</th>
<th>Pedagogical content knowledge – Hindi (Part-1)</th>
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Objectives: After completion of the course student teachers will:

- Appreciate the importance of teaching Hindi as a second language in India and the aims and objectives of teaching it.
- Help pupils acquire the basic skills of language learning.
- Know the different methods of teaching different types of lesson in a second language and use them in his/her teaching.
- Prepare objectives based plans of lesson and teach accordingly.
- Appreciate the importance of suitable teaching materials in language teaching and prepare/select them for the use in his/her lessons.
- Know the principles of text book construction.
- Prepare and use appropriate tools of evaluation to measure the linguistic abilities of pupils.
- Know the entire syllabus prescribed for 8th to 10th standards in Hindi.
- Develop in himself the special qualities, aptitude and interests of a Hindi teacher.

Chapter I: आ) भाषाकार्य, प्रकृतिअवरूप (Language meaning, Nature, Importance)

(12 Hours)

1. भाषाकार्यक्रियाएँवरुप
2. भाषाकार्यक्रियाएँवरुप
3. भाषाकार्यक्रियाएँवरुप
4. भाषाकार्यक्रियाएँबन्ध
5. भाषाकार्यक्रियाएँवरुप
6. भाषाकार्यक्रियाएँबन्ध

आ) हिन्दीयिक्षणकेर्देश्य (Objectives of teaching Hindi)

1. माननागुणकेर्देश्य
2. हिन्दीयिक्षणकेर्देश्य
Chapter II: भाषा शिक्षण के सामान्य सिद्धांत तथा एवं सूत्र : (12 Hours)

(General Principles and Maxim of language teaching)

1. विद्युत-शिक्षण की आवश्यकता।
2. भाषा शिक्षण के सामान्य सिद्धांत।
3. शिक्षण सूत्र।
4. भाषा शिक्षण के मुख्य तत्त्व।

आ) हिन्दी शिक्षण पद्धतियाँ : (Methods of teaching Hindi)

1. प्रत्यक्षपण्डत।
2. व्याकरण अनुवादपण्डत।
3. गणकांश आधारित संख्याधिक।
4. समाचार पण्डत।

अ) शब्द परिवर्तनपद्धति आ) सर्वचनालकविधिय। दिभाषिक विधि।

Chapter III: भाषाकोशलोकाशिक्षण : (Teaching of Language Skills) (12 Hours)

1. श्रवणकोशलः:
   आ) श्रवणकोशलकामहत्या आ) उद्देष्य
   इ) विविधां इ) श्रवणकोशलमें ध्वनियाँ अध्यायनेव वार्तावातः

2. वाचनकोशलः:
   आ) वाचनकोशलकामहत्या आ) उद्देष्य इ) वाचनक्रियाकार
   इ) विविधां उ) वाचनवाचन वृत्तियाँ और सुविधाएँ।

4. लेखनकोशलः:
   आ) लेखनकोशलकामहत्या और उपयोग आ) उद्देष्य इ) विविधां
   इ) लेखनक्रियाकार उ) प्रतिलेख और शुल्केश्वर क्रियाकार
   ऊ) लिखनासिद्धान्त में ध्वनियाँ अध्यायनेव वार्तावातः

Chapter IV. राज्योपाध्या : (Lesson Planing) (16 Hours)

1. आ) पाठ्यमूलकार्युः आ) महत्व और रूप
   इ) हिन्दी पाठ्यमूलकार्युः

2. गद्य और पद्य बोधकार्योज्य अवधारणा।

आ) सूचना सिद्धांत का अर्थ तथा परिभाषा आ) सूचना सिद्धांत के सौपान

इ) सूचना सिद्धांत का स्वरूप इ) कोशालोकार्युः

251
इ) हिंदीशिक्षक : (Hindi Teacher)
अ) हिंदीअध्यापककीआवश्यकताएवंमहत्त्व 
आ) सामान्यऔर 
ई) विशिष्ट गुण 
उ) कर्तव्य

Topics for Seminar (सेमिनारके विषय) :

1. माध्यमिकविद्यालयोंमें बोधनमाध्यमके रूपमें भाषाशास्त्रकामत्व
2. हिंदीभाषाशिक्षणमें व्रत्य-दृश्यसाधनोंकीउपयोगिता
3. भाषा-कौशलसाहित्यके विकासमें एकअध्यापककार्यगान
4. कन्हाबाबूराजमें हिंदीभाषा, साहित्य और संस्कृतिके विकासपर विचारविचार
5. हिंदीभाषाशिक्षणमें निर्धारण (उपन्यास) / मूल्यकन

आधारांशः

1. दिनेशचन्द्र भारद्वाज—हिंदीभाषाशिक्षणविद्वान, आगरा
2. हिंदीशिक्षण—रजस्वलप्रकाश, जयपुर
3. नृत्यहिंदीशिक्षण—प्रो.सत्तपार, करनाटक
4. हिंदीशिक्षण—संतीविकाश, जयपुर—३, १९९८
5. डा. की.गोपालन—मानकहिंदीवाचकता और चन्द्र, राहुलशैक्षिकअनुसंधान और प्रशिक्षणपरिषद
6. विज्ञानशून्य—हिंदीशिक्षणविद्वान—जड़पाल्लिकेजैसा, लूशियाना
7. प्रमाण—नीमा-हिंदीवाचकमान्तक, नीताप्रकाश, १९९५
8. भाषाओ-दलितवाद—अन्यभाषाओ-दलितवाद, हिंदीशिक्षककीरुपरेखा-विनोदपुस्तक 
मंदिर, आगरा.
9. समकालीनसाहित्यकला—पी.डी.पादक, विनोदप्रकाश, आगरा
10. हिंदीसंस्कृति—पी.डी. पादक, राठायागि, विनोदपुस्तकमंदिर, आगरा
11. हिंदीशिक्षकविविधाएँ १, २, औरपाठ—कोजना— डॉ. लक्ष्मीनारायणज्ञानी, विनोदपुस्तक 
मंदिर, आगरा
12. भाषाशिक्षकप्रविहार—किशोरीलालसाहाय, मेहराउमाएंडकम्यूनी, आगरा
13. हिंदीशिक्षण—केशवप्रसाद सरस्वती, दिल्ली
14. भारतमेंमान्त मात्राभाषाशिक्षाने लिए प्राप्त रचनाएँ, आकाशसंगीतलिट्टमुबुलू) ललाप्रेस
15. अध्याप्तकला—सैंतारामपुरुवैद्य, नन्दकिशोरसाहित्य, बाराणसी
16. हिंदीभाषाशिक्षण—भाषाओ-दलितवाद, विनोदपुस्तकमंदिर, आगरा
17. हिंदीवाचकरण—धिमथासदातुभु, विनोदपुस्तकमंदिर, आगरा
Bengaluru Central University
B.Sc.B.Ed Programme

Course Title       ICT Mediation
Course Number      EPC 3
Semester           3
Credits            1
Instructional hours 26
Total marks       50

Rationale
Curricular resource creation by teachers has been seen as an important process of teacher professional development (TPD). Such resources are likely to better correspond to the local needs of teachers. ICTs (digital information and communication technologies) offer possibilities for teachers to design and develop digital curricular resources.

During the first year of the program, the ICT in education provided broader perspectives on ICTs in education and equips students with basic computer literacy. In the second year, the course will meet the requirement of developing curricular resources that are specific to each subject, using relevant subject specific software applications. These digital tools can also be used in the transaction of these subjects in the classrooms. Using ICTs for improving classroom pedagogies, along with using digital curricular resources as part of the curricular content, can help support teacher development as well as improve classroom transaction. The integration of the technological, pedagogical and content knowledge, as discussed in the “Technological Pedagogical Content Knowledge” (TPACK) knowledge framework, is an important element of TPD that the course will explore as an extension of the Facilitating Learning of various subjects. The integration of ICTs in the content and pedagogy aspects in the teaching of different subjects has the potential to improve the transaction (including assessment for learning) of the other subjects. An effective implementation of the ICT Mediation course requires that the transaction of other courses facilitate integration of digital resources and tools.

Secondly ICTs are having far reaching socio-cultural, political and economic implications, both positive and negative on our society and the student teacher needs to have a basic awareness and understanding of these.
Note: Tools for ICTs here should not only be viewed as use of computers but also use of latest digital technologies such as mobile phones, recorders, tabs etc for both collaborative resource creation, assessment, use of technology in classroom etc.

Objectives
The course facilitates student teachers in:

1. Learning the use of various educational tools for creating digital resources in different subjects
2. Understanding possibilities of integrating ICT in teaching learning for different subjects and for creating inclusive classrooms.
3. Evaluating the use of ICT resources in various stages of teaching learning in terms of suitability of content, pedagogic appropriateness and facilitating learning
4. Exploring the possibilities of using ICT in assessment activities.

Units

Unit 1: ICT for resource creation

1. Pedagogic possibilities from different educational tools and media (?)
2. Creating resources using various educational tools and integrating them into lessons. An indicative list of application include Geogebra and Turtle Art (for Mathematics), Simulations and Desktop Planetarium (Science), Vocabulary tools and digital stories (Languages), Digital Maps and atlases (Geography), and Timelines for history (Social Sciences). Translating voice overs or subtitles (Video Documentary across subjects)
3. Spreadsheets to capture, process, analyse data - present analysed information in text and graphical formats.

Unit 2: ICT in teaching learning

1. Integrating digital tools into teaching and learning of Mathematics, Science, Social science and Language subjects - (created and accessed)
2. ICTs for creating and using assessment information - conducting formative assessments.
3. TPACK framework of integration of technological-pedagogical-content knowledge for teacher professional development.
4. Evaluation of ICT resources and determining appropriate use of various ICT resources (created and accessed) in transaction as well as student learning.
**Requirements**

1. **Hardware** - The course will ideally require a 1:1 computer : student ratio. In case of fewer computers, a ratio of 2 or even 3 students per computer may be required to be managed. Student teachers should be encouraged to buy personal devices. The institution should ramp up the computer availability in a phased manner to ensure 1:1 ratio over time. Lab may be made available at other times to student teachers to continue practice.

2. Encourage students to also use their own digital equipments such as mobile phones, tabs etc

3. **Software** - Each computer must be loaded with required softwares/educational tools preferably the public (free and open source) with Operating System such as Ubuntu GNU/Linux.

4. **Connectivity** - Internet connection, ideally, with a minimum speed of 12 MBPS will be needed as well as arrangements for back-up power. In case the bandwidth is lesser, this will need to be managed by having students rationing downloads of heavy video files. The college can also make available on-line resources through off-line media (pen drives, DVDs) to students to avoid repeated downloads of the same resources. The digital resources required for this course also will be be made available both on-line and off-line media to the institutions.

5. Ideally the practical hours should be in combined slots of 2 hours at a time; this will allow an extended period to get into and complete an activity. Individual colleges may have to come up with time-table adjustments to allow for optimal hands-on time for student teachers.

**Tasks** :

**Guiding principle:** Every ICT tool referred here should be critically reviewed by students and faculty against the theories of learning, knowledge, intelligence and administration.

<table>
<thead>
<tr>
<th>S no</th>
<th>Task</th>
<th>Suggestions for implementation</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Resource Creation using ICTs tool</td>
<td>1. For this section we would restrain from suggesting any specific tool for these tasks as newer and simpler tools get added every now and then. Students should explore sites like ubuntu software center, sourceforge, github</td>
<td>Multimedia teaching learning resources are the new norm of the information age. As per Edgar Dale’s Cone of Experience these multimedia resources help extend the learner attention and enhance their meaningful engagement with the content. Teacher's familiarity with these tools will help a great deal initially to modify the existing resources to suit the unique and diverse</td>
</tr>
<tr>
<td>2. <strong>Wikipedia Page creation</strong></td>
<td>Wherever appropriate videos are available and can add value to the students' understanding, they should be included in the classroom transaction. Students may refer to existing Wikimedia pages of popular educational institutes before creating their own. 1. Students may identify the places of educational value in their neighborhood for which a Wikipedia page is yet to be created.</td>
<td>Wikipedia represents one of the finest examples of building a knowledge community where each of us is free to contribute and benefit. These tasks are aimed at empowering students to contribute to the existing knowledge; initially on simpler terms and then gradually getting them to do more complex tasks like creating a book from Wikipedia pages. The task of creating a book from Wikipedia pages is suggested here keeping in mind the existing scenario in rural and poor urban settings where access to computers and internet is yet to reach the satisfactory level. This would enable teachers to create books based on children's areas of interest and then get them printed for their educational purpose. This can also be done to add needed resources for the school library.</td>
<td></td>
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</table>

| | or google play store etc and find the appropriate ones for completing the given tasks. 2. Tasks given for Image, audio or video editing should result in an outcome that can be used for educational purpose. Like creating a poster for a classroom, writing subtitles for a video in different language. | Currently most multimedia resources come with features that also enable systematic learner assessment. |

| Geogebra, Chemcollective, Jmol etc. Familiarising with how simulations are made. Discussion should be held about their educational value and how they can be integrated in classroom transaction. Students will use mind mapping tools to organise the ideas discussed in the above scenarios. 3. Students will build concept maps on content dealt in school textbooks to visualise the relationship between different concepts | | |
2. Students should be encouraged to create wikipedia pages in their home language.

Suggested mode of transaction

1. The theory and practice of ICT will not be split into discrete sections in terms of transaction. Most of the elements of ICT mediation course require practical work, however, the theoretical basis for many of these activities will be introduced through readings, class talks, lectures and group discussions.

2. Subject based tools will be introduced in the ICT Mediation paper. The institution may identify one teacher-educator who will take responsibility for the course transaction. However, the concerned subject teacher educator will transact Section 2 in Unit 1 and Section 1 in Unit 2 to introduce the tools relevant to their subject, so that the deeper pedagogical aspects are able to be explored while teaching the different subject based tools. This would facilitate the technology integration in all subjects. The evaluation of the lessons created must be assessed by the concerned subject teacher educator to assess whether the lesson demonstrates the pedagogic approaches for the subject. Such a “team-teaching” approach will be needed for ICT mediation paper.

3. Further, ICT mediation can be a useful way to bring pedagogic integration across subjects; this will be taken up through a holistic project based approach, cutting across different subject areas to explore an idea/topic. For instance, a group of student teachers can take up a project on ‘Water’ and access, create digital resources on this topic, that has connections to mathematics, science, social science and language.

4. Practical sessions will be conducted in the ICT laboratory, which must be equipped with a laptop connected to a slide projector, white board and student-teachers having access to computers with Internet connectivity. The theory-practical split of transaction time (hours) is as follows for the Units 1 and 2 of Year 1.
**Suggested mode of assessment**

The student teachers will be assessed in three parts with a suggested split as follows:

<table>
<thead>
<tr>
<th>Participation in the class/ course platform/ forum</th>
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<tbody>
<tr>
<td>Portfolio of digital outputs</td>
<td>10</td>
</tr>
<tr>
<td>Conducting a class integrating digital tools and resources in one subject (this should pertain to the topic for which the portfolio has been submitted for assessment)</td>
<td>10</td>
</tr>
</tbody>
</table>

The relative weights of these parts can also be determined by the individual institution. The criteria for each are discussed below.

**Participation in class and virtual forums**

1. Participation in class discussions, sharing ideas/experiences,
2. Volunteering for tasks/ responsibilities and helping peers.
3. Quality of interactions on the email forum and evidence of collaboration and participation

**Portfolio submission**

As part of Units 1 and 2, student teachers are to create resources and lessons. Each student teacher will identify a topic for the purposes of portfolio submission. This topic will be part of the core subject chosen by the subject teacher (from amongst mathematics, science, social science and language). The student teacher will be encouraged to also explore (access, create, revise) digital resources that connect this topic to more than one of these subjects. The submission should also include a ‘meta-document’ which will record their observations, analyses, critical evaluation and reflections on the resources collated. The meta-document will also provide a navigation to the resources for the assessor. The student teachers’ ability to evaluate ICT resources and ability to generate meta-knowledge through organizing digital resources is to form the basis of assessment. The resources will be stored by the student-teacher in relevant folder (with sub folders) and the soft copy of the same submitted for assessment at the end of the year.

The resources and lessons will be assessed based on the appropriateness in the given context and for the stated purpose. These resources will be assessed based on clarity and coherence of ideas presented, appropriateness of the choice of resource creation methods, presentation style, complexity of effort and the overall effectiveness of the resource in communicating an idea. The assessment of the portfolio will be done by the teacher teaching this course, working with the teacher teaching the relevant subject(s) to which the topic pertains to. The use of resources in the overall lesson sequence should
demonstrate a fit with current pedagogic approaches and go beyond. The extent of linking the topic to multiple disciplines will also be assessed.

**Conducting a ‘digital class’**
The student-teacher’s ability to integrate the digital tools (both subject-based applications and generic applications) for transacting the lesson will be assessed. Has the use of these tools improved the presentation of the topic, has it helped in employing the 5E approach (or any other approach) in a manner that has aided learning? Is the transaction supporting learners to actively engage with the issue and provoke their thoughts and responses?

