



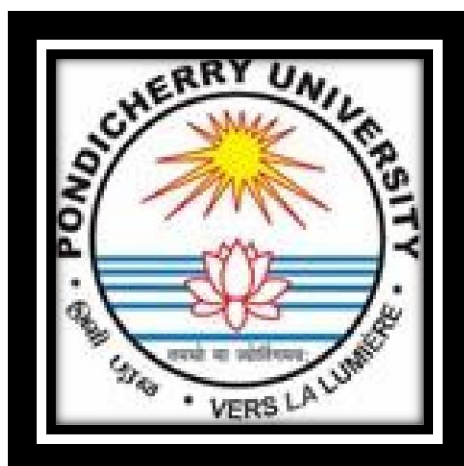
INTEGRATED TEACHER EDUCATION **PROGRAM**

(ITEP: 4-YEAR DURATION)

B.Sc., B.Ed. PROGRAMME (SEMESTER)

Regulations and Syllabus

(2023-24 Onwards)



School of Education

Pondicherry University

(As per NCTE Regulation-2019 & NEP-2020)

1. PREAMBLE

The 4-year Integrated Teacher Education Programme (ITEP) will be a dual-major holistic bachelor's degree, in Education as well as a specialized subject such as a language, history, music, mathematics, computer science, chemistry, economics, art, physical education, etc. Beyond the teaching of cutting-edge pedagogy, the teacher education will include grounding in sociology, history, science, psychology, early childhood care and education, foundational literacy and numeracy, knowledge of India and its values/ethos/art/traditions, and more”.

2. TITLE

The 4-Year Integrated Teacher Education Programme (ITEP) envisaged as per the NEP 2020 and NCTE Norms/Guidelines. The B.Sc.,B.Ed.& B.A.,B.Ed. offered by the Pondicherry University from the academic year 2023 -24 as per the NCTE regulations suggestive Curriculum Framework and University Acts & UGC guidelines.

3. THE 4-YEAR INTEGRATED TEACHER EDUCATION PROGRAMME & EQUIVALENCE

The Integrated Teacher Education Programme (ITEP) consists of 4-Year Duration offered by the School of Education Pondicherry, University as per the NCTE 2023 norms and standards. It is a flagship programme started in all over India from the academic year 2023-24. This course offers two streams namely B.Sc.,B.Ed. and B.A.,B.Ed. as graduate level under semester pattern including the domain knowledge of Science and Arts Education Content. The Education content and Domain specific curriculum incorporated as per NCTE suggestive curriculum framework and the domain specific knowledge of Science and Arts syllabus as per Board of Studies of Pondicherry University for the commencement of the programme from the academic year 2023-24.

The Equivalence of the 4-Year Integrated Teacher Education programme(ITEP) implacable or eligible for the candidates needs to pursue further PG programme of Arts and Science discipline. This programme offered by the University is also eligible to pursue PG programme in Education. The weightage of the Science content treated as Science discipline and the weightage of the Education content treated as Education Discipline are at under graduate level. Similarly, in Arts discipline at under graduate level.

4. OBJECTIVES

On completion of the programme, the student-teachers will:

- Develop competencies and skills needed to become an effective teacher in their discipline.
- Develop insight into the meaning, nature, scope, and objectives of Arts / Science Education.
- Become a competent and committed teacher for understanding rights of the child.
- Be sensitive to emerging issues such as Environment, Population and Gender equality.
- Inculcate rational thinking and scientific temper among the student-teachers.
- Develop critical awareness about the social realities among the students- teachers.
- Develop innovative, novel teaching methods and enhance classroom managerial skills.

5. DURATION & MAXIMUM DURATION TO COMPLETE THE COURSE

The duration of the program shall be four academic years organized into 8 semesters in a semester pattern with two semesters a year. Each semester will consist of 40 hours of weekly instruction, including admission and examinations. The student-teacher shall be permitted to complete the programme within six years from the date of admission.

6. ELIGIBILITY & ADMISSION PROCEDURE.

A Certificate obtained after successful completion of Grade 12 or + 2 Examination or equivalent stage of education such as Pre-University, Intermediate, etc., as per state policy of higher Secondary) with a minimum of 50% marks in aggregate or an equivalent grade from a recognized School Board/ Intermediate College/ are needs to appear the National Common Entrance Test (NCET) conducted by the National Testing Agency (NTA). The select list and wait list will be published by the NTA based on merit list on Rank order as per the Pondicherry University selected by the applicant. The relaxation of admission procedure may sometimes vary to admit the candidates as spot admission if any vacancy arises at the end of closing date of admission. The rights are laid down in the University for admitting such candidates. At any circumstance the reservation of seats for SC/ ST/OBC/EWS will not be changed for admission of candidates through entrance or spot admission if any.

7. INTAKE

The annual intake for the ITEP shall be of two Units (50+50=100) students for B.Sc B.Ed., & B.A., B.Ed., respectively as per NCTE norms. Admission shall be regulated through selection based on marks in the qualifying examination through NCTE or performance in a specially designed selection test conducted by National Testing Agency (NTA) and the admission policies of Pondicherry University from time to time as deemed fit.

Programme/ Discipline	Subject/Specialisation(Major/Minor)	Intake
B.Sc.B.Ed.	Physics/Chemistry/ Mathematics/	50
B.A.,B.Ed.	English/ History/Economics	50

8. MEDIUM OF INSTRUCTION

The medium of instruction shall be in English and in the constitutionally approved Modern Indian Languages.