How is the student-teacher using these digital tools to assess the understanding of the learners during the transaction processes (formative assessment). How is the student teacher using these tools for improving the class participation, and for inclusion?

Note – the institution may decide to drop the third component ‘conducting a digital class’ and do only the first two components. Also, the student-teacher can be asked to conduct the digital class on the same topic on which she has prepared her portfolio. In such a case, the presentation will provide inputs to the teacher-educator on the understanding of the student-teacher with regard to the portfolio, the topic being presented and the understanding of ICT mediation.

**IV. Special expertise required**
All teacher-educators will be required to develop skills for this paper as per the curriculum. The teacher educators would also need to become familiar in using the different educational applications for their subject teaching.

Teacher educators can explore a team teaching approach for transacting this course, since in the laboratory, more than one person may be required to facilitate the learning. Student teachers who are already comfortable in using ICTs may also be roped in by the teacher-educators as support faculty for facilitating the transaction of this course.

**V. Suggested Readings**
- GeoGebra | Powerful, Free Online Graphing Calculator and Interactive


Course Title: Learning and Teaching
Course Number: HC06
Semester: 4
Credits: 1
No. of Instructional hours: 26
Total Marks: 50

Rationale for the course:
This course brings together perspectives from other courses and draws upon theoretical frames from psychology, philosophy, sociology, and language learning. It offers student-teachers an opportunity to critically reflect on notions of learning and teaching that they have formed from their own experience, and to move beyond them. They need to appreciate that learning encompasses many dimensions: knowledge, skills, values, beliefs, attitudes, and habits. Student-teachers will understand theories of learning as conceptualized currently within psychology and cognitive science. Student-teachers will engage theoretically and empirically with the notion of learning as construction of knowledge. Finally, they will form strong images of what powerful learning in a classroom can be, its relationship with learners’ motivation, and develop analytical tools to understand such learning. Student-teachers will appreciate that all teaching is directed at learning, and that the learner is at the heart of teaching. They will critically question the widespread belief that teaching is telling/informing/demonstrating, and understand culturally responsive teaching approaches that support learning. They will explore the activity of teaching in a formal setting, and appreciate it as a contextually located, highly complex enterprise, that cannot be reduced to techniques. They will critically engage with an instructional model to analyse how it can scaffold students’ learning. Student-teachers will evaluate teaching as a profession, reflect on their beliefs and practices, multiple responsibilities located in an institutionalized setting, and the need and opportunities for professional growth.
Objectives of the course:

- Understanding the processes of learning
- Understanding the needs of the learner
- Appreciating teaching as a complex activity
- Analysing teaching in diverse classrooms
- Evaluating teaching as a profession

Course Organisation:

UNIT 1: Learning and the learner – Conceptual and Procedural Learning; Theories of learning; Learning as construction of knowledge; Constructivism and Conceptual Change; Learning in and out of school; Diverse needs of learners.

UNIT 2: Teaching and the teacher – Teaching as a complex enterprise; Teaching for understanding; 5 E instructional model; Teaching as a profession; Teacher as a reflective practitioner.

Critical questions to reflect:

- How do we learn concepts?
- How do we learn skills?
- What are the insights for teachers from Piaget’s theory of learning in terms of schemas and structures?
- Why is an understanding of ZPD important for teachers?
- How do we teach so every child learns?
- Why is it difficult to reduce teaching to methods and strategies?
- What are the primary factors that influence teaching?
- What does reflection on teaching entail?
- How can one evolve as a reflective teacher?

Tasks

- Observe a classroom and study the following:
  i) What kinds of learning are taking place? Were all children participating? How did the teacher support learning of all children? How was the class organized? Discuss with the teacher what she had planned and what changes she made and why. Write a reflective report.
  ii) If you were to teach the same class you observed, how would
you do it? What aspects of the teacher’s plan will you retain and what changes would you make, why? Describe your plan.

- Study videos of classroom transactions (either from the collection that the teacher education institute maintains of teachers/student-teachers/demo classes of teacher educators or the available on the internet). Note how the classroom is organised, how the teacher engages the students, resources used by the teacher, how s/he begins/ends the class/transitions between activities, the examples/metaphors used, the quality of teacher-student interactions, level of engagement of students, the general classroom climate, classroom management techniques used by the teacher and so on. Share your observations in a group and reflect on differences and similarities in your observations. As a group, prepare a report based on your collective observations, without evaluating the transaction or passing judgment on the teacher.

- Study a variety of examples of children’s work. What do they tell you about how children learn and the factors that have a bearing on their learning?

- Study published diaries of teachers (Ex: Hemraj Bhatt’s *The Diary of a School Teacher*, Gijubhai Badheka’s *Divasapna*) and write a report on the insights you gained from the teacher’s experiences.

**Suggested methods of transaction:**

The course will involve students integrating the study of academic texts with visits to schools and other field sites, and the analysis of a variety of records of learning and teaching. These should include videos of lessons, examples of children’s work, records that capture a variety of images of learning and teaching. Student participation will be in an inquiry mode, involving planning, exploration, sharing and reflecting, analytical writing, and studying teachers’ diaries.

**Suggested Assessment methods:**

Participation in class; Participation and Completion of tasks, Quality of reports;

**Essential Readings:**

Unit 1

- Vygotsky, L. (1997). Interaction between learning and development. In M.


**Unit 2**


**Additional Readings:**

- Wolfolk, Anitha.(2004). *Educational Psychology*.Pearson publications.(Chapter 8 & 12 – Classroom Assessment and Grading.)


Rationale

Learning science should help students develop certain habits of mind like critical enquiry, rational thinking and at the same time foster deeper understanding of the concepts. Science teachers need to be equipped to do so.

In order to teach science, it is important to understand one’s own notion of science. The teachers view on nature of science gets reflected in the teacher practices. The questions on how does knowledge gets validated in science are important to engage with. It is also important for the teachers to examine the relationship between science and society and understand social impact of science and vice versa.

Also as teachers it is important to understand the aims of teaching science, engage with the secondary curriculum and the key concepts. They should be able to analyse the relevance and limitations of various curricular resources including textbooks. Teachers need to engage with children’s ideas in science and teach in ways that bring about deeper conceptual understanding about the natural world. In order to make the curriculum relevant and engaging, teachers need to be able to plan flexibly keeping the children’s context in mind. As teachers they need to plan assessment in ways that check for genuine understanding of scientific concepts, while also meeting curriculum requirements. Above all teachers need to continuously reflect on their practice in order to ensure meaningful learning for all children.
Objectives of the course

- Understanding key concepts related to secondary school physical science
- Critically analysing the secondary school physical science curriculum
- Exploring children’s ideas about physical phenomenon and properties of matter
- Planning for teaching physical science – selecting appropriate methods, classroom interactions etc
- Identifying, designing and using resources for teaching physical science
- Developing appropriate assessment processes in physics and chemistry

Course Organisation

UNIT 1: **Revisiting key concepts**

- Matter
- Energy
- Air (Physical and chemical properties)
- Heat and Energy
- Light and Sound

UNIT 2: **Analysing the secondary school physical science curriculum**

- Progression of key concepts across grades in the curriculum
- Mapping curriculum content in terms of key concepts
- Alternative ways of organizing concepts
- Understanding grade level learning outcomes

UNIT 3: **Learners’ ideas about physical phenomenon and properties of matter**

- Reviewing research about children’s ideas
- Probing and analysing children’s ideas
- Identifying gaps in children’s understanding and addressing to it

Unit 4: **Planning for teaching and Organisation of science classrooms**

- Methods, approaches and strategies for concept learning
- Identifying, designing and using resources for teaching chemistry
Developing teaching learning plans for specific concepts
Planning instruction for diverse learners
Reflections on teaching and students’ learning
Managing resources and time
Organising laboratory work, setting up improvised labs

Tasks:

- Interview few teachers of a school on purposes of teaching science.
- Visit a school/ organisation where innovative approaches in science teaching is practiced.
- Observe a classroom teaching of science (unit or a lesson) and analyse how it maps to curricular aims of teaching science.
- Observe classroom teaching of science and evaluate the classroom dynamics with respect to equity and socio-cultural issues.
- Observe a classroom or view a video of a science classroom and analyse how the classroom is organized, the pedagogic approaches, teaching learning resources and classroom management techniques used by the teachers.
- Prepare and administer a test to ascertain students’ alternate conceptions relating to a topic of your choice.
- Short, reflective assignments. Some examples: Analyse a lesson and elicit how science is presented in the textbook based on your understanding of nature of science.

Analyze the aims of teaching science in a state curriculum. Study a topic in science textbooks across classes 6 to 10 and analyse the extent to which the aims are reflected in the textbooks.

Analyze a range of teaching learning resources to study their efficacy for learning science concepts for diverse learners. Suggest ways of improving them.

Analyze a range of lesson plans for any one class of any one topic to study how far they are able to meet the aims of science education and cater to the needs of diverse learners. Suggest ways of improving them.

Suggested mode of Transaction:

Foster discussions, critical enquiry, debates, reading and sharing of views and texts.

Some examples:

The students could be asked to read parts of the text and debate/ present the summary based on few questions which might help close reading of texts.
The students could view AV resources or watch a movie with some questions in mind and discuss the same.

Newspaper articles based on science and society could be collected by students and review/present the same in groups.

Guest faculty/scientists could be invited to present a seminar/guest lecture.

Teachers could be invited to classroom to share their experience of teaching of science and curricular approaches.

Suggested mode of assessment:

- Formative assessment of participation/performance during all classroom activities including discussions
- Written questionnaires to ascertain contextual understanding
- Worksheets to assess comprehension of reading materials
- All practical to be assessed both in terms of products (reports, resources, etc..) and processes (participation, teamwork, research, etc.,)

Essential Readings

UNIT 1: Revisiting key concepts

- NCERT Science textbooks (Classes 9 to 12). New Delhi: NCERT.
- HBCSE. Experimental Problems in Chemistry. Mumbai: HBCSE.
- https://edu.kde.org/kalzium/

UNIT 2: Analysing the secondary school chemistry curriculum

- NCERT. Learning Indicators and Learning Outcomes. www.ncert.nic.in.
UNIT 3: Children’s ideas about Physical phenomenon and properties of matter.


Unit 4: Planning for teaching and Organisation of Science Classrooms


Additional Readings:


- Eklavya. Balwaigyanik (Classes 6 to 8). www.eklavya.in.


Bengaluru Central University
B.Sc.B.Ed Programme

Course Title: PCK of Languages – Kannada - Part 2
Course Number: SC02
Semester: 4
Credits: 2
No. of Instructional hours: 52
Total Marks: 100

1. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.
2. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.
3. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.
4. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.
5. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.
6. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.
7. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.
8. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.
9. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 교육과정 및 교육 과목, 배경 도와 지시한다.

제시성: 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다. (10 점)

1. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다.
2. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다.
3. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다.
4. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다.
5. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다.

제시성: 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다. (15 점)

1. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다.
2. 코스를 코오루드 행하여 고등 교육 및 전문 교육, 그리고 교육과정 및 교육 과목, 배경 도와 지시한다.
2.3  ಸ್ಫೂರ್ತಿಕರಣ ಸರ್ವಸ್ವದ ಸಂಬಂಧಿಸಿದ್ದು ಮಾರ್ಗಾಧಿಕೃತಿ.
2.4  ಕೇಂದ್ರ ಸ್ಫೂರ್ತಿಕರಣ ಸರ್ವಸ್ವ ಸಂಬಂಧಿಸಿದ್ದು ಸೂಚಿಸ ಪಟ್ಟೆ.
2.5  ಸ್ಫೂರ್ತಿಕರಣಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಜಗತ್ತಾಧಿಕೃತಿ, ವೃತ್ತಿ.
2.6  ಕೊನೆಗೆ ವಿವರಣೆಗಳು: ಸಂಬಂಧಿತ ಸಂಬಂಧದ ಸಹೋದರಿಯರು ತಿಳಿದಿರಬಹುದು.

ಜಾನಿಸ್-3: ನಾಂಕಿ, ಸುಭೇ, ಅಭಿವೃದ್ಧಿ, ಓದಿಗೆ ವ್ಯಕ್ತಿಯಾಗಿ ಬಾರೆಗೆ (14 ಅವತರಿಗೆ)

3.1  ನಾಂಕಿ ಬಾರೆಗೆ: ಪ್ರಧಾನಕಾಯಿ, ವಿಜ್ಞಾನ, ಸ್ವೀಕಾರಿಸಿದ್ದು ನಿರ್ಧಾರಿಸಿದ್ದು, ತಿರುಬೆಯು ಮತ್ತು ಪ್ರಮೇಯವಾದ ವಿಷಯ.
3.2  ಸುಭೇ ಬಾರೆಗೆ: ಪ್ರಭಾವಕಾಯಿ, ಹಿಂಸೆಯನ್ನು, ಸ್ವೀಕಾರಿಸಿದ್ದು ನಿರ್ಧಾರಿಸಿದ್ದು, ಮತ್ತು ಸ್ವಾಯತ್ತಿಸಿದ್ದು, ತಿರುಬೆಯು ಮತ್ತು ಪ್ರಮೇಯವಾದ ವಿಷಯ.
3.3  ಅಭಿವೃದ್ಧಿ ಬಾರೆಗೆ: ಸೃಷ್ಟಿಯನ್ನು, ವಿಶೇಷಾಧಿಕೃತಿಯನ್ನು ಕಂಡ ಸ್ಥಳದಲ್ಲಿವೆ, ಅಭಿವೃದ್ಧಿ ಬಾರೆಗೆಯನ್ನು ನಿರ್ಧಾರಿಸಿದ್ದು.
3.4  ಓದಿಗೆ ಬಾರೆಗೆ: ಕೇಂದ್ರದೊಡ್ಡ ಕಾನೂನು, ಸ್ವತಂತ್ರತೆಯನ್ನು, ಸ್ವೀಕಾರಿಸಿದ್ದು ಮತ್ತು ಪ್ರಮೇಯವಾದ ವಿಷಯ.
3.5  ಓದಿಗೆ ಬಾರೆಗೆ – ವಿವಿಧ ವ್ಯಾಪ್ತಿಗಳು ಮತ್ತು ನಿರ್ಧಾರಿಸಿದ್ದು.
3.6  ಓದಿಗೆ ಬಾರೆಗೆ: ಸಂಬಂಧಿತ ಸಂಬಂಧವಾಗಿ, ಸ್ವತಂತ್ರತೆಯನ್ನು, ಸ್ವೀಕಾರಿಸಿದ್ದು ಮತ್ತು ಪ್ರಮೇಯವಾದ ವಿಷಯ.

ಜಾನಿಸ್-4: ಮುಖ್ಯ ಬಾರೆಗೆಕವನ್ನು ನಿರ್ಧಾರಿಸಿದ್ದು (13 ಅವತರಿಗೆ)

4.1  ಮುಖ್ಯ ಬಾರೆಗೆಕವನ್ನು ನಿರ್ಧಾರಿಸಿದ್ದು: ಸರ್ವಸ್ವದಿಕ್ಷೆ ಅಧ್ಯಯನ, ಸರ್ವಾಷ್ಟಿಗಾಧಿಕೃತಿ ಅಧ್ಯಯನವು – ರಾಜ್ಯ.
4.2  ಮುಖ್ಯ ಬಾರೆಗೆಕವನ್ನು ನಿರ್ಧಾರಿಸಿದ್ದು: ಸರ್ವಾಷ್ಟಿಗಾಧಿಕೃತಿ ಅಧ್ಯಯನವು, ರಾಜ್ಯ.
4.3  ಮುಖ್ಯ ಬಾರೆಗೆಕವನ್ನು ನಿರ್ಧಾರಿಸಿದ್ದು: ಸರ್ವಾಷ್ಟಿಗಾಧಿಕೃತಿ ಅಧ್ಯಯನವು, ರಾಜ್ಯ.
4.4  ಮುಖ್ಯ ಬಾರೆಗೆಕವನ್ನು ನಿರ್ಧಾರಿಸಿದ್ದು: ಸರ್ವಾಷ್ಟಿಗಾಧಿಕೃತಿ ಅಧ್ಯಯನವು, ರಾಜ್ಯ.