9. MULTIPLE ENTRY AND MULTIPLE EXIT

The ITEP envisages multiple entry and exit points and re-entry options, with appropriate certifications. Student-teachers who wish to exit after completion of one year (two semesters) of study will be awarded a **Certificate** indicating the credits secured for the courses pursued. Student-teachers who wish to exit after completion of two years (four semesters) will be awarded a **Diploma in Teacher Education** indicating the credit secured for the courses completed. Student teachers who wish to exit after successful completion of three years (six semesters) will be awarded a **Bachelor's Degree** in the chosen Major area of study upon securing a minimum of 120 credits and satisfying the minimum credit requirements of 48 credits for the Major. Student-teachers who successfully completed four years (A total of eight-semesters) of study will be awarded a **Dual-major Bachelor's Degree** such as **B.A.,B.Ed. or B.Sc., B.Ed.(Secondary)**

10. METHODS OF TRANSACTION

The following are the suggestive methods of curriculum transaction

- Lectures-cum-Discussion
- Lecture-cum-Demonstration
- Use of narratives based on research and documentation
- Project reviews
- Case studies/ Interviews/Focus Group Discussion
- Video Clips and Transcripts of Classroom Teaching
- Success Stories/Innovations
- Observation in schools and Other field sites
- School Internship
- Panel or Group discussion
- Individual Projects
- Journal Writing / Academic Writing
- Use of library and ICT/Digital resources.

11. ATTENDANCE

Students of the program must secure a minimum of 80% attendance in theory courses and 100% for field-based experience cum school internship to appear in the End Semester Examination (ESE). If any student fails to complete 80% of the course and 90% of the training, he/she will not be permitted to attend end-semester examinations. She/ He shall be asked to redo the course by enrolling for it then exits time when it is offered and as per CBCS regulations of Pondicherry University.

12. COURSE OUTLINE

- The B.Sc., B.Ed. & B.A., B.Ed. programme covers a total of 160 credits each. The Science and Arts curriculum is a single major course with two minors offered at II and IV Semester.
- If Mathematics is the major course of 56 credits and Physics (4 credits) and Statistics (4credits) shall be the minor courses, similarly to all other disciplines like Chemistry, Physics in B.Sc., B.Ed. stream and English, History and Economics in B.A., B.Ed. stream. The Major courses shall be offered in the first six semesters of 3 years duration including 2 minor courses.
- The curriculum structure of the ITEProgramme of B.Sc., B.Ed. & B.A., B.Ed. is adapted from NCTE's Suggestive Curriculum Framework-2023. This consists of Student Induction Programme, Foundations of Education (30Credits), Disciplinary/Inter-disciplinary Course (64Credits) Stage-Specific Content cum Pedagogy (16credits), Ability Enhancement & Value-Added Course (28 credits), School Experience (20credits) and Community Engagement and Service (2 credits)
- Details of courses and schemes of study, duration, etc., are provided in Tables 1 and 2. Courses of study is organized under the following categories. The nomenclature of all Core papers, Minor Paper and other related categories has been adapted from NCTE regulations.

Under Graduate B.Ed Stage Specific Content cum Pedagogy

ITEP STRUCTURE												
Sl. No.	Curricular Component	Courses	Credit per Semester								Total Credits per Course	Total Credits
			S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8		
1.	1. Student Induction Programme	Two-Week Student Induction Programme	-	-	-	-	-	-	-	-	-	-
2.1	2. Foundation of Education	Evolution of Indian Education	4	-	-	-	-	-	-	-	-	4
2.2		Child Education & Educational Psychology	-	-	4	-	-	-	-	-	-	4
2.3		Philosophical & Sociological Perspectives of Education – I	-	-	-	4	-	-	-	-	-	4
2.4		Assessment & Evaluation	-	-	-	-	-	2	-	-	-	2
2.5		Inclusive Education	-	-	-	-	-	2	-	-	-	2
2.6		Perspectives on School Leadership & Management	-	-	-	-	-	-	2	-	-	2
2.7		Curriculum Planning & Development Textbooks, material development, etc) (Stage specific)	-	-	-	-	-	-	2	-	-	2
2.8		Philosophical & Sociological Perspectives of Education-II	-	-	-	-	-	-	-	4	-	4
2.9		Education Policy Analysis	-	-	-	-	-	-	-	2	-	2
2.10			One Elective from offered courses as per the choice of students teachers (Adolescence Education, Education for Mental Health, Education for sustainable development, Emerging Technologies in Education, Gender Education, Guidance& Counselling, Peace Education, Sports & Fitness Education or any other relevant course decided by the University.	-	-	-	-	-	-	-	-	-
3.1	3.Disciplinary/ Inter Disciplinary Courses	One/two discipline(s) from any of the school curricular areas. 2. Physics./Chemistry, Mathematics 3. English /Economics/ History	8	12	12	12	12	8	-	-	-	64
4.1	4.StageSpecific Content-cum-Pedagogy	Stage – Specific Content-cum-Pedagogy Courses	-	-	4	4	4	4	-	-	-	16
5.1	5.Ability	Language-I (as per the 8 th Schedule of Constitution of India	4	-	-	-	-	-	-	-	-	4

5.2	Enhancement & Value Added Courses	Language-II (Other than Language-I)	-	4	-	-	-	-	-	-	4	
5.3		Art Education (Performing and visual)	2	-	-	-	-	-	2	-	4	
5.4		Understanding India (India Ethos and Knowledge Systems)	2	2	-	-	-	-	-	-	2	
5.5		Teacher and Society	-	2	-	-	-	-	-	-	2	
5.6		ICT in Education	-	-	-	-	2	-	-	-	2	
5.7		Mathematical & Quantitative Reasoning	-	-	-	-	-	2	-	-	2	
5.8		Sports, Nutrition and Fitness	-	-	-	-	-	-	2	-	2	
5.9		Yoga & Understanding Self	-	-	-	-	-	-	-	2	2	
5.10		Citizenship Education, Sustainability and Environment Education	-	-	-	-	-	-	-	2	2	
6.1		6.School Experience	Pre – Internship Practice (Demonstration, Lessons, Peer Teaching)	-	-	-	-	2	-	-	-	
6.2	School Observation (Field Practice)		-	-	-	-	-	2	-	-	2	
6.3	School based Research Project		-	-	-	-	-	-	2	-	2	
6.4	Internship in Teaching		-	-	-	-	-	-	10	-	10	
6.5	Post Internship (Review and Analysis)		-	-	-	-	-	-	-	2	2	
6.6	Creating Teaching Learning Material work Experience (Educational Toy making, Local/Traditional Vocations, etc)		-	-	-	-	-	-	-	2	2	
7.1	7.Community Engagement &Service	Community Engagement and Service (Participation in NSS related activities, New India Literacy Programme etc)	-	-	-	-	-	-	-	2	2	2

13. ASSESSMENT & EVALUATION

The Choice Based Credit System (CBCS) enables the student-teacher to obtain a ITEP degree by accumulating prescribed number of credits. The number of credits earned by the students reflects the knowledge or skills acquired. Credits are assigned to each course based on the content. The grade points earned in each course reflects student-teacher proficiency.

Internal and External

All theory courses in ITEP Course shall carry an internal assessment component of 30 Marks and End semester component of 70 Marks. Each teacher shall organize a continuous assessment of each courses assigned. The internal assessment marks shall be given to as per the following break up.

Sl.No.	Internal/Sessional Test/ Term paper (Average of 2 Test)	20 Marks
1.	Seminar/Assignment/Write up/Viva Voce	10 Marks
2.	Total	30 Marks

End semester examination shall be conducted for all the courses offered by the School of Education. The duration of the end semester shall be for 3 hours. Question Paper setting, invigilation and single evaluation of answer paper shall be by the concerned course teacher.

Sl.No.	Section	Type of Question	Marks	Total Marks
3.	Part-I	10 Very Short Answer (10 Out 12)	2x10	20
4.	Part-II	5 Short Answer (5 Out 8)	5x4	20
5.	Part-III	3 Essay Type Question with Internal Choice	3x10	30
Total				70 Marks

Grading System: Letter Grade and Grade Points

Performance of the students in each paper is expressed in terms of marks as well in Letter Grades. In case of fractions the marks shall be rounded off to nearest integer.

Sl. No.	Letter Grade	Grade Points for calculation of SGPA
1.	O	10
2.	A+	9
3.	A	8
4.	B+	7
5.	B	6
6.	C	5
7.	F	0
8.	FA	0

14. CHOICE BASED CREDIT SYSTEM(CBSC) FRAMEWORK FOR ITEP

Curricular Structure & Credit Load for Four Year ITEP- B.Sc. B.Ed.:

SEMESTER - I

Curricular Component	Course Code	Name of the Course	Credits	CCE*	UE**	Total
Foundations of Education	FE01	Evolution of Indian Education	4	30	70	100
Physics	PHY200	Mechanics	4	30	70	100
	PHY201	Practical – A	4	30	70	100
Chemistry	CHE200	Principles of General Chemistry – 1	4	30	70	100
	CHE201	Practical – A	4	30	70	100
Mathematics	MATH200	Theory of Equations & Trigonometry	4	30	70	100
	MATH201	Differential Calculus	4	30	70	100
Ability Enhancement & Value Added Courses	AEVL100	Language – I Tamil / French / Malayalam / Telugu / Hindi	4	30	70	100
	AEV101	Art Education – I (Performing & Visual)	2	50	-	50
	AEV102	Understanding India	2	50	-	50
Total Credits (for each discipline)			20	220	280	500

SEMESTER – II

Curricular Component	Course Code	Name of the Course	Credits	CCE*	UE**	Total
Physics	PHY202	Optics	4	30	70	100
	PHY203	Kinetic Theory	4	30	70	100
	PHY204	Chemistry Theory Chemistry Practical – I	3+1	30	70	100
Chemistry	CHE202	Principles of General Chemistry – II	4	30	70	100
	CHE203	Physical Chemistry – I	4	30	70	100
	CHE204	Physics Theory Physics Practical - I	3+1	30	70	100
Mathematics	MATH202	Analytical Geometry 3D	4	30	70	100
	MATH203	Integral Calculus	4	30	70	100
	MATH204	Mathematical Statistics - I	4	30	70	100
Ability Enhancement & Value Added Courses	AEVL103	Language-II English	4	30	70	100
	AEV104	Understanding India (Indian Ethos & Knowledge System)	2	50	-	50
	AEV105	Teacher & Society	2	50	-	50
Total Credits (for each discipline)			20	220	280	500

SEMESTER – III

Curricular Component	Course Code	Name of the Course	Credits	CCE*	UE**	Total
Foundations of Education	FE02	Child Development & Education Psychology	4	30	70	100
Physics	PHY205	Electricity	4	30	70	100
	PHY206	Modern Physics	4	30	70	100
	PHY207	Practical – B	4	30	70	100
Chemistry	CHE205	Inorganic Chemistry – I	4	30	70	100
	CHE206	Physical Chemistry – II	4	30	70	100
	CHE207	Practical – B	4	30	70	100
Mathematics	MATH205	Ordinary Differential Equations	4	30	70	100
	MATH206	Abstract Algebra	4	30	70	100
	MATH207	Numerical Methods	4	30	70	100
Stage – specific content - cum - Pedagogy	PEDP218	Basics of Pedagogy at Secondary Stage (Physics)	4	30	70	100
	PEDC218	Basics of Pedagogy at Secondary Stage (Chemistry)	4	30	70	100
	PEDM218	Basics of Pedagogy at Secondary Stage (Mathematics)	4	30	70	100
Total Credits (for each discipline)			20	150	350	500