ಪ್ರಸಿದ್ಧಿಗಳು: ಆಧುನಿಕ ಕ್ರಮವಿನ ವಿಭಾಗಗಳು (ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣದ ಸಂಬಂಧಿಸಿದ್ದು)

1. ಕೆಲವು ವಿದ್ವಾಂಸ. ತಮ್ಮು ವಿದ್ವಾಂಸ, ಸಂಬಂಧಿಸಿದ್ದು ಸಂಬಂಧಿಸಿದ್ದು ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣದ ಸಂಬಂಧವನ್ನು ಮಾಡಿದರು. ತಮ್ಮು ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣ.
2. 9,10/11ಕ್ಕೆ ಸಂಬಂಧಿಸಿದ್ದು ವಿದ್ವಾಂಸ, ತಮ್ಮು ವಿದ್ವಾಂಸ, ಸಂಬಂಧಿಸಿದ್ದು ಸಂಬಂಧಿಸಿದ್ದು ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣದ ಸಂಬಂಧವನ್ನು ಮಾಡಿದರು. ತಮ್ಮು ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣ.
3. ಯವತ್ತಿಲ್ಲ ಎಂದು ಸಂಬಂಧಿಸಿದ್ದು ಸಂಬಂಧಿಸಿದ್ದು ಸಂಬಂಧಿಸಿದ್ದು ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣದ ಸಂಬಂಧವನ್ನು ಮಾಡಿದರು. ತಮ್ಮು ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣ.
4. ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣದ ಸಂಬಂಧಿಸಿದ್ದು ಸಂಬಂಧಿಸಿದ್ದು ಸಂಬಂಧಿಸಿದ್ದು ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣದ ಸಂಬಂಧವನ್ನು ಮಾಡಿದರು. ತಮ್ಮು ಪ್ರತಿಯಾದ್ಯಾಗ್ರಹಣ. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.1, 4.2, 4.3, 4.4.
23. Ram S.K., et.al, Reading in Language and Language Teaching. NCERT, New Delhi, 1983.
27. ःऋमितिः., चर अत्य चर अत्यय अत्र दुधेनः. अहुआ 2010.
30. ಗೆದೆದು ಸುಂದರಿ, ಭೀಮಾರುವುಳುಸುಂದರಿ. ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ರಾಜ್ಯಾಲಯ.
31. ರಾವಿ ಸುಂದರಿ, ವಿಜಯ ರಾಜ. ರಾಜ್ಯಾಲಯ ಸಂಸ್ಥಾನ, ರಾಜ್ಯಾಲಯ. ೨೦೦೭
32. ಶ್ರೀಮತಿ ಸುಂದರಿ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ. ರಾಜ್ಯಾಲಯ. ೨೦೦೫
33. ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ. ರಾಜ್ಯಾಲಯ. ೧೯೯೬.
34. ಗೆದೆದು ಸುಂದರಿ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ರಾಜ್ಯಾಲಯ. ೨೦೦೨.
35. ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ಸಲ್ಲಿಸಿತರಾಟು ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ರಾಜ್ಯಾಲಯ. ೧೯೯೬.
36. ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ರಾಜ್ಯಾಲಯ. ೧೯೭೭.
37. ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ರಾಜ್ಯಾಲಯ. ೧೯೭೭.
38. ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ರಾಜ್ಯಾಲಯ. ೧೯೭೮.
39. ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ಸಂಸ್ಥಾನ ಮಾರ್ಗದೊಂದಿಗೆ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ. ರಾಜ್ಯಾಲಯ. ೧೯೮೩.
40. ಸರ್ಕಾರದ ಸಂಸ್ಥಾನ, ಸಂಸ್ಥಾನ ಮಾರ್ಗದೊಂದಿಗೆ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ. ರಾಜ್ಯಾಲಯ. ೧೯೭೫.
41. ಗೆದೆದು ಸುಂದರಿ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ನಾಮಕರಣ ಸಂಸ್ಥಾನ, ರಾಜ್ಯಾಲಯ. ೨೦೦೬.
Bengaluru Central University
B.Sc.B.Ed Programme

Course Title: PCK of Languages – English - Part 2
Course Number: SC02
Semester: 4
Credits: 2
No. of Instructional hours: 52
Total Marks: 100

Objectives: After completion of the course student teachers will:

- Acquire an understanding of the nature and structure of English language and its component skill.
- Acquire the theoretical knowledge of different methods and approaches and apply them in the classroom teaching.
- Develop core skills and reference skills among them.
- Understand the role and importance of language.
- Appreciate different forms of literature and inculcate the same in students teachers.
- Learn and use different aspects of testing and E-evaluation.
- Prepare and use different audio-visual aids and e-learning tools and use them in their classroom teaching effectively.
- Develop professional competencies among teachers in the making.
- Learn and use different techniques to design language games in teaching-vocabulary pronunciation, spelling, grammar and composition.
- Use innovative practices in teaching of English.
- Understand the importance of instructional objectives and taxonomy.
- Design/write a unit plan and lesson plan based on evaluation approach.
- Acquire knowledge of the sound system of English and to familiarize them with the appropriate terminology, to describe the sounds in English.
- Understand need and function of language lab.
- Use multilingualism as a strategy in the classroom situation.
- Understand constructive approach to language teaching and learning.
- Develop an insight into the relationship between curriculum and textbooks.
Unit-1. Content-Aspects of English Language (Content from 9th, 10th, 11th and 12th Standard of Karnataka State Syllabus (II Language)) (12 Hours)

1.1. Semantic Structure of English-meaning, components, homonyms, synonyms, Antonyms, Polysemy, connotative and denotative aspects.
1.2. Graphic structure of English-meaning, components unique features of spellings marks of punctuation, hand writing, illustrations are to be drawn from high school English textbooks.
1.3. Verbs-meaning and types-tenses and aspects.
1.4. Transformations of sentences-simple, complex and compound sentences, reported speech, active and passive voices and degrees of comparison.

Unit-2. Resources in Teaching of English (14 Hours)

2.1. Audio-aids-lingua phone-Audio cassettes, Radio Broadcasts, Visual aids, charts, three dimension pictures, flash cards, albums, A-V aids-Films, Videos and multimedia, language Lab their importance and uses in ELT.
2.2. Library as a resource in teaching and learning of English.
2.3. Literary activities in language teaching-debates, elocution-group discussion-field trips, quiz, seminars and workshops and their importance.
2.5. Computer assisted learning in English, use of internet and websites, advantages of using different software in learning of English.
2.6. Steps of designing lesson plan in English for power point and multimedia applications and their advantages.

Unit 3. Methods, Techniques and Approaches (16 Hours)

3.1. Language curriculum, meaning and principles (with reference to NCF2005) and teaching language through literature-concept and types of literature.
3.2. School textbooks in English -characteristics and review of present textbooks of 9th, 10th 11th, 12th.
3.3. Work books in English, steps and uses.
3.4. Teaching of Vocabulary- Types, importance and techniques of enriching Vocabulary.
3.5. Teaching of Grammar—meaning, importance types, steps in teaching functional grammar.

3.5. Techniques of teaching spellings—Importance peculiarities, different ways of teaching of spellings, common errors and remedies.

3.6. Study skills: meaning, importance, types gathering skills, (Skimming and Scanning), (dictionary reference skills)—storage skills—note-making, note-taking, graphic presentation, browsing skills & summarization.

**Unit-4. Professional development of teachers**

(10 Hours)

4.1. Professional competencies of an English teacher, programmes for teacher empowerment—workshops, seminars, conference, panel discussion and projects.

4.2. Role of NCERT, DSERT, RIE, IEFL, British Council Library, Central Institute of Indian Languages to enhance the professional development of English Language Teachers.

**Practical Activities: (any one)**

Carry out the following practical activities and submit a report.

1. Practice in 46 sounds in English, (common for the group).
2. Preparation of passages/lesson on mechanics of reading
4. Techniques of teaching vocabulary/spelling through power point presentation.
5. Creating Language games
6. Remedial teaching of core skills.
7. Story telling.

**Reference Books:**

6. ELT web sites.
    Menon and Patel: Teaching of English as a foreign language, Baroda: Acharya
11. Raju T.N.: content cum methodology of teaching English. DSERT Publication, 2005
Objectives: After completion of the course student teachers will:

- Appreciate the importance of teaching Hindi as a second language in India and the aims and objectives of teaching it.
- Help pupils acquire the basic skills of language learning.
- Know the different methods of teaching different types of lesson in a second language and use them in his/her teaching.
- Prepare objectives based plans of lesson and teach accordingly.
- Appreciate the importance of suitable teaching materials in language teaching and prepare/select them for the use in his/her lessons.
- Know the principles of text book construction.
- Prepare and use appropriate tools of evaluation to measure the linguistic abilities of pupils.
- Know the entire syllabus prescribed for 8th to 10th standards in Hindi.
- Develop in himself the special qualities, aptitude and interests of a Hindi teacher.

Chapter I: गद्य शिक्षण: (Teaching of prose) (15 Hours)

1. हिन्दीशिक्षणमेंगद्य कार्यान्त
2. उद्देश्य
3. सौनान
4. गद्य पाठकृपकार
5. गद्य शिक्षणकीप्रणालियाँ

आ). व्याकरणशिक्षा (Teaching of Grammar)

1. अर्थपरिभाषा
2. आवशयकतात्त्वार्थर्थराज
3. उद्देश्य
4. व्यक्तिकृपकारार्थप्रणालियाँ
6. निगमन और आगमन प्रणालियों में अंतर
7. व्याकरण शिक्षण को प्रभावित करने के उद्देश्य

इ). कविताशिक्षण: (Teaching of Poetry)
1. कविताकीर्तिवादिक एवं महत्त
2. उद्देश्य
3. सौंपन
4. कविताशिक्षण की प्रणालियाँ

Chapter II: अ). रचनाशिक्षण: (Teaching of Composition) (15 Hours)
1. रचना का अर्थ और महत्त
2. अन्वेषण रचनाकी विशेषताएँ
3. रचना के मेध
4. मौखिक और लिखित रचना के उद्देश्य
5. प्रणालियाँ
6. रचना संबंधी सामान्य अनुभूतियों एवं सुझाव
7. रचनासंबंधी अनुभूतियों के कारण एवं सुझाव

आ). नाटकशिक्षण: (Teaching of Drama)
1. नाटक का अर्थ एवं महत्त
2. नाटकशिक्षण के उद्देश्य
3. नाटकशिक्षण की प्रणालियाँ

इ). अनुवादशिक्षण: (Teaching of translation)
1. अनुवाद और महत्त
2. अनुवादशिक्षण के उद्देश्य
3. अनुवाद के प्रकार
4. अनुवादशिक्षण की प्रणालियाँ

Chapter III. अ). हिंदी की पुस्तक (Hindi Text Book) (10 Hours)
1. पुस्तक का प्रयोग चर्चा 
2. पुस्तक के उद्देश्य
3. हिंदी की पुस्तकों के गुण 
4. पुस्तक का कारण
5. हिंदी की वर्तमान पुस्तकों की सीमाएँ 
6. पुस्तक में सुधार के लिए सुझाव

आ). हिंदी शिक्षण मे मूल्यांकन (Evaluation Hindi Teaching)
1. परीक्षा (वांकर) के आवश्यकता 
2. विभिन्न प्रकार की परीक्षाएँ
3. हिंदी प्रश्न पत्र
4. सविधान तक्ता (नीलनक्ता) उद्देश्य, रचना 
और निरीक्षण

Chapter IV. अ). हिंदी शिक्षण में श्रेय-दु:श्रेयसाधन (Hindi teaching and teaching Aids):
(12 Hours)
1. श्रेय-दु:श्रेयसाधन के आवश्यकताएँ एवं महत्त
2. शिक्षण के लिए उपयोगी प्रसंस्कर श्रेय-दु:श्रेयसाधन
3. श्रेय-दु:श्रेयसाधन के उपचार्यांक
4. गणकशृंखला और अन्तरजाल की उपयोग
आ). हिंदीकक्षाकाश्यामोरसहगामिक्रियान्य(Hindi teaching and co-curricular activities)

1. कक्षाशिक्षणकीसहगामिक्रियाएँ  2. विद्यालयपत्रिकामहत्व
3. वेरेक्निफ्यूर्टनकामहत्वलाभसीमा  4. वादविचारप्रतियोगिता
5. कक्षाप्रतियोगिता ।

इ) गृहाकार्य : (Home assignment)

1. गृहाकार्यका火灾ैवमहत्व  2 सिद्धांत
3. हिंदीशिक्षणमेंगृहाकार्य  4. गृहाकार्यकक्षाविशेषताएँ।

प्रायोगिककार्यक्रियाएँकेिन्द्रु :- (Practical Activities)

1. हिंदीपुस्तकोकार्यसििता (सर्वे)
   कक्षा 8, 9, व 10 कीहिंदीपुस्तकोकार्यसिितकस्वयंसेवकलेखलिन्यः।
2. उच्च विद्यालयकीहिंदीपुस्तकोकार्यसेवितकवियांकेिवारेिमेंसूचनाएँकक्षेत्रीकृित
   कीजिए।
3. हिंदीविद्यालयकीभाषालेखकलना (कोशल) केिविकाससिितकलेखलिन्यः।
4. उच्च विद्यालयकिपाठपुस्तककेिआधारभाषा-कोशलकेिविकासकेिलिए,
   गतिविधियाँ केिवालीकीजिए।
5. विद्यार्थियोंमेंसमूहाधीनकेिकार्यक्रमकेिलिएकक्षेत्रीकार्यक्रियाकीजिए।
6. गणकवंत्रकीप्रयोगकरतेिमेंएकक्षेत्रील श्रेणी-दुर्बलसाधनोंकीवाणी।

आयामङ्ग्रे:-

1. दिनेशचन्द्र भारदास-हिंदीबालाकृिक्षणविवोद्पुस्तककंडलिखित, आगरा
2. हिंदीशिक्षण-राहस्प्रकाशन, जयपुर
3. नूतनहिंदीशिक्षण-प्रौ.सातीगा, कराटक
4. हिंदीशिक्षण-संजीवपश्चिमकंड, जयपुर-३, १९९८
5. डा. की.गोपाल-मानकहिंदीवाचक औरस्थान, राजस्थानीशिक्षकअनुसंधानऔर
   प्रशिक्षणसंस्थान
6. बिजयमुल्ल-हिंदीशिक्षणविविधीय-टूडपशिमकंड, लुधियाना
7. पतिमन-नीमहिंदीव्यक्तकेशाशिक्षण, नैनीतापुरकंड, १९९५
8. भाईयोगेन्दुजितेण्डुन्थाइयोगेन्दुजित, शिक्षाशिक्षकोंपुरेिखा-विनोदपुस्तक
मंदिर, आगरा।

२. सफलशिक्षणकला–पी.डी.पाठक, विनोदप्रकाशन, आगरा

३. शिक्षाके सिद्धांत–पी.डी. पाठक, टाटात्यागी, विनोदपुस्तकमंदिर, आगरा

४. शिक्षण सिद्धांत–डॉ. लक्ष्मीनारायण शर्मा, विनोदपुस्तक मंदिर, आगरा

५. भाषा शिक्षक प्रबंधन–किशोरीलाल शर्मा, मेहराउमा एण्ड कम्प्युटर, आगरा

६. हिंदी शिक्षक–कृषिविद्यालयाध्यक्ष एण्ड सार्वजनिक, दिल्ली

७. भारतेंस्मातू भाषाशिक्षण के लिए सुझाव–रविंद्र उण्डल, आलवड, आगरा

८. अद्यावकाश–सौराष्ट्र मण्डल, नारायण एण्ड संस्थान, वाराणसी

९. हिंदी बाँधव–भाँदोगे, जीत, विनोदपुस्तकमंदिर, आगरा

१०. हिंदी वाखरण–कमलाप्रसाद गुरु, विनोदपुस्तकमंदिर, आगरा
Bengaluru Central University
B.Sc.B.Ed Programme

Course Title: Arts and Craft in Education
Course Number: EPC04
Semester: 4
Credits: 1
No. of Instructional hours: 26
Total Marks: 50

Rationale
The National Curriculum Framework-2005 has introduced arts education as a mainstream curricular area, which must be taught in every school as a compulsory subject in every school. It is 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 in the school system should be sensitised to understand and experience the use of Arts for holistic development of the learner. The course is meant to equip student-teachers to do this as well as act as a conduit for self-development both as a teacher as well as an individual.

Objectives of the Course
• Understanding basics of different Art forms – impact of Art forms on the human mind
• Enhance artistic and aesthetic sensibility among learners to enable them to respond to the beauty in different Art forms, through genuine exploration, experience and free expression
• Enhance skills for integrating different Art forms across school curriculum at secondary level
• Enhance awareness of the rich cultural heritage, artists and artisans.

Course Outline - PRACTICAL
• Experimentation with different materials of Visual Art, such as pastel, poster, pen and ink, rangoli materials, clay, etc.
• Exploration and experimentation with different methods of Visual Arts like Painting, block printing, collage, clay modelling, paper cutting and folding, etc.
• Paper framing and display of Art works.
Theme-based projects from any one of the curricular areas covering its social,
economic, cultural and scientific aspects integrating various Arts and Craft forms; Textbook analysis to find scope to integrate Art forms either in the text or activities or exercises; Documentation of the processes of any one Art or Craft form with the pedagogical basis such as weaving or printing of textiles, making of musical instruments, folk performances in the community, etc. – how the artist design their products, manage their resources, including raw materials, its marketing, problems they face, to make them aware of these aspects of historical, social, economic, scientific and environmental concerns. Student-teacher should prepare at least ten lesson plans in their respective streams of subjects (Science/Maths/Social Sciences/Languages etc.) while integrating different art forms

**Workshop**

Two workshops of half a day each, of one week duration for working with artists/artisans to learn basics of Arts and Crafts and understand its pedagogical significance. The Arts forms learnt during the course should be relevant to the student-teachers in their profession. Activities, such as drawing, and painting, rangoli, clay modelling, pottery, mixed collage, woodcraft, toy making, theatre, puppetry, dance, music, etc. region specific should be given more importance for making arts learner-centred. The focus of the workshops should be on how art forms can be used as tool/ method of teaching-learning of Languages, Social Sciences, Mathematics and Sciences.