SEMESTER – IV

Curricular Component	Course Code	Name of the Course	Credits	CCE*	UE**	Total
Foundations of Education	FE03	Philosophical & Sociological perspectives of Education - I	4	30	70	100
Physics	PHY208	Magnetism and Electro Dynamics	4	30	70	100
	PHY209	Solid State Physics	4	30	70	100
	PHY210	Chemistry Theory Chemistry Practical - II	3+1	30	70	100
Chemistry	CHE208	Organic Chemistry – I (Functionalizing Hydro Carbons)	4	30	70	100
	CHE209	Introduction to Quantum Chemistry & Molecular Symmetry	4	30	70	100
	CHE210	Physics Theory Physics Practical – II	3+1	30	70	100
Mathematics	MATH208	Vector Calculus	4	30	70	100
	MATH209	Linear Algebra	4	30	70	100
	MATH210	Mathematical Statistics – II	4	30	70	100
Stage – specific content - cum - Pedagogy	PEDP219	Content cum pedagogy of Physical Sciences at Secondary stage – Course - I (Physics)	4	50	-	50
	PEDC219	Content cum pedagogy of Physical Sciences at Secondary stage – Course - I (Chemistry)	4	50	-	50
	PEDM219	Content cum pedagogy of Mathematics at Secondary stage – Course - I (Mathematics)	4	50	-	50
Total Credits (for each discipline)			20	150	350	500

SEMESTER – V

Curricular Component	Course Code	Name of the Course	Credits	CCE*	UE**	Total
Physics	PHY211	Electronics	4	30	70	100
	PHY212	Quantum Mechanics	4	30	70	100
	PHY213	Electro Magnetic Waves	2	50	-	50
	PHY214	Practical – C	2	50	-	50
Chemistry	CHE211	InOrganic Chemistry – II	4	30	70	100
	CHE212	Organic Chemistry – II (Functional Group Transformation)	4	30	70	100
	CHE213	Equilibrium Thermodynamics	2	50	-	50
	CHE214	Practical – C	2	50	-	50
Mathematics	MATH211	Partial Differential Equations	4	30	70	100
	MATH212	Real Analysis – I	4	30	70	100
	MATH213	Complex Analysis – I	4	30	70	100
Stage – specific content - cum - Pedagogy	PEDP220	Content cum Pedagogy of Physical Sciences at Secondary stage - Course (II) (Physics)	4	50	-	50
	PEDC220	Content cum Pedagogy of Physical Sciences at Secondary stage - Course (II) (Chemistry)	4	50	-	50
	PEDM220	Content cum Pedagogy of Mathematics at Secondary stage - Course (II) (Mathematics)	4	50	-	50
Ability Enhancement & Value Added Courses	AEV106	ICT in Education	2	50	-	50
School Experience	SE222	Pre-Internship Practice (Demonstration Lesson, Peer Teaching)	2	50	-	50
Total Credits (for each discipline)			20	220	280	500

SEMESTER – VI

Curricular Component	Course Code	Name of the Course	Credits	CCE*	UE**	Total
Foundations of Education	FE04	Assessment and Evaluation	2	50	-	50
	FE05	Inclusive Education	2	50	-	50
Physics	PHY215	Nuclear Physics	4	30	70	100
	PHY216	Numerical Methods & Computational Physics	2	30	70	100
	PHY217	Practical - D	2	50	-	50
Chemistry	CHE215	Inorganic Chemistry – III	4	30	70	100
	CHE216	Organic Chemistry – III (Bio Organic Chemistry)	2	30	70	100
	CHE217	Practical - D	2	50	-	50
Mathematics	MATH214	Real Analysis – II	4	30	70	100
	MATH215	Complex Analysis - II	4	30	70	100
Stage – specific content - cum - Pedagogy	PEDP221	Content cum Pedagogy of Language-I / Language – II at Secondary stage – Course (III) (Physics)	4	30	70	100
	PEDC221	Content cum Pedagogy of Social Sciences at Secondary stage – Course (III) (Chemistry)	4	30	70	100
	PEDM221	Content cum Pedagogy of Social Sciences at Secondary stage - Course (III) (Mathematics)	4	50	-	50
Ability Enhancement & Value Added Courses	AEV107	Mathematical and Quantative Reasoning	2	50	-	50
School Experience	SE223	School Observation (Field Practice)	2	50	-	50
Total Credits (for each discipline)			20	290	210	500

SEMESTER – VII

Curricular Component	Course Code	Name of the Course	Credits	CCE*	UE**	Total
Foundations of Education	FE06	Perspectives of School Leadership & Management	2	50	-	50
	FE07	Curriculum Planning and Development (Text book, Material Development, Etc) – Stage Specific	2	50	-	50
Ability Enhancement & Value Added Courses	AEV108	Art Education – II (Performing & Visual)	2	50	-	50
	AEV109	Sports, Nutrition & Fitness	2	50	-	50
School Experience	SE224	School - based Research Project	2	50	-	50
	SE225	Internship in Teaching	10	-	100	
Total Credits (for each discipline)			20	250	100	350

SEMESTER – VIII

Curricular Component	Course Code	Name of the Course	Credits	CCE*	UE**	Total
Foundations of Education	FE08	Philosophical & Sociological Perspective of Education - II	4	30	70	100
	FE09	Education Policy Analysis	2	50	-	50
	FE10	Adolescence Education / Education for mental health / Education for Sustainable Development / Emerging Technologies in Education / Gender Education / Guidance and Counselling / Human Rights Education / Peace Education / Sports & Fitness Education / Tribal Education / Economics of Education	4	30	70	100
Ability Enhancement & Value Added Courses	AEV110	Yoga & Understanding Self	2	50	-	50
	AEV111	Citizenship Education, Sustainability & Environment Education	2	50	-	50
School Experience	SE226	Post Internship (review & Analysis)	2	50	-	50
	SE227	Creating Teaching learning material / Work Experience (Educational Toy making, Local/Traditional/Vocations.)	2	50	-	50
Community Engagement & Service	CES228	Community Engagement & Service (Participation in NSS – related activities New India Literacy programme Etc)	2	50	-	50
Total Credits (for each discipline)			20	360	140	500

4-YEAR INTEGRATED B.Sc. B.Ed. CURRICULUM ITEP

2023-24 Onwards



**School of Education
Pondicherry University**

B.Sc.,B.Ed. LIBERAL OPTIONS**PART III: B.Sc. B.Ed.****Branch: PHYSICS**

SEM	No.	SUB	NAME OF THE COURSE	CREDIT
I	Core 1	Major 1	Mechanics	4
	Core 2	Major 2	Practical - A	4
II	Core 3	Major 3	Optics	4
	Core 4	Major 4	Kinetic Theory	4
		Minor 1	Chemistry Theory Chemistry Practical – I	3 1
III	Core 5	Major 5	Electricity	4
	Core 6	Major 6	Modern Physics	4
	Core 7	Major 7	Practical - B	4
IV	Core 8	Major 8	Magnetism and Electrodynamics	4
	Core 9	Major 9	Solid State Physics	4
		Minor 2	Chemistry Theory Chemistry Practical – II	3 1
V	Core 10	Major 10	Electronics	4
	Core 11	Major 11	Quantum Mechanics	4
	Core 12	Major 12	Electromagnetic waves	2
	Core 13	Major 13	Practical - D	2
VI	Core 14	Major 14	Nuclear Physics	4
	Core 15	Major 15	Numerical Methods and Computational Physics	4
	Core 16	Major 16	Practical - D	2
	Major Total			56 Credits
	Minor Total			8 Credits

B.Sc.,B.Ed. LIBERAL OPTIONS**PART III: B.Sc. B.Ed.****Branch: CHEMISTRY**

SEM	No.	SUB	NAME OF THE COURSE	CREDIT
I	Core 1	Major 1	Principles of General chemistry - I	4
	Core 2	Major 2	Practical - A	4
II	Core 3	Major 3	Principles of General chemistry - II	4
	Core 4	Major 4	Physical Chemistry - I	4
		Minor 1	Physics Theory Physics Practical – I	3 1
III	Core 5	Major 5	Inorganic Chemistry - I	4
	Core 6	Major 6	Physical Chemistry - II	4
	Core 7	Major 7	Practical - B	4
IV	Core8	Major 8	Organic Chemistry – I (Functionalizing Hydrocarbons)	4
	Core9	Major 9	Introduction to Quantum Chemistry and Molecular Symmetry	4
		Minor 2	Physics Theory Physics Practical – II	3 1
V	Core 10	Major 10	Inorganic Chemistry - II	4
	Core 11	Major 11	Organic Chemistry – II (Functional Group transformation)	4
	Core 12	Major 12	Equilibrium Thermodynamics	2
	Core 13	Major 13	Practical - C	2
VI	Core 14	Major 14	Inorganic Chemistry - III	4
	Core 15	Major 15	Organic Chemistry – III (Bioorganic Chemistry)	4
	Core 16	Major 16	Practical - D	2
	Major Total			56 Credits
	Minor Total			8 Credits

..... PART-I: ITEP - B.Sc.B.Ed.,
Branch: MATHEMATICS
CREDIT FOR EACH PAPER: 4 TOTAL- 64 CREDITS FOR MAIN
DISCIPLINE

Sem	Core/ Ancil	Sub	Name of the Course	Credit
I	Core 1	Main 1	Theory of Equations & Trigonometry	4
	Core 2	Main 2	Differential Calculus	4
II	Core 3	Main 3	Analytical Geometry 3D	4
	Core 4	Main 4	Integral Calculus	4
	Ancil.1	Ancillary	Mathematical Statistics-I	4
III	Core 5	Main 5	Ordinary Differential Equations	4
	Core 6	Main 6	Abstract Algebra	4
	Core 7	Main 7	Numerical Methods	4
IV	Core 8	Main 8	Vector Calculus	4
	Core 9	Main 9	Linear Algebra	4
	Ancil-2	Ancillary	Mathematical Statistics-II	4
V	Core 10	Main 10	Partial Differential Equations	4
V	Core 11	Main 11	Real Analysis-I	4
V	Core 12	Main 12	Complex Analysis-I	4
VI	Core 13	Main 13	Real Analysis-II	4
VI	Core 14	Main 14	Complex Analysis-II	4
	Major Total			56 Credits
	Minor Total			8 Credits

SEMESTER-I

SEMESTER-I**Contents**

Course Code	Curricular Component	Name of the Course	Credits	Total	Page no.
FE01	Foundations of Education	Evolution of Indian Education	4	4	23-25
PHY200	Physics	Mechanics	4	8	26-27
PHY201		Practical – A	4		28-28
CHE200	Chemistry	Principles of General Chemistry – 1	4		29-30
CHE201		Practical – A	4		31-31
MATH200	Mathematics	Theory of Equations & Trigonometry	4		32-33
MATH201		Differential Calculus	4		34-35
AEVL100	Ability Enhancement & Value Added Courses	Language – I Tamil / French / Malayalam / Telugu / Hindi	4		8
AEV101		Art Education – I (Performing & Visual)	2	42-45	
AEV102		Understanding India	2	46-48	
Total Credits (for each discipline)				20	