**Suggested mode of transaction:**

Every student-teacher must participate and practice different Art forms.

They need to be encouraged to visit places of arts/see performances/exhibitions/art and craft fairs/local craft bazaars, etc.

Artists and artisans may be invited for demonstrations and interactions from the community.

Student-teachers should be encouraged to maintain their diary on art interactions to enhance their knowledge and awareness in this area.

Student-teachers can also be motivated to interpret art works/ commercials/events etc. to enhance their aesthetics sensibility.

A Resource Centre for Arts and Crafts should be a part of all the RIEs, where materials, including books, CDs, audio and video cassettes, films, software, props, art works of Regional and National level, books and journals must be displayed for the purpose of reference and continuous motivation.

Application of Arts and Aesthetics in day-to-day life, in the institute and in the community are some of the practical aspects, which needs to be taken care too. Student-teachers must organise and participate in the celebrations of festivals, functions, special days, etc.

**Suggested Mode of Assessment**

The engagement of student-teacher in the above set of experiences should be assessed on continuous and comprehensive manner, based on (a) submission of work/project; (b) participation in the activities; (c) creative potential displayed; (d) application of aesthetic sensibility in campus events and in other course activities.
V SEMESTER

Bengaluru Central University
B.Sc.B.Ed Programme

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Contemporary India and Education</th>
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<td>Course Number</td>
<td>HC 07</td>
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Rationale
This course is meant to provide an understanding of contemporary realities in India vis-à-vis the current educational scenario in the country. The course involves a study of contemporary concerns in education through key historical, political, sociocultural and economic issues within inter-disciplinary frameworks.

Student-teachers need to appreciate how social diversity in India enriches our life and at the same time poses challenges for universal education. They need to understand that diversity exists at any levels, at the level of the individual, of regions, languages, religions, castes, tribes, etc. Diverse communities and individuals have diverse knowledge and experience bases and thereby place different sets of demands from education. As future teachers, they have to don the role of grooming children to respect diversity and at the same time establish frameworks for collective living and resolution of tensions peacefully and justly.
Objectives of the course:

- Understanding the concept and context of universalization of school education
- Appreciating the need to maintain the pluralistic fabric of Indian Society
- Recognising that diversity exists at many levels and the need for inclusive education to meet diverse needs
- Understanding the constitutional provisioning, the legal and policy imperatives in meeting the needs of marginalized children
- Understanding the crucial role of teachers in universalization of school education and in making inclusive education a reality

Course Organisation:

UNIT 1: Universal Elementary and Secondary Education – When did UEE & USE evolve; how did it shape up in India: Wardha & Jomtein Education Conferences.

UNIT 2: Diversity, Inequality & Marginalisation – Characteristics of India’s pluralistic society; Inequality, discrimination and marginalisation; Social diversity as enriching; Challenges that diversity poses for universal education; Existence of diversity at multiple levels; Inclusive education to meet diverse needs.


UNIT 4: Role and agency of teachers in the context of universal and inclusive education – Sensitising children to respect diversity, including towards persons with disabilities; establishing frameworks for harmonious living in a diverse community; Educating children on resolving conflicts peacefully and justly; Classroom organisation and resources based on Universal Design Principles.

Critical questions to reflect:

- What does it mean to universalize school education?
- How did the idea of UEE evolve historically? Why is it considered important for all countries to ensure UEE/USE?
- What does the concept of social diversity entail? How does it both enrich our life as well as pose a challenge for universal education?
What are the primary causes for marginalisation of some groups of children in education? How are these being addressed in contemporary India?

What are the major impediments to fulfilling the constitutional rights of freedom, justice, equality and fraternity bestowed on all Indians?

How can teachers don a pro-active role in ensuring inclusive education? What are the opportunities and challenges she would face?

Tasks:

1. Prepare and present seminar paper on the following topic
   - Role of mass media in education
   - Modernisation and social change
   - Impact of globalisation on education in India
   - Social responsibilities of youth
   - Student unrest causes and remedies
   - Role of education in national economy

2. Group project (through reference work, focus group discussions of stakeholders, surveys on one of the topics): Reservation as an egalitarian policy; Aspirations for common neighbourhood schools; Stratification of schools according to localities/class/religious affiliation/school boards; Nature and extent of Implementation of RtE 2009.

3. Study the national education policies of India (1968, 1986 & the proposed new policy). What are the similarities and differences in their articulation of the primary goals of education? Analyse the reasons for the continuities and changes.

Essential Readings:

Unit 1:


PROBE Team (India), & Delhi School of Economics (Eds.). (1999). *Public report on basic education in India*. New Delhi: Oxford University Press.

Unit 2:


Unit 3:


Unit 4:


Additional Readings:


Suggested mode of transaction:

Reading, discussions and reflections of the suggested readings; Discussions on case studies; Analyses of educational statistics; Field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.

Suggested Mode of Assessment:

Participation in classroom discussions; Seminar presentation; Project work.
Bengaluru Central University
B.Sc.B.Ed Programme

Course Title: Optional Course – Guidance and counselling

Course Number: HC8

Semester: 5

Credits: 1

No.of Instructional hours: 26

Total Marks: 50

Objectives of the course:

- Understand the need and importance of guidance and counselling.
- Familiarize student teachers with types of guidance and counselling.
- Develop awareness among the student teachers about the tools & techniques of guidance.
- Aquatint the student teachers about the guidance and counselling services in the educational institutions.
- Develop counselling skills in the student teachers.
- Develop understanding about the role and professional ethics of the counsellor.

Course Organisation:

UNIT 1: Guidance and Counselling

- Types of Guidance – Individual and Group Guidance
  Educational, Vocational, Personal guidance meaning, objectives, need and importance.
- Principles and organization of Guidance Services in educational institutions.
- Educational and informational services – Dissemination of information through Career talk, Career Exhibition, Class talks, Career resource center, their importance and organization.

UNIT 2: Counselling

- Meaning, Nature, Objectives and importance of Counselling, differences between Guidance and Counselling.
• Role and qualities of a Counsellor, Professional code of ethics in Counselling.
• Counselling skills – Attending behaviours, Building rapport closed and open ended- Questioning, Active listening, Paraphrasing, Summarizing.
• Common behavioural problem of Adolescents – Addictions, Aggression, Anxiety, Truancy, ADHD, causes and interventions.

Tasks:

Carry out the following practical activities and submit a report.

1. Conduct a case study.
2. Organise any one of the following activity:
   • Career talk, Career Exhibition, Class talk.
3. Administer any one of the following Psychological tests on 5 Secondary school children:
   • Intelligence test, Aptitude test, Personality test.
4. Organise a counselling session for a student or group.
5. Organise a Career Exhibition.

Essential Readings:
• B.Stanley, School Counselling for the Twenty First Century, New York, 1992.
• Gibson, R.L & Mitchell, M.H, Introduction to Counselling and Guidance, New Delhi, 2003
• සුල්තන්නාහින්දුන්ත පුළුවන්ගීම් – මුළුකාභය.
• සුල්තන්නාහින්දුන්ත පුළුවන්ගීම් – කොටස්ස්ඨීස්වපැස්සය.
• මුළුක විහාරය කැටයෝභය – නොහැක.
• කොටස්ස්ඨීස්වපැස්සය – නොහැක.
• කොටස්ස්ඨීස්වපැස්සය – නොහැක.
**Bengaluru Central University**  
**B.Sc.B.Ed Programme**

<table>
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**Rationale**

This course aims at broadening notions of student-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 socialisation. Thus, transformed student-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 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 modelled 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 student-teachers may be discussed.

**Objectives of the course:**

- Understand the concept of peace education.
- Recognize the significance of peace education in National development.
- Examine the relationship between Peace and Education.
- Appreciate the contributions of great educational philosophers.
• Imbibe the knowledge, attitudes and skills needed to achieve and sustain a global culture of peace.

**Course Organisation:**

**UNIT 1:** Nature and concept of peace education
Concept of Peace Education- Political, Social, Spiritual, Economical and Cultural.
• Role of Education in promoting peace in Indian context.
• Basic principles to promote peace.
• Need of peace education in the Era of Globalization.
• Challenges to peace: Stresses, conflict, crime, terrorism, violence and wars resulting in poor quality of life.

**UNIT 2:** Methods and approaches of peace education
• Critical reflection on the curricular processes Awareness of opportunities inherent in curriculum for introducing
• (i) 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;
  (ii) symbols, activities and other structures in the school that reflect a multi-cultural ambience; and
  (iii) experiences of different cultural identities, issues, challenges, conflicts in the neighbourhood, or country and global levels with regard to resources, opportunities of poverty, level, political issues, etc.
• Critical pedagogy of peace education
  (i) Challenging the traditional models of learning to constructivist approaches in teaching
  (ii) Rethinking authority relations from democratic perspective: promoting dialoging, and, developing capabilities for decision making
  (iii) Understanding social justice in local context – its implications for beliefs, attitudes, and values and school/social practices and conflict resolution at all levels
  (iv) Awareness of pedagogical skills and strategies for removing tensions, examination fear, stress, corporal punishment, violence and conflicts at school level
  (v) Compassion, love and caring, mindfulness in all transaction of avoid hurt, humiliation, degrading over academic, personal, social and culture matters. Non-evaluative orientation empathetic founding academic and discipline problems
  (vi) Humanistic approach to evaluation
    (a) Belief in worth of all pupils irrespective of academic talents
    (b) Adopt broad-based assessment taking in multiple talents, emphasise success rather than failure, enable enemy pupil to experience success in some area
  (vii) Educationists view on peace and peace education-Rabindranath Tagore, M.K. Gandhi, Mother Teresa, Dalai Lama.
**Tasks:**

1. Keep a Reflective journal to record experiences of the day and reflections there on during the training programme, share, discuss and reflect with peers
2. Visit to organisations connected with peace and intercultural harmony, and aesthetic appreciation to experience peace as reality submission of reports on experiences
3. Understand and generate creative/alternative ideas to deal with issues and challenges to peace; Topics could be on
   (i) Conflicts experienced at home/in family/ in society/ in school, etc.
   (ii) Exploring possible strategies of resolving commonly experienced conflicts
   (iii) Healthy discipline among school children
   (iv) Identifying challenges of peace in school and dealing with one such challenge
4. Role plays to enact situations involving conflict, corporal punishment, discrimination, and domestic violence in day-to-day life
5. Watch and discuss films clips displaying concerns of peace, good intercultural relationships, environmental presentation and other key ideas and discussions thereon, like -Doha Debates, Sadako, etc.
6. Preparation of collages from newspapers, etc. to highlight issues and challenges to peace or positive response to them

**Essential Readings:**

Bengaluru Central University
B.Sc.B.Ed Programme

Course Title     Optional Course – Education for Children with special needs
Course Number   HC8
Semester        5
Credits          1
No.of Instructional hours 26
Total Marks     50

Rationale
This course seeks to develop critical perspectives on special education as a theoretical construct and as professional practice. While examining prevalent practices of diagnosing and dealing with disability, students learn to conceptualise and design educational

Objectives: The students will be able to
• demonstrate knowledge of different perspectives in the area of education of children with disabilities;
• reformulate attitudes towards children with special needs;
• identify needs of children with diversities;
• plan need-based programmes for all children with varied abilities in the classroom;
• use human and material resources in the classroom;
• use specific strategies involving skills in teaching special needs children
• in inclusive classrooms;
• modify appropriate learner-friendly evaluation procedures;
• incorporate innovative practices to respond to education of children with special needs;
• contribute to the formulation of policy; and
• be aware of laws pertaining to education of children with special needs.
Course Outline

UNIT 1:

Paradigms in education of children with special needs

Historical perspectives and contemporary trends - Approaches of viewing disabilities: The charity model, the bio centric model, the functional model and the human rights model. Concept of special education, integrated education and inclusive education; Philosophy of inclusive education.

Legal and policy perspectives


UNIT 2:

DEFINING SPECIAL NEEDS

• Understanding diversities – concepts, characteristics, classification of children with diversities (Visual Impairment, Hearing Impairment, Specific Learning Difficulties, Locomotor and Neuromuscular Disorders, Mental Retardation, Autism, Leprosy Cured Persons, Mental Illness and Multiple Disabilities)
• Special needs in terms of the curriculum in the context of different disabilities and their learning styles
• Concept of an inclusive school – infrastructure and accessibility, human resources, attitudes to disability, whole school approach
• Community-based education.

INCLUSIVE PRACTICES IN CLASSROOMS FOR ALL

• School’s readiness for addressing learning difficulties
• Assessment of children to know their profile
• Technological advancement and its application – ICT, adaptive and assistive devices, equipments and other technologies for different disabilities
• Classroom management and organisation
• Making learning more meaningful—Responding to special needs by developing strategies for differentiating content, curricular adaptations, lesson planning and TLM

• Pedagogical strategies to respond to individual needs of students: Cooperative learning strategies in the classroom, peer tutoring, social learning, buddy system, reflective teaching, multisensory teaching, etc.

• Supportive services required for meeting special needs in the classroom — special teacher, speech therapist, physiotherapist, occupational therapist, and counsellor

• Development and application of learner-friendly evaluation procedures; Different provisions for examination by CBSE and the board in their State

• Documentation, record keeping and maintenance.

**Tasks:**

1. Visit any inclusive school and report about school settings - A study of barrier free environment. Conduct survey about barriers in social inclusion
2. Write an analysis of your school observation in comparison with the policies on education
3. Effectiveness of SSA on education for all - in context to children with special needs
4. Develop teaching learning materials for children with special needs - for children with specific needs
5. To make a list of available curricular support services for children with special needs in the community and school where you would be doing the internship
6. Create inclusive effective assessment tools mapping the teaching goals

**READINGS:**

5. NCF 2005, Position Paper on Education of children with special needs
Bengaluru Central University B.Sc.B.Ed Programme

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<tr>
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<td>Course Number</td>
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**Rationale**

The course is designed to reinforce the critical role of assessment in enhancing learning. The course also discusses the relationship of assessment with self-esteem, motivation, and identity as learners, with an emphasis on ‘fixed’ or ‘growth’ mindsets regarding notions of intelligence and ability. The course critiques the traditional purpose of assessment as a mechanism to filter learners as per their abilities or potentials and assessment as a selective and competitive act and achievement as an outcome of individual’s innate factors.

Our current understanding of learning indicates that assessment cannot be an end-of-teaching activity. Rather, it has to be an ongoing process where the teacher closely observes learners during the process of teaching-learning, records progress in learning using a variety of tools and supports them by providing relevant feedback. The need for giving periodic feedback to learners and their guardians has to be stressed and student-teachers must be provided with practical experience of how to record and report progress and create forums for engagement with the community. Student-teachers will thus learn to explore diverse methods and tools of assessing an array of learning/performance outcomes of diverse learners. This course has to be closely linked with HC 05 “Creating an Inclusive School” where constructs of ‘disability’ and ‘failure’ are seen as the other face of notions of ‘ability’ and ‘achievement’ as promoted by school.

**Objectives of the course:**

- Appreciating the role of assessment in learning
- Understanding the purposes and forms of assessment
- Analysing ways and means of making assessment inclusive
- Developing a critical understanding of the issues in assessment
- Creating a range of assessment tools and reports on assessments
Course Organisation:

UNIT 1: Learning and Assessment - Role of assessment in learning; Assessment, Measurement & Evaluation: Conceptual and empirical bases; Purposes & Forms of assessment, CCE; Addressing equity issues; No Detention Policy - Philosophical and pedagogic bases; Impact of competitions, ‘high stakes testing’.

UNIT 2: Designing assessment tools and reporting - Questionnaire, schedule, rating scale, checklist, rubrics, portfolio, paper pencil test; Revised Bloom’s Taxonomy; Analysing & drawing inferences from assessment data; Adaptations for children with disabilities; Reporting and providing feedback to different stakeholders.

Critical questions to reflect:

Do we need assessment? Why or why not?

What is the relationship of assessment with learners’ self-esteem, motivation and identity?

How do we adapt assessment for diverse learners?

What are the ways in which we use assessment? What are their implications on learners?

Tasks:

1. Analyse a range of test papers prepared by teachers to determine how much the test items relate to the objectives they set out to test.

2. Design Observe-Predict-Test activities for select objectives.

3. Develop rubrics for assessing non-scholastic areas.

4. Create a range of assessment tools with support from special educators for learners with visual impairment/hearing impairment/learning disabilities.

5. Study a case of effective participatory assessment and community monitoring in your neighbourhood.

6. Use ICT to design assessment tools, capture data, analyse data and prepare a report on the assessment conducted.
Essential Readings:

Unit 1:


- NCERT Position Paper-Learning and Assessment

Unit 2:

- Wolfolk, Anitha.(2004). Educational Psychology. Pearson Publications. (Chapter 15 – Classroom Assessment and Grading.)