2.0 FOUNDATIONS OF EDUCATION

2.1 Evolution of Indian Education

Credit: 4

Semester: S-1

2.1.1 About the Course

The course seeks to develop an understanding among student teachers of the evolution of education in India that would allow student teachers to locate themselves within the larger system of education. The course aims at orienting student teachers to the historical perspective of Indian education including the development and features of education in ancient India such as the Gurukuls, post-Vedic period, during Mauryan and Gupta empires, during colonial era and post-independence period, and future perspectives about education development in India, and progression from Education 1.0 to Education 4.0 etc. This course also provides an overview of the contribution of Indian thinkers to evolve Indian Education system – Savitribai and Jyotiba Phule, Rabindranath Tagore, Swami Vivekananda, Mahatma Gandhi, Sri Aurobindo, Gijubhai Badheka, Pt. Madanmohan Malaviya, Jiddu Krishnamurti, Dr. Bhima Rao Ambedkar and others.

2.1.2 Learning Outcomes

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

- discuss genesis, vision, and evolution of education in ancient India to the contemporary India,
- enable themselves to shape their educational perspective to act as an effective teacher.

UNIT - I

Ancient Indian Education: Vedic Period

- A. Vision, objectives and salient features of Vedic Education System.
- B. Teaching and Learning Process.
- C. Development of educational institutions: Finances and Management.
- D. Famous Educational institutions and Guru-Shishya.
- E. Education at the time of Epics: Ramayana and Mahabharata.

UNIT - II

Ancient Indian Education: Buddhist and Jain Period

- A. Vision, objectives and salient features of Buddhist and Jain Education System.
- B. Teaching and Learning Process.
- C. Finance and Management of Educational Institutions.
- D. Educational Institutions: Nalanda, Taxila, Vikramshila, Vallabhi, Nadia.
- E. Famous Guru-Shishya.

UNIT - III

Post-Gupta Period to Colonial Period

- A. Vision, objectives, brief historical development perspective as well as salient features of Education in India.
- B. Teaching and Learning Process.
- C. Finance and Management of educational institutions.

UNIT - IV

Modern Indian Education

A. Colonial Education in India

- Woods Despatch, Macaulay Minutes and Westernization of Indian Education

B. Shiksha ka Bhartiyakaran (Indigenous Interventions in Education)

(Bird's eye view of their contribution)

- Swadeshi and Nationalist attempts of educational reforms with special reference to general contribution of Indian thinkers – Savitribai and Jyotiba Phule, Rabindranath Tagore, Swami Vivekananda, Mahatma Gandhi, Sri Aurobindo, Gijubhai Badheka, Pt. Madanmohan Malaviya, Jiddu Krishnamurti and Dr. Bhima Rao Ambedkar others – to the education systems of India.

C. Education in Independent India

- Overview of Constitutional values and educational provisions.
- Citizenship Education:
 - Qualities of a good citizen.
 - Education for fundamental rights and duties.
- Overview of 20th Century Committees, Commissions and Policies.
- UEE, RMSA, RTE Act 2009: Overview and impact.
- NEP 2020: vision and implementation for a vibrant India.

2.1.3 Suggestive Practicum

1. Prepare a report highlighting educational reforms with special reference to school education in the light of NEP 2020.
2. Critically analyze the concept of good citizen from the perspective of education for democratic citizenship.
3. Compare vision, objectives, and salient features of education during different periods.
4. Working out a plan to develop awareness, attitude and practices related to Fundamental Rights or fundamental duties or democratic citizenship qualities, execute it in the class and write the details in form of a report.
5. Sharing of student experiences (in groups) related to Indian constitutional values, help them to reshape their concept and enable them to develop vision, mission and objectives for a school and their plan to accomplish the objectives in form of a group report.
6. Analyses of current educational strengths and weaknesses of one's own locality and work out a critical report.
7. Visit to places of educational significance and value centers and develop a project report.
8. Observation of unity and diversity in a social locality and matching it with unity and diversity in the class and work out a plan for awareness for national-emotional integration for class to develop awareness, attitudes, skills, and participatory values, execute it in the class and report the details.

2.1.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field

engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.

- Hands on experience of engaging with diverse communities, children, and schools.

2.1.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.1.6 Suggestive Reading Materials

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

MAJOR SUBJECTS: PHYSICS**3.1 MECHANICS****Credit: 4****Semester: S-1****3.1.1. About the course**

This course is intended to review the concepts of Newtonian mechanics. The students will be introduced the formalisms of force laws. They are exposed to angular momentum in real life situation.

3.1.2. Learning outcomes:

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

- understand the principles of various force laws and the concept of energy and momentum
- apply linear momentum conservation principles to different physical systems
- relate linear and rotational motion
- apply conservation of angular momentum to real life situations

UNIT– I: NEWTON'S LAWS AND ITS APPLICATIONS

Classical mechanics – Newton's first law – force – mass – Newton's second law – Newton's third law – weight and mass – applications of Newton's laws in one dimension – force laws – tension and normal forces – frictional forces – dynamics of uniform circular motion

UNIT-II: CONSERVATION OF MOMENTUM AND COLLISIONS

Collisions – linear momentum – impulse and momentum – conservation of momentum – two body collisions – motion of a complex object – two particle systems – many particle systems – center of mass of solid objects – conservation of momentum in a system of particles