- NCERT Manual on Assessment

Additional Readings:


Bengaluru Central University B.Sc.B.Ed Programme

Course Title: PCK of Biological Science Part 1

Course Number: SC 03

Semester: 5
Credits: 2
Instructional hours: 52
Total marks: 100

Rationale

Learning science should help students develop certain habits of mind like critical enquiry, rational thinking and at the same time foster deeper understanding of the concepts. Science teachers need to be equipped to do so.

In order to teach science, it is important to understand one’s own notion of science. The teachers’ view on nature of science gets reflected in the teacher practices. The questions on how does knowledge get validated in science are important to engage with. It is also important for the teachers to examine the relationship between science and society and understand social impact of science and vice versa.

Also as teachers it is important to engage with science curriculum, understand the aims of teaching science and analyse the relevance and limitations of various curricula that has been developed in various contexts and tried in classroom. It is essential to engage with broader perspectives on nature of science, science curriculum, aims of teaching science, conceptual development among students etc, and hence this course would provide the basis for the pedagogy courses in science.

Often science is presented as vast body of facts and infallible information. This course is meant to help teachers engage with the nature of science and scientific inquiry.

Objectives of the course

- Analysing one’s own notions of science and gaining an understanding of the meaning, nature and scope of scientific knowledge and method
- Understanding the purposes of teaching science and its place in the school curriculum
- Developing an awareness of the aims of science education
- Analysing relevance, limitations and rationale of school science curriculum.
Course Organisation:

UNIT 1: *Nature of science*
- What is science?
- Notions of science and scientists
- Nature, scope and branches of biological science
- What constitutes scientific knowledge? Is there a scientific ‘method’?
- History and philosophy of science and its implication for classroom teaching

Unit 2: *Concepts and concept change*
- What are scientific concepts?
- Conceptual change
- How children learn concepts
- Implications for pedagogy

UNIT 3: *Science in the school curriculum*
- Aims and Objectives of teaching Biological Science
- Considerations and approaches in Science curriculum
- Textbooks and teaching learning resources
- Science for All

UNIT 4: *Pedagogic Content Knowledge of Science*
- Nature of science and its influence in teaching science
- Subject matter knowledge for teaching
- Socio-cultural context and learning of science
- Components of PCK
- Developing PCK
Tasks

- Interview school students to understand their notion of science and scientists. The students could be asked to draw a scientist and a set of questions could be used to interview students on their view of science.
- Interview few teachers of a school on the purposes of teaching science.
- Observe a child learning a concept / performing a task in science class and prepare a report.

Suggested mode of transaction:

The classrooms would help foster discussions, critical enquiry, debates, reading and sharing of views and texts.

Some examples:

The students could be asked to read parts of the text and debate/ present the summary based on few questions which might help close reading of texts.

The students could interview each other on notions of science and present the views.

The teacher educator could initiate a discussion based on few readings or explain complex ideas using graphic organisers/concept maps and help students read the text later.

The students could view related film clips. Teacher educator to provide reflective questions for discussions post the viewing.

Newspaper articles based on science and society could be collected by students and review/ present the same in groups.

Guest faculty/ scientists could be invited to present a seminar/ guest lecture.

Teachers could be invited to classroom to share their experience of teaching of science and curricular approaches.

Suggested mode of assessment:

Short reflective pieces or assignments- 3

Some examples:

Analyse a lesson from the science textbook of classes 6 to 10. Elicit how science is presented in the textbooks based on your understanding of nature of science.

Examine a recent debate on issues of science and sustainability, or science and technology and write a note on its implication on the society.

Analyse the aims of teaching science in the state curriculum with respect to the NCF 2005 Position Paper on Teaching of Science. Write a report of the analysis.
Essential Readings

UNIT 1: *Nature of science*


Unit 2: *Concepts and concept change*


UNIT 3: *Science in the school curriculum*


UNIT 4: *Pedagogic Content Knowledge of Science*

Additional Readings


Rationale
This first course in mathematics education seeks to situate the knowledge of mathematics that student teachers bring to the classroom in a broader context of understanding mathematics as a discipline. The course focuses on developing an understanding of the nature of discipline, its historical development and epistemic formulations. School mathematics, as we know today, draws heavily from academic mathematics and focuses on equipping the students with formal mathematical skills, such as knowing how to use the language and symbols of mathematics and acquire algorithmic competence while higher mathematics confines itself to imparting disciplinary knowledge. Such an understanding of mathematics allows for shaping school mathematics curriculum in multiple ways to meet the diverse needs of the learners. The knowledge of mathematics as a school subject involves an engagement with (a) selection, organization, and sequencing of content to be taught, (b) transitions and connections in the learning of concepts, (c) students’ ways of thinking and problem solving, and (d) deep knowledge of the content to be taught. These form the core areas of the four courses on mathematics. In the first course, the focus is on developing an understanding of mathematics as a form of knowledge and viewing it from the lens of different perspectives (philosophical, psychological, historical, sociological and critical). Further, ways in which these perspectives help in building an image of a learner of mathematics will be discussed.

Course Objectives
The course aims to provide student teachers an opportunity to engage with

(a) processes involved in doing mathematics;
(b) issues of selection, organisation, and sequencing of content of school mathematics;
(c) psychological and sociological perspectives on the learning of mathematics; and
(d) critical perspectives on the ‘content’ and ‘learning’ of mathematics

Course Organisation

UNIT 1: Nature of Mathematics

The unit focuses on understanding the nature of mathematics and various processes involved in understanding it as an epistemic entity. An engagement with different processes of generalisation, visualisation, abstraction, symbolisation, modelling, etc. is an important way of understanding how the learning of the discipline is organized. The history and philosophy in the development of mathematics as a form of knowledge invites an engagement into these processes.

UNIT 2: A Critical Approach to Mathematics

The critique of mathematics as a discipline need to be constructed and understood from the perspectives of disability, gender, tribal communities, non-western countries, different cultures, etc. The unit aims to develop a critical stance on the nature of knowledge called mathematics and ways in which its teaching and learning is exclusionary.

UNIT 3: Mathematical Practices

Mathematics teaching in classrooms is accompanied with some common practices like rote-memorisation of formulae and rules, repeated practice of procedures, knowledge of algorithms, learning the facts and application to word problems, lack of connection to real life, etc. Such common practices will be problematized and practices like use of representations, conceptual understanding, alternative algorithms, manipulatives, students’ knowledge, persistence in problem solving, etc. will be examined. The links between these practices and the decisions made by teachers while teaching in classroom will be discussed. The discussion on mathematical practices and decisions will also provide student teachers with the language used to describe the discourse in a mathematics classroom.
UNIT 4: Knowing the Learners

The unit emphasizes the primacy of learners’ thinking in the work of teaching. The knowledge of learners’ thinking, identities and relation to mathematics, learning trajectories, formation of concepts, misconceptions or obstacles to learning, etc. is an important part of designing and planning for teaching.

Tasks

- In groups, identify one of the processes, which is crucial to mathematics as a discipline (generalisation, modelling, abstraction, etc.). Study the first chapter of the National Focus Group Report on Teaching of Mathematics (NCERT 2006) and discuss how the process has been considered important. Identify an example (of a problem, example, figure, exercise, etc.) from the NCERT textbooks to exemplify the emphasis on this particular process.

- Take a historical tradition in the development of mathematics. The groups can choose from these traditions - Greek, Islamic, Chinese, Indian, etc. Identify some key ideas in each tradition and engage the whole class in some mathematics problems and procedures developed by these traditions. Some of the references include


- Choose a particular topic (algebra, decimal numbers, fractions, real
numbers, geometrical constructions, trigonometry, calculus, etc.) in
groups. Identify a few research papers which discuss the common
student errors or difficulties in the learning of this topic. Formulate an
understanding of ways in which students think in a particular domain
and think about possibilities of handling such responses while teaching
in class.

- A group of student teachers can choose from the themes outlined below
to focus on a teaching-learning practice and its use for teaching of a
concept in classroom. They can summarise the approach and its
strengths to the whole class and design a few problems or a task to
exemplify its use.

- **Theme 1: Real and Realistic Contexts**


- **Theme 2: Algorithms and Alternate Solutions**


• **Theme 3: Using representations**


• **Theme 4: Exemplification**


• **Theme 5: Connections (Horizontal and Vertical)**


• **Theme 6: Out of school and school mathematics**


**Essential Readings**

**UNIT 1: Nature of Mathematics**


The book “What is Mathematics” tries to answer this question by giving a brief introduction to the philosophical and historical aspects of the discipline. It covers a range of elementary ideas and concepts of modern mathematics namely Number Systems, Algebra, Set theory, Calculus, Geometry, Topology and Functions. The student teachers will revisit basic ideas in mathematics through this book.


Davis and Hersh problematize a mathematical experience by asking questions like “what is mathematics?” “Where is mathematics?” what is a mathematical community”. These questions are concerned with the nature, the meaning and the methods of mathematics. The book gives an elementary introduction to the philosophy of mathematics and gives revealing insights into nature of mathematical discovery and proof as well as a popular account of some recent advances in mathematics. The students after reading this book may appreciate the fallible nature of mathematics and may get an insight that mathematics must be debated and explored. It is not a discipline that can be transferred to students solely through brute conditioning.


According to Hersh mathematics is a human activity carried out in society, something that has developed historically. He terms his philosophy of mathematics ‘humanism” and his approach as socio historical. The basic
thesis of this book propounds that mathematics is a human activity and it’s a part of human culture. Mathematical knowledge is not infallible. There are different versions of proof and rigor. Mathematical objects are special parts of culture. The student teachers who have been students of mathematics may get an insight into philosophical aspects of mathematics like formalism, logicism and Platonism.


In this chapter Freudenthal offers his answer to the question: What is mathematics? In his view, mathematical concepts, structures and ideas serve to organize the phenomena of real world as well as the field of mathematics. The development of mathematics, the learning of mathematics as well as the creating of mathematics starts from “common sense”; learning and developing mathematics are conceived as ongoing process of mathematisation on different levels and into different directions. Basic activities in this process are local and global ordering, schematizing, formalizing and symbolizing.


Symbols are indispensable objects of mathematical knowledge. They serve both as labels and as handles for communicating the concepts with which they are associated. This chapter discusses the role of symbolism in mathematics. It highlights the different between surface structures and deep structures involved in grasping of symbols by the learners. The chapter discusses aspects of mathematical symbolism that may be important for the student teachers to understand for teaching of mathematics in school.


Across the globe mathematics has a privileged place in the school curriculum which we tend to take for granted. What are the arguments that have been put forward in its defence? Do they justify its status as a compulsory subject? What priority should it have in the curriculum compared with other subjects? The contributors to this book explore these questions and their historical background. They investigate the varied aims of learning and teaching mathematics, and to what extent the discipline deserves the high curricular
status it has traditionally enjoyed. They include leading writers in the field of mathematics education, school improvement, and history of education and philosophy of education. Their views represent perspectives from outside the world of mathematics education as well as from within, and there is sharp disagreement among them about the future of compulsory mathematics at secondary level.

**UNIT 2: A Critical Approach to Mathematics**


This chapter talks about the meaning of a mathematical discourse prevalent in different cultures. It gives interesting examples of the ways in which mathematical discourse which involves numbers; space, patterns, quantities and measurement are communicated across different cultures. The discussion aims at giving an insight into mathematical discourse of aboriginal, non literate and literate cultures. The student teachers may learn to appreciate meanings of mathematics as a discourse that transcends the usual deductive symbolic logic and see how different cultures use their local resources to generate their own mathematical discourse.


This is a reading into critical aspect of mathematics education which argues that mathematics education is undetermined meaning that it can be an open ended exercise. Math education can be empowering and disempowering at the same time. This chapter offers a critical stance into school mathematics curriculum which is often embedded into “regimes of truths” which can be deeply disempowering for the learner. On the other hand it also discusses how mathematics education can be empowering in three senses: it is intellectually empowering, pragmatically and in socio political terms. The aim is to help student teachers to develop a critical perspective towards school mathematics curriculum which is otherwise taken for granted.

In this volume Gutstein envisions mathematics as a tool to understand cultural, societal and political values. With a critical mathematics education framework, the book discusses real life classroom scenarios where mathematics which is generally viewed as a value neutral discipline is indeed envisaged as a tool that can be used to think about social justice issues. The chapter particularly aims at identifying the critical role of mathematics education for student teachers to think about inconsistencies associated with class, race, culture and community. The student-teachers may learn to introduce students to the ethical consequences of mathematically-based decision-making, to use the most important tool available to create change in their lives and their world: understanding social justice through the lens of mathematical evidence.


In this chapter reports results from self-study of a Critical Mathematics geometry course taught at an inner-city high school. Through examining student responses to Critical Mathematics (CM), he focuses on the gap between its ideals and realities. It was found that trying to implement CM in a secondary classroom to pose deeper problems than those documented the extant literature. In addressing the findings, Bartlinger responds to the question that is central to this book, namely: what can we learn from specific research studies or programs relevant to quality and equity agendas in mathematics education? This reading offers an interesting account of an action research based on critical mathematics education. The discussion reveals the shortcomings as well as the gains of mathematics education for equity and justice.


Working with children with special educational needs is a big challenge for teachers. More so teaching mathematics to children with special needs
becomes even a greater challenge. The paper discusses a research finding conducted in Brazilian inclusive schools. It argues that irrespective of the kind of schools in which mathematics is being studied, it seems that the development of a more inclusive school mathematics depends on deepening our understandings of how mathematics practices and knowledge are mediated through different sensory channels. Perhaps by doing so, we might not only become better able to create learning opportunities for students with disabilities, we might also build more robust appreciations of the relationships between experience and mathematical cognition more generally.

UNIT 3: Mathematical Practices


In this chapter the author contends that it is the abstract nature of mathematics which makes it very difficult for many of the learners to learn mathematics. But the question is what does it mean for something or statement or a discipline to be abstract? The chapter tries to seek answer for this question and hence tries to explain how mathematical concepts are formed and how the teaching of mathematics has to be construed. The aim is to gain an insight into concept formation, abstraction, primary and secondary concepts and everyday and mathematical concepts.


One of the most important aims of mathematics education is to help students think mathematically. But what does this phrase “think mathematically” actually mean? Does it relate to problem solving abilities? What role does metacognition play in this? This chapter by Schoenfeld answers these questions using a survey of relevant literature on mathematical thinking, problem solving and meta-cognition. The paper cites interesting illustrative examples of these three concepts from the classroom situations.


This paper attempts to clarify what it means to teach mathematics for understanding and to learn mathematics for understanding. The paper to this
end presents an analysis of two classroom situations of different elementary schools. In one classroom, the teacher and students appeared consistently to constitute mathematics as the activity of following procedural instructions in the course of their moment by moment interactions. The analysis of the other classroom indicated that the teacher and students constituted mathematical truths as they co-constructed a mathematical reality populated by experientially real, manipulable yet abstract mathematical objects.


The paper gives intriguing illustrations of apparently simple elementary math problem relating to division of fractions and records the responses of teachers for the given problems. The responses depict interesting instances of teachers’ pedagogical content knowledge. How teachers use various ways to help students develop deep understanding of these apparently simple but intricate concepts of school mathematics which are traditionally dealt with rote memorizations or meaningless algorithms. The paper gives examples about developing deep/profound understanding of for the student teachers into simpler looking problems of elementary mathematics.

**UNIT 4: Knowing the Learners**


This paper describes a research based teacher professional development program for elementary school mathematics and includes an overview of cognitively guided instruction (CGI). Also described are the CGI professional development program and research base for CGI with regard to children’s thinking; teachers’ knowledge and beliefs about children’s thinking and the relation of teachers’ knowledge and beliefs to their student’s achievement; the effect of the CGI professional development on teachers’ knowledge, beliefs and practice; and the achievement of students in CGI classes.


This paper focuses on examining and illustrating how classroom-based factors
can shape students' engagement with mathematical tasks that were set up to encourage high-level mathematical thinking and reasoning. The findings suggest that when students' engagement is successfully maintained at a high level, a large number of support factors are present. A decline in the level of students' engagement happens in different ways and for a variety of reasons. The study provides student teachers with concrete illustrations of the ways in which students' engagement in high-level cognitive processes can be found to continue or decline during classroom work on tasks. The student teachers are expected to critically review these factors and discuss the veracity of the claims of the papers.


This paper reviews various shared meanings for the concept of “learning trajectories” that has been used to developing innovative mathematical curriculum and to conducting research on teaching and learning of mathematics in western contexts.


Mathematics often acts as a gatekeeper in the upwards mobility in the social ladder. This paper highlights how socio-political processes of inclusion and exclusion manifests themselves in schools and in mathematics classrooms as high or low achievements. It draws attention to the conceptual notion of student’s foregrounds as expressions of what students experience as their opportunities and obstacles in a mathematics classroom. The paper gives a critical perspective to the implicit process of inclusion and exclusion that operate in a mathematics classroom which shape the learners’ foregrounds.
**Additional Readings**


**Suggested methods of transaction**

The students will be given all the reading materials which they are supposed to read and come to class. The classes will be largely interactive and discussion based. Few topics will be distributed to the students for making group/
individual presentations in the class. Videos and short films will also be a part of classroom teaching, upon which the students are expected to make presentation and discussion.

**Suggested methods of assessment**
This course includes four exercises which will be assessed individually or in groups. The student teachers are expected to complete these exercises in stipulated time period within this semester. The credit for each exercise will be decided later.
### Drama and Art in Education

#### Rationale

The National Curricular Framework 2005 (NCF) reminds us that the school curriculum must integrate various domains of knowledge, so that the ‘curricular’ encompasses all, and is not separated from the cocurricular or extra-curricular. This has significant implications for the role of art, music and theatre in education, to nurture children’s creativity and aesthetic sensibilities.

Theatre in Education helps learners to extend their awareness, through multiple perspectives, to look at reality through fantasy, and to predict everyday situations in order to cope with unpredictable and unsettling experiences. Theatre in Education transcends the here and now, to travel through time - to the past, to the future, while it also allows us to freeze time. Thus we can live or relive moments and evoke or even recreate situations that can help us accept them better. Theatre in Education is not merely doing theatrics or ‘acting’ in a superficial manner, but is for creating that ‘dramatic pressure’ or tension, where the student would arrive at a problem or an understanding in a new way (Heathcote & Bolton, 1994). The challenge is for prospective teachers to understand the medium, in order to transpose learners into a different time and space, to shape their consciousness through introspection and imagined collective experience. In the present context where children are growing up in starkly segregated environments, bounded by caste, class, religion or gender, drama must be used to potentially interrogate these categories - Who is the other? Why? How is the process of ‘othering’ happening in different lives? Mere moral sermons do not help build sensitivities. The ability to feel empathy for and relate with the other can be nurtured through drama based on experience, emotion and interpretation. It also gives
opportunities for learners to recognise their agency, for transformational action. Drama as ‘critical pedagogy’ can move beyond the classroom, to invoke the collective consciousness and involve the community to participate in educational and social change. Students-teachers will need to experience different genres of street theatre that continue to engage with life, through folk and contemporary traditions, improvising and critiquing, while mobilising for transformative action.

The course on Theatre in Education also helps in understanding the self and as a form of self-expression for enhancing creativity. The components of fine arts aim to develop aesthetic sensibilities in student-teachers and learn the use of art in teaching learning (Prasad, 1998). Student-teachers will visit places of art, exhibitions and cultural festivals. Encouragement needs to be given to understand local culture and art forms and interpret art works, movies and other Media. Likewise other activities can be used to build trust and cooperation, the sense of responsibility, pursuing tasks collectively and exploring varied perspectives.

**Objectives**

- Providing a theoretical background on the relation between education and theatre
- Realising one's own potential for self-enhancement through theatre in education
- Recognising the importance of group work and socialisation
- Developing organisational skills, interpersonal relationships and discipline
- Making linkages among various art forms on the one hand and between theatre and school subjects

**Unit 1 : Understanding and Appreciation of theatre**

- Importance of theatre in education
- Viewing/listening to live and recorded performances of Classical and Regional Art forms
- Exploring regional/local forms of theatre and puppetry

**Unit 2 : Participation in theatre activities**

- Self learning and development (Voice/Body posture/presentation)
- Identifying ways to integrate theatre in classroom planning - performances
**Tasks:**

The student-teachers must be guided to acquaint with four thrust areas. One is related to developing their own personality and capacity. The second is to help develop the potentialities of school children to the point of driving home the fact that child is the creator of knowledge. The third is to develop communication and interaction capabilities. And the fourth is to find linkages between various art forms and school subjects so as to develop a holistic view about learning.

The practicum can fulfil the objectives only when a series of workshops are organised in continuity and under professional guidance, over the academic year.

Suggested activities are given below.

1. **Theoretical background:** Importance of ‘play’ in general and ‘dramatic-play’ in particular, child drama, creative drama, children's theatre, theatre in education, drama and theatre, ‘role play’ in social life and on stage, traditional role of drama and theatre in educating people and its modern use, dramatics in relation to other art forms, uses of dramatics in relation to school subjects.

2. **Drama as playful transformation:** Transformation of ‘self’, objects, space and time; transformation for realisation; role of empathy, transcendence.

3. **Enhancement of ‘self’** The purpose would be to sensitise students about their inherent potentialities. Components—activities related to body and mind, senses, emotions, imagination, concentration, observation, introspection, etc.

4. **Creating space:** The basic idea is to recognise available space and to create one even under most trying conditions. Components - many ideas about space: physical, mental, social, individual, limited and unlimited (example: limited space of classroom and its unlimited use, or limited space on stage where everything is possible); space for oneself and space shared with others; uses of space in classroom, in school and in life.

5. **Taking the floor:** Energetic entry, lively presence and exit on promise of better experience together is common to a teacher and a performer. Each individual style can be sensitised for improvement.

6. **Communication:** Reaching out to others and different means of doing so, *dramatics and related art forms as means of communication, performance as a way Communication.

7. **Verbal communication:** Sound extended to speech (clarity, dictation volume, tonal variation, emphasis, pause, silence), recitations, story telling, mask and puppet play, and lesson transaction.
8. **Non-verbal communication:** Sign and symbol, importance of contact (touch, eye, etc.), gesture, expression, mime movement, child art and craft, arrangement and design.

9. **Improvisation:** Role play, observation and imitation, action-reaction, spontaneity responding to situations.

10. **Problem solving:** Problem solving as an approach to life and work: transcending the problems in classroom school and resources; this also amounts to accepting the fact that children are intelligent human beings and capable of solving their own problems, the need is to have confidence in them.

11. **Relaxation:** Playfulness and enjoyment of work, learning to relax in the midst of intense activity, relation between energy and relaxation, thinking positive and be creative, relaxation of body and mind.

12. **Linkage activities:** Dramatics incorporates all art forms. The basics of all these can be easily understood and practised by all. These are also language systems, used for communication at various levels and ways. These are also the means to enhance cognitive and affective skills. In addition, linkages can be worked out to enhance organisational skills, human relations, confidence, resourcefulness and self-discipline.

13. **Drama and school objects:** Dramatics can be and have to be linked to curriculum subjects, simply because drama is also a learning process. One has to find the devises for doing so.

The heads mentioned above may overlap. These are classified more for understanding and a sense of direction.

**Record Keeping**

Each student will be expected to maintain a reflective journal which will include:

- A detailed record of the sessions
- Reflective analysis of the activities
- Insights gained
- Linkages with school subjects, with examples

**Faculty Support**

Workshops must be conducted and supervised by a professional (trained drama, theatre, preferably as it applies to education) and coordinated by a teacher educator. Facilitation and supervision will include:

- Planning and conducting the activities
- Maintaining a diary of comments on each day session and on each student
- Initiating discussion and building up an environment for critical and
reflective sharing. While assessing a student, the change in overall personality of each student must find mention in Resource Person’s comments. The diary maintained by the resource person should be submitted to the college authorities at the time of submission of awards.

**Assessment**

There will be an ongoing internal assessment of each student by the concerned professional and faculty member, using the following basis and criteria.

**Basis Criteria**

<table>
<thead>
<tr>
<th>Activities</th>
<th>Regularity</th>
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<tr>
<td></td>
<td>Participation and interest</td>
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<td>Self-discipline</td>
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<td>Interpersonal adjustments</td>
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<td>Organisational skill</td>
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<td>Confidence</td>
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**Performance**  Attitude towards work

- Initiative taking
- Originality and resourcefulness
- Skills acquired
- Flexibility and adaptability
- Problem solving
- Creativity

**Reflective journal**

- Description of sessions
- Analysis of activities
- Linking dramaties to pedagogy with examples
- Reflections and critical assessment of dramaties in education
- Overall presentation - including the arrangement and look of the journal, as a record for future reference.
READINGS:
VI SEMESTER

Bengaluru Central University B.Sc.B.Ed Programme

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Knowledge and Curriculum</th>
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</thead>
<tbody>
<tr>
<td>Course Number</td>
<td>HC 10</td>
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<tr>
<td>Semester</td>
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<td>52</td>
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<td>Total Marks</td>
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Rationale

One of the important roles of teachers includes facilitation of, construction, transfer, reinforcement, and refining of knowledge during interaction with students. In this context, the teachers are required to be competent about the epistemological thinking of knowledge and also in dealing with the social environment involving transaction of knowledge. This paper imparts necessary preparation to student teachers in dealing with various dimensions of knowledge and its transaction in a social environment.

This course also offers a critical analysis of considerations in curriculum design including the role of social, cultural, and ideological factors and helps develop varied perspectives on curriculum organisation, curriculum transaction, and evaluation.

Objectives of the course:

- Understanding rudimentary epistemological propositions
- Understanding the basic concepts and processes relating to curriculum development
- Appreciating the complexities and the problems of curriculum development
- Analysing text books and related educational materials in the context of aims and objectives of education
- Recognising the impact of hidden curriculum
- Designing culturally sensitive curriculum implementation plans

Course organisation

Unit 1: Knowledge and Knowing
- Knowledge: Meaning and nature
- Difference between opinion, fact, information, knowledge
- Knowing Process: Know-that, know-how, metacognition; Knowledge construction, Processes of Construction of Knowledge
- Facets of Knowledge and their relationships - 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 2: Knowledge and Curriculum
- What is worth teaching: who decides and how
- Forms of knowledge and their characterisation as school subjects
- Aims of education, curriculum framework, curriculum, syllabus and textbooks
- Curriculum visualised at different levels: National-level; state-level; school-level; class-level

Unit 3: Curriculum Development and Issues
- Broad determinants of curriculum development:(At the nation or state-wide level): Socio-political aspirations, including ideologies and educational aims and vision; Cultural orientations; National priorities and International contexts
- Considerations in curriculum development:(At school level): Relevance and specificity of educational aims and objectives for concerned level; Socio-cultural context of students; Teachers’ experiences and concerns
- Critical issues: Inclusiveness; Environmental concerns and issues
- Hidden curriculum: nature and impact
Unit 4: Curriculum implementation and Renewal

- Role of school: School’s philosophy, administration (and organisation); Provisioning in terms of infrastructure, curricular sites and resources; School culture, climate and environment as the context for teachers' work
- Teacher's' role in generating dynamic curricular experiences through contextualisation of learning; providing varied and meaningful learning experiences; Selection and development of learning resources; Evolving assessment modes
- Process of curriculum evaluation and revision: Need for a model of continual evaluation; Feedback from learners, teachers, community, and administrators; Assessing observable incongruencies and correspondence between expectations and actual achievements

Tasks:

1. Study a curriculum in action in a primary school in (1) a slum and (2) in a middle class locality
2. Study an innovative curriculum (Basic curriculum as an example of the past and anyone innovative curriculum in the present)
3. Analyse the state curriculum in the light of NCF 2005 and how various issues like gender, inclusiveness are integrated in the curriculum.
4. Debate on the need, role and purposes of a national curriculum framework.
5. Interact with school teachers and principal to understand how they operationalise the prescribed curriculum into an action plan.
6. Analyse of any one textbook with regard to how the objectives of the national curriculum framework are reflected.
7. Study the past 4 national curriculum frameworks prepared by NCERT and identify areas of continuity and change.
8. Discuss on how curriculum can be evaluated and revised.
References

Essential Readings

Unit 1: Knowledge and Knowing


Unit 2: Knowledge and Curriculum


Unit 3: Curriculum Development and Issues


Unit 4: Curriculum Implementation and Renewal

Additional Readings


Bengaluru Central University B.Sc.B.Ed Programme

Course Title: Development and Management in School

Course Number: HC 11
Semester: 6
Credits: 1
No. of Instructional hours: 26
Total Marks: 50

Objectives of the course:
- Understand primary, secondary, Higher Secondary.
- Understand structure of educational administration at the state level.
- Identify challenges and strategies related to imparting quality education at the secondary stage. Understand importance and status of open school, distance education and types of school. Develop managerial skills required in schools.
- Develop and insist Total Quality Management in schools.
- Appreciate features of Indian constitution and the policies of education.
- Understand the management of school education by Government and Private agencies.

UNIT – I: Educational Management
- Concept, principles, purpose and process of Educational Management.
- Time Management: concept, importance, role of head master and teacher.
- Time table: meaning, importance, types and principles and factors
- School records – meaning, types, importance and maintenance.
- Annual Programmes of Work: School calendar, meaning, Importance and factors to be considered
- School discipline: Concept, Importance, causes of indiscipline and measures to overcome indiscipline
- Classroom management: Concept and techniques
UNIT II: School Resources and Programmes

- Managerial Resources: Office staff- Role and responsibilities. Human Resource Management: Concept, importance.
- Head Master: Qualities and Functions
- Teacher- Qualities and functions
- Financial Resources: School Budget- Meaning, Types, Sources of Income and Expenditure, steps in preparing school budget.
- Material Resources: Essential features and components of school plant-Site, building, design, classroom design, laboratory, playground and equipment
- Institutional Planning, meaning, purpose and procedure.
- School Complex
- Management of school Programme: Co-curricular activities, meaning, importance, types and Organization
- Parent teacher Association: Importance, objectives and Activities
- Conduct of test and examinations
- Total quality management in education: Concept, principles and strategies.
- Stress management: Meaning, factors, cause and effect of stress, Management of Stress

Tasks:
Prepare and present seminar paper on any 3 of the following topic
- Place of secondary education in the educational ladder.
- Revision of secondary school education as visualized in independent India.
- Policies and programmes of government to improve educational opportunities for disadvantaged groups.
- Examination reforms.
- Problems of out of school children.
- Status of open schools in India.
- Professional code of ethics for teachers.
- Challenges in inclusive education
- Implications of Right to Education
- Role conflicts of secondary school teachers
References:


8. Kochhar S.K., Secondary School Administration, University Publisher Delhi, 1964.


10. Murthy S.K., Essentials of school organization and administration, Tandon Publisher.


**Bengaluru Central University B.Sc.B.Ed Programme**

<table>
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<tr>
<th>Course Title</th>
<th>Action Research</th>
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</tr>
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</table>

**Objectives of the course**

After completion of the course student teachers will:

- Understand the concept and types of research – applied basic and action research.
- Be familiar with the concept of Action research in Education.
- Identify the suitable problems for Action Research.
- Get acquainted with the various steps of conducting action Research.
- Understand and use descriptive statistical techniques in action Research.
- Acquire the skills of planning, executing, evaluating and reporting action research.

**Unit-1: Introduction to Research**  
(12 Hours)

- Research and Educational Research: Definition and Importance
- Types of research – Fundamental /Basic research, Applied and Action Research- Meaning and its importance and differences.
- Action Research – definition, importance, limitations.
- Steps of action Research-Identification of the problem, pinpointing the problem, analysis of the problem in terms of probable causes, objectives of Action research, formulation of Hypothesis, Design of Action plan(pre-test, treatment, post-test), Implementation of Action Plan, analysis and Interpretation of data, drawing conclusion, report writing.
Unit-2: Collection and analysis of data:  
(14 Hours)

- Tools for collection of data-Achievement test, diagnostic test, questionnaire, observation schedule and interviews-meaning and their importance in Action Research.
- Measures of central tendency-computation and interpretation of mean for grouped and ungrouped data.
- Graphical representation of the data: Bar graph, Frequency polygon-meaning, construction and uses.
- Formatting of proposal and report-meaning of proposal and report and its importance. Format-preface, acknowledgment, index, tables, graphs, bibliography and appendix.

Practical Activities:

Carry out the following practical activities and submit a report.

- Prepare Action Research proposal for any one of the problem selecting from the following fields
  a) Classroom problems
  b) Teaching strategies
  c) Children with special needs.
  - Prepare any one of the following tool to conduct action research
    Rating scale / Questionnaire / Checklist

Reference Books:

- John W. Best : Research in Education
- Lokesh Kaul: Research Methodology
- Lulla B.P : Essential of Educational Research
- Sukhria S. P: Essentials of Educational Research
- Tharayani : Action Research
- Usha Rao: Action research
- Usha Rao: Conducting Educational Research
- "The End"
Bengaluru Central University B.Sc.B.Ed Programme

**Course Title**  
PCK of Biological Science - Part 2

**Course Number**  
SC 04

**Semester**  
6

**Credits**  
2

**No.of Instructional hours**  
52

**Total Marks**  
100

**Rationale**

Learning science should help students develop certain habits of mind like critical enquiry, rational thinking and at the same time foster deeper understanding of the concepts. Science teachers need to be equipped to do so.

In order to teach science, it is important to understand one’s own notion of science. The teachers view on nature of science gets reflected in the teacher practices. The questions on how does knowledge gets validated in science are important to engage with. It is also important for the teachers to examine the relationship between science and society and understand social impact of science and vice versa.