UNIT–III: ROTATIONAL KINEMATICS AND DYNAMICS

Rotational motion – rotational variables – rotation with constant angular acceleration – rotational quantities as vectors – relationships between linear and angular variables: scalar form – vector relationships between linear and angular variables – torque – rotational inertia and Newton's second law – rotational inertia of solid bodies – combined rotational and translational motion

UNIT–IV: ANGULAR MOMENTUM

Angular momentum of a particle – systems of particles – angular momentum and angular velocity – conservation of angular momentum – spinning top – quantization of angular momentum – rotational dynamics: a review

UNIT–V: WORK AND ENERGY

Work and energy – work done by a constant force – work done by a variable force: one dimensional case – work done by a variable force: two dimensional – kinetic energy and work energy theorem – power – conservative forces – potential energy – conservation of mechanical energy

3.1.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.1.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.1.5. Suggestive readings:

1. Resnick, Halliday, Krane, (2002). *Physics*, (5th ed.). Vol.1, New Delhi: John Wiley & Sons (ASIA) Pvt Ltd., Print Chapters: 3,5,6,7,8,9.1–9.3, 9.7,10,11.1– 11.6, 12.1– 12.3.
2. Atam P. Arya, (1979). *Introductory College Physics*, (3rd ed.). New Delhi, Macmillian Publications, Print. George Gamove & John M. Cleveland, (1978). *Physics: Foundations & Frontiers*, New Delhi: Prentice Hall, India, Pvt. Ltd. Print. 3. Jerold Touger, (2006). *Physics*, New Delhi: Wiley India (P) Ltd. Print.
4. Neil Chatterjee, (2009). *Enjoyable Physics, Vol.1*, New Delhi: Macmillan Publishers India Ltd. Print.

3.2 PHYSICS PRACTICAL – A

Credit: 4

Semester: S-1

3.2.1. About the course:

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

- use basic measuring instruments
- infer the basic concepts in Mechanics, Optics and Electrical circuits
- develop the skill of observation and make meaningful conclusions.

3.2.2. Experiments/Lab

1. Handling basic laboratory instruments (screw gauge, travelling microscope, spectrometer, spherometer)
2. Study of Collisions
3. Study of rigid body oscillations (Torsional/bifilar/compound pendula)
4. Study of refraction (Lenses / Prisms)
5. Study of frictional forces
6. Study of lens system (simple and compound microscope)
7. Comparing EMF of two batteries using potentiometer
8. Melde's string – standing waves
9. Coefficient of viscosity by flow method
10. Surface tension by capillary rise method

3.2.3. Suggestive mode of transaction:

Experimentation, Demonstration

3.2.4. Suggestive mode of assessment:

In lab- experimentation, Semester examinations

3.2.5. Suggestive readings:

1. Arora C.L., (2011). B.Sc. Practical Physics, New Delhi: S. Chand & company Ltd. Print.
2. Bhattacharya C.K., (1984). University Practical Physics with Viva-Voce, New Delhi: CBS publishers and distributors. Print.
3. Chattopadhyay D. and Rakshit P.C., (2005). An Advanced course in Practical Physics, (7th ed.), Kolkatta: New Central Book Agency Pvt., Ltd. Print.
4. Gupta S.L., and Kumar V., (2002). Practical Physics, (25th ed.), Meerut: Pragatiprakashan Publication. Print. Ouseph C.C., Rao U.J. and Viyayendran V., (2010). Practical Physics and Electronics, Chennai: S. Viswanathan Printers and Publishers Pvt., Ltd., Print.
5. Palanisamy P K, (2002). Physics Laboratory Manual, Chennai: Scitech Publications (India) Pvt. Ltd., Print.

MAJOR SUBJECTS: CHEMISTRY
3.1 PRINCIPLES OF GENERAL CHEMISTRY - I

Credit: 4

Semester: S-1

3.1.1. About the course:

This course deals with atomic structure, periodic table, chemical bonding, properties of gases, liquids, solids and solutions.

3.1.2. Learning outcome:

On successful completion of this course learners will be able to:

- Comprehend the evolution of electronic structure of atom
- Use quantum numbers and atomic orbital wave function equations to visualize the shapes of orbitals
- Recognize the relationship between position of an element in periodic table and its atomic properties and the periodic trend in properties
- Explain the concept of chemical bonding
- Analyze the properties of gases, liquids, solids and solutions

UNIT I : ATOMIC STRUCTURE

Blackbody emission and temperature, Photoelectric effect, Double slit experiment, Line spectrum of elements, Rutherford's experiment, Bohr's atomic model, Heisenberg's Uncertainty, Quantum atomic model, hydrogen atomic orbitals and quantum numbers, atomic orbital equations (no derivation required), hybrid atomic orbitals, Electronic configuration of atoms, Madelung rule, atomic mass, synthetic elements, isotopes and stability of isotopes (qualitative description).

UNIT II: PERIODIC TABLE AND PERIODICITY

Periodic trends in atomic properties, reactivity and compound formation, types of compounds, mole concept and composition, oxidation states - Chemical reactions, stoichiometry, chemical reactions in solutions, limiting reagent - Reactions in aqueous medium, precipitation, acid-base, redox, balancing redox reactions, oxidizing and reducing agents, stoichiometry and titration.

UNIT III : CHEMICAL BONDING

Types of bonds, representation of electrons as dots, Lewis model of ionic, covalent structures, Electronegativity and bond polarity, Lewis structure of molecular compounds, resonance and formal charge, exception to octet rule, bond energies and bond lengths, bonding in metals - VSEPR theory, predicting molecular geometry, shapes and polarity - Valence Bond theory - Molecular orbital theory, electron delocalization.