Also as teachers it is important to understand the aims of teaching science, engage with the secondary curriculum and the key concepts. They should be able to analyse the relevance and limitations of various curricular resources including textbooks. Teachers need to engage with children’s ideas in science and teach in ways that bring about deeper conceptual understanding about the natural world. In order to make the curriculum relevant and engaging, teachers need to be able to plan flexibly keeping the children’s context in mind. As teachers they need to plan assessment in ways that check for genuine understanding of scientific concepts, while also meeting curriculum requirements. Above all teachers need to continuously reflect on their practice in order to ensure meaningful learning for all children.
Objectives of the course

- Understanding key concepts related to secondary school biology curriculum
- Critically analysing the secondary school biology curriculum
- Exploring children’s ideas about life and living processes
- Planning for teaching biology – selecting appropriate methods, classroom interactions etc
- Identifying, designing and using resources for teaching biology
- Developing appropriate assessment processes in biology

Course Organisation

UNIT 1: Revisiting key concepts
- Living things
- Nutrition and growth
- Microbes
- Evolution
- Ecosystems

UNIT 2: Analysing the secondary school biology curriculum
- Progression of key concepts across grades in the curriculum
- Mapping curriculum content in terms of key concepts
- Alternative ways of organizing concepts
- Understanding grade level learning outcomes

UNIT 3: Children’s ideas about life and living organisms
- Reviewing research about children’s ideas
- Probing and analysing children’s ideas
- Identifying gaps in children’s understanding
- Addressing children’s alternate/misconceptions
Unit 4: **Planning for teaching**

- Approaches to deepen conceptual learning
- Developing teaching learning plans for specific concepts
- Designing teaching learning resources for diverse learners
- Assessing for understanding
- Reflections on teaching and students’ learning

**Tasks:**

- Visit a school/ organisation where innovative approaches in science teaching is practiced.
- Observe classroom teaching of science (unit or a lesson) and analyse how it maps to curricular aims of teaching science.
- Observe classroom teaching of science and evaluate the classroom dynamics with respect to equity and socio-cultural issues.
- Design a simple diagnostic tool to probe children’s alternate conception/misconceptions. Using these tools and analysing results.

**Suggested mode of transaction:**

Discussions

- Dialogues
- Selected readings
- Films/videos
- Field visits
- Reflections

Note: A pedagogic content knowledge approach is advocated for transacting this course.

**Class Talk**

What research literature says about children’s ideas on key Science concepts.

**Suggested mode of assessment:**

- Formative assessment of participation/performance during all classroom activities including discussions
- Written questionnaires to ascertain contextual understanding
- Worksheets to assess comprehension of reading materials
All practical to be assessed both in terms of products (reports, resources, etc.,) and processes (participation, teamwork, research, etc.,)

**Essential Readings**

**Unit 1: Revisiting key concepts**
- NCERT Biology textbooks (Classes 9 to 12). New Delhi: NCERT.
- HBCSE. Microbes and Diseases. Mumbai: HBCSE

**Unit 2: Analysing the secondary school biology curriculum**
- Karnataka State text books classes 6 to 10

**Unit 3: Children’s ideas about life and living organisms**

**Unit 4: Planning for teaching**

**Additional Readings**

• HBCSE. Foundation Course – Ecological Balance. Mumbai: HBCSE
Course Title: PCK of Mathematics - Part 2

Course Number: SC 04

Semester: 6

Credits: 2

No. of Instructional hours: 52

Total Marks: 100

**Rationale**

The knowledge of mathematics as a school subject involves an engagement with (a) selection, organization, and sequencing of content to be taught, (b) transitions and connections in the learning of concepts, (c) students’ ways of thinking and problem solving, and (d) deep knowledge of the content to be taught. These form the core areas of this course. In the previous semester, the focus was on developing an understanding of the nature of mathematics and the teaching learning of core concepts in mathematics relating to number systems, algebra and geometry. This course builds on these and engages student-teachers in a critical study of curriculum, textbooks and other teaching learning resources and critical elements of planning to ensure all children learn mathematics. Assessment is central to teaching and learning, not just for evaluating students but for understanding their thinking, reflection on teaching, and making decisions about teaching and learning. Student-teachers will examine the test items, analyse students’ responses to these items, and develop a variety of assessment tools. Using the student responses generated, student-teachers will discuss the purposes and nature of information extracted through different kinds of assessments.

**Course Objectives**

- Understanding the goals of teaching mathematics and organization of mathematics curriculum
- Preparing student-teachers to develop a repertoire of resources which
can be accessed when planning teaching of specific topics and sub-topics
- Examine, develop, and test assessment items and different modes of assessment of students
- Identify ways in which assessment can be used as reflections on teaching and learning

**Course Structure**

**UNIT 1: School Mathematics Curriculum**
- Goals of teaching mathematics in school; focus on problem solving and mathematisation.
- Organisation of school mathematics curriculum; nature of selection and sequencing of content across grades and key transitions in the content areas that pose challenges to teaching and learning of these areas.
- Critiquing mathematics textbooks and debates around school mathematics curriculum.

**UNIT 2: Planning for teaching learning of mathematics**
- Selecting the content for instruction; Identifying concepts to be transacted at grade 6 to 10
- Organisation of the concepts for designing teaching-learning
- Reflections on students’ alternate conceptions in mathematics and fear of mathematics
- Preparing unit plans for inclusive learning of mathematics

**UNIT 3: Reflecting on the use of resources in teaching mathematics**
- Puzzles, games and manipulatives
- ICT tools
- Preparation and use of resources for teaching specific mathematical concepts.

**UNIT 4: Assessment of Mathematics learning**
- Different purposes of assessment (diagnostic, evaluation, peer feedback, etc.)
- Design, development, and use of variety of tools and tasks to assess particular aspects of mathematics learning.
- Assessing conceptual understanding in mathematics, mathematical reasoning and problem solving-construction of test items, analysing students’ responses to the test items and discussing patterns.
- Designing a unit test.
**Tasks:**

- Select a topic domain (algebra, numbers, geometry, analysis) and study the way in which it has been sequenced in at least two textbooks (state and NCERT, or text books of any two states, an old and new text book, etc.). From the mapping of the topic at different levels identify - key ideas emphasized within its learning, nature of examples and experiences used, transitions at different grades, etc. Extract the goals of teaching and learning this topic to students and ways in which these they are achieved.

- Take a historical tradition in the development of mathematics. The groups can choose from these traditions - Greek, Islamic, Chinese, Indian, etc. Identify some key ideas in each tradition and engage the whole class in some mathematics problems and procedures developed by these traditions. Some of the references include


- Design a range of resources for the teaching learning of any one topic to meet the diverse learning needs of students.

- Design a variety of puzzles and games. You may also collate traditional games (like *alluguli mane*) that promote mathematical reasoning.

- Explore and use community resources for learning mathematics in a small group. Present a report.

- For a topic of any grade design a set of questions/tasks and plan modes to assess students’ understanding of the selected topic. Write a review of the exercise with an analysis of students’ responses to the tasks designed for assessment.
Essential Readings

UNIT 1: School Mathematics Curriculum


The two chapters from NCF 2005 discuss the notion of an active learner and the implications of this belief for planning teaching and learning. Student teachers must engage with the idea of learner and learning envisioned by the existing curriculum framework, notions of ‘what counts as knowledge’ and its sources, and ways in which the curriculum is organized into different stages. Chapter 3 provides an overview of ways in which learning is conceptualized in different subject domains. The readings aim to provide a context to the changing discourse on the goals of mathematics education, particularly an emphasis on processes. Student teachers can read parts of these two chapters in pairs, discuss, and present their understanding to the whole class.


After engaging with the broader context of reform through a careful reading and discussion of NCF, student teachers can be engaged with the new vision of mathematics teaching and learning. The national focus group report analyses the problems in teaching and learning of mathematics and discusses ways in which goals of mathematics teaching have to be reimagined to make mathematics learning meaningful for all learners. The goals of teaching mathematics at the upper primary level and the skills to be developed in students require detailed deliberation among student teachers.


The book is an outcome of a national presentation made by India in the International Congress on Mathematics Education. It captures several aspects of mathematics education – teacher preparation, curriculum change, analysis of mathematics textbooks, historical traditions in mathematics, etc. and provides a comprehensive engagement with the teaching and learning of mathematics in schools, colleges, and research institutions. Student teachers can be made to take a chapter each and in pairs present their understanding to whole class.


Another important aim of teaching mathematics has been problem solving. In this reading, the author connects the aim of problem solving with thinking mathematically and developing a sense of metacognition among learners of mathematics. The shifts in mathematics teaching from rote learning to seeking
solutions, finding patterns, and formulating conjectures need to be discussed explicitly with student teachers.

UNIT 2: Planning for teaching learning of mathematics


In this book an attempt had been made to integrate theory and practice wherever possible by illustrating each concept/method with examples/topics from high school mathematics and thereby providing teacher-trainees with ample opportunities to transfer their training to actual classroom situations.


This handbook provides a comprehensive introduction to teaching mathematics in primary and secondary schools. It brings together the latest standards with authoritative guidance, ensuring that readers feel confident about how to approach their role as a teacher. The book explores the context of the subject of mathematics and brings readers up to date with key developments. It places the mathematics curriculum in the context of whole-school numeracy issues and it introduces readers to key areas. "--BOOK JACKET.


UNIT 3: Reflecting on the use of resources in teaching mathematics


The empirical study by Khan presents a comparison of everyday practices with the school mathematics practices while computing with numbers. Through a detailed study of working class children in three different settings, the reading brings to our notice the limitations of the existing school ways of teaching mathematics. Further, it opens up a discussion on ways in which everyday mathematics can be linked with school mathematics.


The reading invites a discussion on the pedagogical issues arising from the use of technology in senior secondary mathematics classrooms. It conceptualizes different roles of the technology in a mathematics classroom and ways in which it use can be made conducive to active learning among students. The reading can be used to problematize the use of technology in limited ways in classrooms.
UNIT 4: Assessment of Mathematics learning


NCERT (2013), Source book on Assessment of Mathematics – Classes VI-VIII, New Delhi


Reading 3 and 4 reports articles which were an outcome of a large scale study aimed to assess seventh and twelfth graders’ performance on discrete mathematics, data organization and interpretation, numbers and operations, variables and relations, geometry, fundamental methods of mathematics, and attitudes. Ways in which students’ knowledge of specific concepts is assessed and judgments about their thinking are made need discussion. Student teachers must be made to focus on the test items, their design, and analysis. Further, issues of ecological validity could be discussed in relation to these test items, thus thinking about how students from different cultures, countries, and communities would respond to such items.


The reading invites us to look at different modes of assessment by challenging the traditional modes of problem posing in school mathematics and suggesting alternative questioning. Further, it introduces the idea of a problem-posing rubric with an example. Use of rubrics for assessing students' understanding of mathematics must be explored with student teachers for a continuous and more elaborate assessment.
Additional Readings

7. Ian Stewart, ‘Math Hysteria: Fun and Games with Mathematics’
8. Saraswathi, L.S. Everyday mathematics and the classroom: Case studies from rural South India chapter vii: Mathematical riddles/problems

Suggested mode of transaction
Since this course is focused on development of pedagogical content knowledge of the student teachers, the methods of teaching will revolve largely around practical aspects of making the students prepare unit plans along with essential readings that are provided in various units of this course. There will be a special workshop with an experienced field practitioner with whom the student teachers will discuss their lesson plans and develop appropriate resources.

Suggested mode of assessment
There will be parallel assessments through the given tasks in this course. The unit plans, resources, unit test prepared by student-teachers to be assessed.
**BENGALURU CENTRAL UNIVERSITY  B.Sc.B.Ed Integrated Programme**

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<tr>
<th>Course Title</th>
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**Introduction:**
It is a teacher education institution based programme which takes place during the 6th semester for getting students ready for their school internship programme. During this phase the prospective teachers are exposed to various teaching skills to ensure an understanding of teaching process. The student teachers are also engaged in the practice of teaching skills and its integration in simulated condition.

**Pre internship activities**
- To identify various types of school such as Government, Private, Urban, Rural, and Specified category schools (e.g. KVs, JNVs, Sainik Schools), Ashram Schools, Schools for challenged learners for internship.
- The school exposure programme shall be carried out in local/nearby schools.
- During pre internship necessary orientation programmes for Mentor Teachers and Heads of the selected schools will be organized in the institute.
- Discussion on unit planning, lesson planning, blueprint and unit tests/diagnostic tests, CCE etc.
- Discussion on records to be maintained by student teachers during internship.
- Demonstration of lessons in each subject by the experts/supervising teacher followed by discussion
- Demonstration of criticism Lessons by the experts/supervising teacher followed by discussion
- Observation of at least 2 lessons, by the student teachers, of their peers in each subject followed by discussion.
- Review literature on action research in the areas that student teachers wish to take up during their school internship.
- The institute shall develop detailed guidelines for school observation; and orient the student teachers to the process of school observation as well as to the use of guidelines.
VII SEMESTER
BENGALURU CENTRAL UNIVERSITY
B.Sc.B.Ed Integrated Programme

Course Title: Gender, School and Society
Course Number: HC 13
Semester: 7
Credits: 1
No.of Instructional hours: 26
Total Marks: 50

Rationale
Gender is a social construct that impacts attitudes, roles, responsibilities and behavior patterns of boys and girls, men and women in all societies. Gender relations vary from society to society. Gender determines power relations in multicultural societies like India. It deals with human concerns encompassing diversities and differences. It has been the most visible form of discrimination operating across cultures. When one analyses the present context of gender discourse, the prime concern is how gender functions as a determinant of construction of knowledge in different disciplines. Education has the inbuilt potential of formulating interlinkages between gender and education. Discourses on gender and education require critical engagements with the deep questions on the nature of socialization. It needs to reflect and focus on transforming attitudes, beliefs and behavioral patterns that impact gender relation in family, community, school and work place and so on. In order to eliminate the hierarchies on such social constructions, gender debates and discourses have to be operationalised within the overarching concern for democratic education. This course is crucial for addressing gender bias and stereotypes that operate in all social spaces in textual materials and print media accessed by students and other stakeholders. It would make the teachers reflect on her /his socialization and analyze critically the processes that shape masculinity and femininity. Further, it is hoped that teachers as agents of change would encourage students to reflect on their socialization and critique all those practices that perpetuate stereotypes and biases.
Objectives:

The course will enable the student teachers to -

- develop basic understanding and familiarity with key concepts - gender, gender bias, gender stereotype, empowerment, gender parity, equity and equality, patriarchy and feminism and transgender.
- know about policies, plans and schemes of the government for addressing all forms of disparities and inequalities existing in the society
- learn about gender issues in school, curriculum, textual materials across disciplines, pedagogical processes and its intersection with class, caste, religion and region; and
- understand the need to address gender based violence in all social spaces and evolve strategies for addressing it.

Course Organisation

Unit 1: Gender Issues: Key Concepts

1. Gender, Social construction of Gender
2. Gender socialization and Gender Roles
3. Gender discrimination at different levels of institutions (institutions related to social, cultural, religious, economic, political and educational settings).

Unit 2: Gender socialization processes in India: Family, School and Society

1. Gender identities and socialization practices in different types of families in India.
2. Gender concerns related to access, enrolment, retention, participation and overall achievement.
3. Gender Issues in Curriculum –
   - Gender, Culture and Institution: Intersection of class, caste, religion and region
   - Construction of gender in curriculum frameworks since Independence: An Analysis – Gender and the hidden curriculum
   - Gender in text and classroom processes – Life skills and sexuality.
4. Gender Jurisprudence (in Indian Context)
   - Prenatal diagnostic Technique Act, 1994
   - The draft sexual Law Reforms in India, 2000
   - Domestic Violence Act, 2005
   - Reservation for Women
   - Supreme Court Verdict about transgender.
The below exercise shall be part of internship course : Creating Gender Inclusive Classroom

1. Developing positive self concept and self esteem among girls
2. Teaching Learning Materials
3. Classroom transaction
4. Teacher as an agent of change

Suggested Tasks:

1. Students share their own experience of growing up as female or male in comparison with the other sex.
2. Watch films such as Gejje Pooje, Shara Panjara, Dweepa etc. Write your observations and comments about the film with a focus on female character.
3. Choose a T V Serial of the regional languages. Write an analysis of the female characters represented in the serial.
4. Analyse Textbooks of Class VI to X (of your State) from the Perspective of Gender Bias and Stereotypes.
5. Organize Debates in Class on Equity and Equality cutting across Gender, Class, Caste, Religion, Ethnicity Disability and Region.
8. Observe Participation of Boys and Girls in different Activities in Heterogeneous Schools Public and Private-Aided and managed by Religious Denominations and prepare a report.
9. Field visits to Schools, to Observe the Schooling Processes and Transactional Strategies from a Gender Perspective.
12. Collect material related to Women Role Models in various fields with Emphasis on Women in Unconventional Roles and prepare a brief report.
13. Collect thoughts of Eminent Men and Women of India on Girls Education and Women’s Empowerment.
14. Organise poster competition on Gender Equality And Empowerment.

Suggested mode of transaction:

Critical reading and discussions of the essential reading texts; movies and documentaries. Sharing of student teachers’ experiences of their own experience of growing up as a female or male in a comfortable, trusted and non
threatening atmosphere
Readings about growing up belonging to particular gender from diverse contexts; Engaging with children in different contexts, writing reports on the engagement, sharing with the rest of the class and reflections;

Reading and discussing about children’s lived realities in many ways: through biographies, stories, narrations of growing up in different cultures, observations about children by parents and teachers, children’s diaries, testimonies and the media.

**Suggested Mode of Assessment:**
Assessing student-teachers’ capacities to observe, understand and interpret notions about sex and gender. Nature of critique of the universalistic normative notions of gender; Ability to interpret how gender, caste and social class may impact the lived experiences of children at home and in schools.

**Readings**

**Unit 1:**
1. Rokeya, Sakhawat Hossain, 1905. ‘Sultana’s dream’ First published in The Indian Ladies magazine
4. Butalia U, 2011, Mona’s Story, Granta, (Online Magazine)

**Unit 2:**
Education for Women, in Women in Modern India, Cambridge University

NCERT 2005 Report of the National Focus Group on Gender Issues in Education ([www.ncert.org](http://www.ncert.org))


UNESCO – Methodological Guide – Promoting Gender Equality through text books

**Additional Readings**

3. [https://www.edge.org/3rd_culture/debate05/debate05_index.html](https://www.edge.org/3rd_culture/debate05/debate05_index.html)
4. Documentary - Bioscope,Non-Binary Conversations on Education and Gender, Directed by Samreen Farooqui and Shabani Hassanwalia,
**BENGALURU CENTRAL UNIVERSITY B.Sc.B.Ed Integrated Programme**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>School Internship Programme</th>
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</thead>
<tbody>
<tr>
<td><strong>Course Number</strong></td>
<td>SC 05</td>
</tr>
<tr>
<td><strong>Semester</strong></td>
<td>7</td>
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<tr>
<td><strong>Credits</strong></td>
<td>6</td>
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<tr>
<td><strong>No.of Instructional hours</strong></td>
<td>170</td>
</tr>
<tr>
<td><strong>Total Marks</strong></td>
<td>300</td>
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</tbody>
</table>

**Note:** In Semester 7 student-teachers can intern in higher primary schools, engaging with classes 6 to 8.

**Rationale:**

This course is visualised as an essential part of the B.Ed programme as it will provide opportunities to the student teachers to gain field experiences by engaging with students, teachers, parents, schools and community at large. It will equip the student teachers to link the tasks they have to perform with the theoretical knowledge acquired through various courses included in practical situation. This shall be done through three different components viz, Tasks and Assignments in different courses, School Internship, and Courses on Enhancing Professional Capacities.

**Objectives of the course:**

This course will enable the student teachers

- to facilitate student learning by creating authentic learning situations;
- prepare school development plan in collaboration with local community;
- to use local resources, including material and local knowledge in teaching learning process;
- to integrate ICT in teaching learning process;
- to respect diversity among learners and seek to promote learning of all;
• to use alternative assessment tools and involve students in assessment process;
• to adapt teaching learning strategies and/or use various teaching learning strategies to address diversity among learners, including cultural and learning needs;
• To promote holistic approach to student assessment and organization of learning environments; and bring out pedagogical innovations in promoting quality of learning

Activities that should be undertaken by Students during School Internship (for classes 6 to 8)

1. Planning and Facilitating Teaching Learning
• Unit/ Lesson planning
• Classroom teaching
• Lesson observation
• Developing and Using Teaching Learning Resources
• ICT integration

2. Assessment, Remediation and Action Research
• Preparation of CCE activities including unit tests
• Preparation of diagnostic tests and identifying learning difficulties
• Planning and executing remediation
• Assessing effectiveness of remediation through action research

3. Understanding School Context
• Prepare Profile of the school (Type of School/infrastructure, facilities teachers, students and community information)
• Analyze Learner Performance(One class)

4. Understanding Learner
• Collecting information about a student(Case Study)

5. Participation in School Activities
• Organize all types of curricular activities, e.g. sports and games, debate, song, art, music, painting

6. Community and school
• Survey of households
• Interaction with SDMC/SMC members  Interacting with parents

Records to be submitted for assessment
• Lesson plans/ Unit plans
• School profile: infrastructure; Social Science Laboratory - physical facilities, Equipment, School Library- facilities
• Record of Participation/organization of school activities
• Diagnostic testing, remediation
Assessment:

The assessment of the performance of student teachers shall be based on the feedback received from all associated with the programme, including mentor teachers, peers, supervisors of the institute; and various records submitted by the student teachers.
VIII SEMESTER

BENGALURU CENTRAL UNIVERSITY B.Sc.B.Ed

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Education and National Concern</th>
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<tbody>
<tr>
<td>Course Number</td>
<td>HC 14</td>
</tr>
<tr>
<td>Semester</td>
<td>8</td>
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<td>Credits</td>
<td>1</td>
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<tr>
<td>No.of Instructional hours</td>
<td>26</td>
</tr>
<tr>
<td>Total Marks</td>
<td>50</td>
</tr>
</tbody>
</table>

**Rationale:**
This course aims at encouraging students to appreciate the coherence in their individual aspirations and concerns with that of their Nation. Every citizen of this nation is affected by environmental pollution, health risks, poverty, and inefficient economy due to low productivity, violation of Human rights etc in one or the other form. But most often we end up blaming our individual fate for these and do not situate the problem in the larger context to seek collective solution. Seeing the coherence in our individual concerns and aspirations with that of our nation would help us cooperate and work harmoniously to solve these problems.

**Objectives of the course:**

- Develop insight and strategies about the process of Population and Environmental Education.
- Develop knowledge and skills on the concept, process, ways & means of sustainable development.
- Understand the concepts of HIV/AIDS, clarify the myths and misconceptions related to HIV/AIDS.
- Understand the meaning, importance and develop strategies of Peace & Multicultural Education.
- Understand the historical backdrop of Universal Declaration of Human Rights.
- Develop sensitivity and skills in conducting appropriate scholastic and co-scholastic activities to promote human rights culture among students.
Course Organisation:

Unit 1: Contemporary National Concerns and Education
- Population Education-meaning and objectives, measures to achieve stability in population growth.
- Environmental Education- meaning and objectives.
- Environmental pollution-types, causes, consequences and measures.
- Sustainable Development – Concept, importance and strategies. Eco-friendly lifestyle.
- Multicultural Education- meaning, importance and strategies.

Unit 2: Life skills & Adolescence Education
- Meaning and importance of life skills Education.
- Basic life skills recommended by Unesco- critical thinking, creative thinking, decision making, problem solving, self – awareness, stress management, management of emotion, interpersonal relations, effective communication and empathy.
- Strategies of teaching life skills.
- Educational implications of life skills.
- Adolescence Education – meaning, objectives & school activities.

Tasks:
Prepare and present seminar paper on the following topic
1. Status of literacy programmes and Non-Formal Education in India.
2. Role of school and community in promoting environmental concern & values among students. 3. Programmes and strategies to create awareness & responsible behaviour on HIV/AIDS - transmissions & prevention.
4. Critical analysis of the human rights policies and programmes in India.
6. Disaster Management in India – status, hazards, policies-procedure and implementation strategies.
7. Sustainable Development through Eco – Friendly lifestyle.

Unit 1: Essential Readings
Unit 2: Essential Readings

Additional Readings
Course Title: School Internship Programme

Course Number: SC06

Semester: 8

Credits: 4

No. of Instructional hours: 140

Total Marks: 200

Note: In Semester 8 student-teachers can engage classes 9 & 10.

Rationale:
This course is visualised as an essential part of the B.Ed programme as it will provide opportunities to the student teachers to gain field experiences by engaging with students, teachers, parents, schools and community at large. It will equip the student teachers to link the tasks they have to perform with the theoretical knowledge acquired through various courses included in practical situation. This shall be done through three different components viz, Tasks and Assignments in different courses, School Internship, and Courses on Enhancing Professional Capacities.

Objectives of the course:
This course will enable the student teachers

- to facilitate student learning by creating authentic learning situations;
- prepare school development plan in collaboration with local community;
- to use local resources, including material and local knowledge in teaching learning process;
- to integrate ICT in teaching learning process;
- to respect diversity among learners and seek to promote learning of all;
- to use alternative assessment tools and involve students in assessment process;
- to adapt teaching learning strategies and/or use various teaching learning strategies to address diversity among learners, including cultural and learning needs;
- To promote holistic approach to student assessment and organization of learning environments; and bring out pedagogical innovations in promoting quality of learning.
Activities that should be undertaken by Students during School Internship (for classes 9 & 10)

1. Planning and Facilitating Teaching Learning
   - Unit/ Lesson planning
   - Classroom teaching
   - Lesson observation
   - Developing and Using Teaching Learning Resources
   - ICT integration

2. Assessment, Remediation and Action Research
   - Preparation of CCE activities including unit tests
   - Preparation of diagnostic tests and identifying learning difficulties
   - Planning and executing remediation
   - Assessing effectiveness of remediation through action research

3. Understanding School Context
   - Prepare Profile of the school (Type of School/infrastructure, facilities teachers, students and community information)
   - Analyze Learner Performance (One class)

4. Understanding Learner
   - Collecting information about a student (Case Study)

5. Participation in School Activities
   - Organize all types of curricular activities, e.g. sports and games, debate, song, art, music, painting

6. Community and school
   - Survey of households
   - Interaction with SDMC/SMC members  Interacting with parents

Records to be submitted for assessment
   - Lesson plans/ Unit plans
   - School profile: infrastructure; Social Science Laboratory - physical facilities, Equipment, School Library- facilities
   - Record of Participation/organization of school activities
   - Diagnostic testing, remediation
   - Report of action research
   - Case study of a student
   - Assessment record (CCE)
   - School time table
   - Reflective Journal

Assessment:
The assessment of the performance of student teachers shall be based on the feedback received from all associated with the programme, including mentor teachers, peers, supervisors of the institute; and various records submitted by the student teachers.
Introduction:
This is a final phase of internship programme which takes place in the last semester. For the most part it will be based on the various records submitted by the student teachers as part of their school internship. It will also include peer evaluation of each other’s records and discussions based on that. These records should be consolidated and an exhibition should be held at the end for which School Heads and mentor teachers will be invited for review.

Post Internship Activities
The following activities shall be organised in the Post Internship phase:

- Preparation of brief report by each student teacher on his/her internship experiences.
- Presentation of the reflections of internship by student teachers, which will be conducted in smaller group/subject wise and assessed by the supervisors.
- Students in their reflections will profusely draw relationships or inconsistencies if any between the courses that they went through as part of the B.Ed programme and the experiences of the field.
- Exhibition of teaching aids and consolidated reports. Inviting feedback from cooperating schools.
- Viva-Voce on School Internship Programme by a board comprising of faculty members of the institute.
**Rationale**

One of the major preoccupations of quality education has been promoting reflective practices among all practitioners. A truly reflective professional can contextualise his/her knowledge to attend to issues that arise in his/her workplace. Maintaining journals, teacher development groups, peer interactions, reflections over student portfolios, or any feedback obtained through continuous and comprehensive evaluation could be facilitating reflective practices.

Action research is one such tool that facilitates reflections among teachers. Action research perhaps subsumes all other tools because it is a way of thinking; it is an attitude and makes use of all available resources for addressing problems. It is desirable that a student teacher is prepared with action research know-how so that when entering the profession he/she is competent enough to take on the challenges.

Hence this paper deals exclusively with action research. It is designed with a view to expose the student teachers to the concept of action research as well as provide some practical experience in conducting action research during their internship. The theoretical and practical inputs given is hoped to enhance the professional competence of the would be teachers.
Objectives

The course facilitates student teachers in:

- Gaining practical experience in conducting action research
- Relating action research to their professional development.

Unit 1: Conducting action research in school

This unit is to be taken up in the school where the student-teachers undergo their internship. They observe classes, prepare a proposal, discuss the proposal, prepare appropriate tools, implement the plan and collect data.

- Identifying a problem for action research
- Preparation of a proposal
- Preparing appropriate tools
- Implementing the plan
- Data collection and encoding for analysis
- Analysis of data and interpretation
- Preparing action research report

Unit 2: Reflections, sharing and further initiatives

- Presentation of the report to the class and discussion, sharing insights
- Teacher educators can choose some of the reports and after due editing student-teachers can share them in the classroom.

Assessment

- 15 marks for the action research proposal prepared. (Both process and products are to be assessed).
- 20 marks for involvement in conducting action research, tools and support material used - to be assessed using a checklist.
- 15 marks for report and presentation (10 marks for the quality of report submitted, 5 marks for presentation)

Suggested mode of transaction

Discussions – could be held on preparations to be done – identification of a problem while in school, finalising the problem, preparation of a proposal, discussion with the teacher educator and implementation.

Presentation – The following topics could be briefly discussed by the teacher educator focusing on tools of data collection and preparation of tools.
- Tools of data collection – tests, observation schedules, diaries etc.
- Collection of data through various sources – observation, tests, interviews
- Analysis of data and interpretation. (Only up to descriptive statistics covering the mean, SD, kurtosis, skewness is sufficient to describe the composition of the group.)
- The student-teachers practice in the school where they undergo internship. They observe classes, prepare proposal, discuss the proposal, prepare appropriate tools using WORD PROCESSORS, implement the plan and collect data. Use of spreadsheet (available in any computer – preloaded along with Office Tools) for keying in data and its analysis.

**References**

SSA, Karnataka(2006). Kriya Samshodhane Tarabethi Kaipidi(Action Research Training Manual). – This book is a comprehensive handbook for teachers conducting action research. It deals with theoretical aspects along with examples. This book has been supplied to all government schools and almost all working teachers in government schools in Karnataka have been trained in Action Research.

http://rmsa.karnatakaeducation.org.in/?q=forum- The Subject Teacher Forums that have been started under RMSA provide space for teachers to share their experiences and problems faced. The discussions are quite beneficial to all teachers. Anyone can become a member of these forums.
Part 4: Foundation Course/ Skill Development Course

1. Constitution of India
2. Computer Literacy
3. Yoga
4. Environmental Studies
5. Life Skills
6. Indian History, Culture and Diversity
Acknowledgements

We gratefully acknowledge the constant Academic support and encouragement we received from Prof. Haseen Taj, Department of Education, and Bangalore University throughout the curriculum development process as the Chairperson of 4 Years Integrated Bsc.B.Ed Sylabus Committee.

Our heartfelt gratitude to Sr. Dr. Arpana, Principal of Mt. Carmel College and Dr. Snehalatha Nadigar, Principal of NMKRV College for their leadership and all the help they rendered.

We thank the advisory group for anchoring the process and all the members of the curriculum development team but for whose support this exercise could not have been possible.

We also thank the management of Rashtreeya Sikshana Samithi Trust for their support and the team from RVEC: Asha.P, Asha.Y, Kavya C.V, Ramya V.S, Naveenkumar B.P, and Annapurna S for help with compiling the curriculum document.

We acknowledge with thanks Tata Institute of Social Sciences for permission to adopt pedagogical content knowledge courses that they have developed for their proposed two year B.Ed programme, IT for Change for the ICT Mediation course, Azim Premji University and Rishi Valley Education Center for sharing their faculty pack. The curriculum for Art and Craft education course and Theatre in Education draws from 4 year B.El.Ed curriculum of Delhi University. Curriculum for Health and physical education based on NCERT’s 2-Year B.Ed curriculum

Advisory group members

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Dr. Haseen Taj</td>
<td>Professor &amp; Chairperson for 4 Years Integrated Bsc.B.Ed Sylabus Committee, Department of Education, Bangalore University.</td>
</tr>
<tr>
<td>Dr. Padma Sarangapani</td>
<td>Professor &amp; Chairperson, Center for Education Innovation and Action Research Tata Institute of Social Science</td>
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<tr>
<td>Dr. Indira Vijayamha</td>
<td>Faculty, Azim Premji University</td>
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<tr>
<td>Mr. Alok Mathur</td>
<td>Director, Rishi Valley Education Center</td>
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<tr>
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<td>Formerly Dean, Dept of Education, Banasthalli Vidhya Peetha, Banasthalli</td>
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<td>Formerly Principal of Regional Institute of Education, Mysore</td>
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<td>Professor, Institute of Mathematical Sciences, Chennai</td>
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<td>Suvidya</td>
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<td>Independent Consultant</td>
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<td>Scientist, Jawaharlal Nehru Planetarium</td>
</tr>
<tr>
<td>Dr. Raghavendra</td>
<td>Faculty, Indian Institute Of Science</td>
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**Curriculum Compilation Team**

**Disciplinary Courses**

<table>
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<tr>
<th>Subject</th>
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</thead>
<tbody>
<tr>
<td>Physics</td>
<td>Ms. Mahua Ghosh, Mount Carmel College</td>
</tr>
</tbody>
</table>
| Chemistry | Smt. Shilpa P, NMKRV Degree College  
Ms. Shanthi.S, Mount Carmel College |
| Botany | Ms. Reena Singh Rajput, NMKRV Degree College  
Prof. Y.B. Jayashree, NMKRV Degree College  
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Ms. Geetha M, R V Educational Consortium  
Mr. Narasimha Swamy, R V Educational Consortium |

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**Dr. Shantha Maria**, Mount Carmel College