UNIT IV: GASES, LIQUIDS, SOLIDS AND SOLUTIONS

Gas equations, van der Waals gas, virial gas equation, real gases, intermolecular forces - Properties of liquids, properties of solids, phase diagrams, nature of bonding in solids, crystal structures.

UNIT V: SOLUTIONS

Types of solutions, solution concentration, solubilities of gases, vapour pressure, osmotic pressure, colligative properties of non-electrolyte solutions, electrolyte solutions, colloidal mixtures.

3.1.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.1.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.1.5. Suggestive Readings:

1. Lee. J.D. concise inorganic chemistry ELBS,1991.
2. Chemistry A Molecular approach, Nivaldo J Tro, 4ed, Pearson, 2017
3. Chemistry: The Central Science, Theodore L. Brown, H. Eugene LeMay, Jr., Bruce E. Bursten, Catherine J. Murphy, Patrick M. Woodward, Matthew W. Stoltzfus, 13ed, Pearson, 2015
4. J.E.Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry: Principles of Structure and Reactivity, ISBN-13: 9788177581300, HarperCollin College Publishers, 4th Ed., 1993.
5. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, ISBN: 9789354245701, Wiley Interscience, 4th & 5th Ed., 1998
6. Neil Winterton, Jeff Leigh Modern Coordination Chemistry, ISBN: 9780854044696, RSC, 1960
7. D. F. Shriver, P. W. Atkins and C. H. Langford
Inorganic Chemistry. ISBN: 9780195685237, Oxford University Press, 1994

3.2 PRACTICAL – A

Credit: 4

Semester: S-1

3.2.1. About the course:

This course deals with estimation process, comparison of melting point, crystallization.

3.2.2. Learning outcome:

On successful completion of this course learners will be able to:

- Estimate the anta acid tablet
- Compare the melting point of compounds.
- Find molecular formula of a compound.

These experiments are indicative only and are not restricted only to these. Course tutor may extend, innovate, extrapolate as per the requirements.

1. Preparation of Exactly 0.10 N HCl
2. Comparison of melting point of impure and recrystallized benzoic acid
3. Qualitative visualization of exothermic and endothermic reactions
4. Estimation of anta-acid tablet
5. Estimation of water of crystallization of a hydrated salt
6. Estimation of molecular formula of oxide of magnesium
7. Density measurement of irregular objects using liquid displacement method
8. Preparation of soap from vegetable oils
9. Identification of simple organic functional groups by chemical tests
10. Preparation of a simple polymer.

3.2.3. Suggestive mode of transaction:

Demonstration, experimentation.

3.2.4. Suggestive mode of Assessment:

In lab-experimentation and semester examination.

3.2.5. Suggestive Readings:

1. V.Venkateswaran,R.Veerarwamy,A.R.Kulandaivelu,Basicprinciplesofpracticalchemistry,SultanC hand&Sons,ISBN:81-8054-776-8.
2. V.V. Ramanujam, *Inorganic Semi-micro Qualitative Analysis*, 3rd Ed., ISBN:196500ENGGPCX,National PublishingCompany,I990.
3. A.I.Vogel,*TextBookofQuantitativeInorganicAnalysis*,5thEd.,ISBN-10:047020608X,ISBN-13:978-0470206089,Longman, 1989
4. Brauer,*HandbookofPreparativeInorganicChemistry(Vol.IandII)*,ISBN:9780323161275,ISBN:9780323161299, AcademicPress, 1963.

MAJOR SUBJECTS: MATHEMATICS**CORE 1: THEORY OF EQUATIONS AND TRIGONOMETRY****Credit: 4****Semester: S-1****About the Course:**

In algebra, the study of algebraic equations, which are equations defined by a polynomial, is called the theory of equations. A polynomial is an expression consisting of one or more terms. The main difficulty of the theory of equations was to know when an algebraic equation has an algebraic solution. Trigonometry” basically deals with the study of the relationship between the sides and angles of the right-angle triangle. Hence, it helps to find the missing or unknown angles or sides of a right triangle using the trigonometric formulas, functions or trigonometric identities.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT- I: Relations between the roots and the coefficients of a general polynomial equations in one variable – Transformation of equations – Descarte’s rule of signs.

UNIT-II: Solution of cubic equations: Cardon’s Method - Trigonometrical method–Horner’s Method, Bi-quadratic equation– Ferrari method.

UNIT- III: De Moivre’s theorem and its applications – Direct and Inverse circular and hyperbolic functions.

UNIT- IV: Logarithm of a complex quantity- Expansion of Trigonometrical functions.

UNIT- V: Gregory's series- Summation of series.

Suggestive practicum:

- Solve / workout any one Chapter’s Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction

Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials***Prescribed Text (specify sections clearly):***

1. *Algebra Volume-1, T.K. Manicavachagom Pillay , T.Natarajan and K.S. Ganapathy,. Viswanathan (Printers & Publishers) Pvt. Lid, (1999)*
2. *Trigonometry, S. Narayanan and T.K. Manicavachagom Pillai, S. Viswanathan (Printers & Publishers) Pvt. Ltd, (1997)*

Recommendedbooks:

1. *Plane Trigonometry-Part-I&II(6th Edition), S.L.Loney, ArihantPublications, 2016.*

e-LearningSource

<http://ndl.iitkgp.ac.in><http://ocw.mit.edu> <http://mathforum.org>

CORE 2: DIFFERENTIAL CALCULUS**Credit: 4****Semester: S-1****About the Course:**

A differential is a study of a rate of change. In math, this term is most often associated with differential equations which are equations containing derivatives. Derivatives are an algebraic method for generalizing the instantaneous rate of change of a function. Differential calculus studies the rate of change of the slope of a function. Using differential calculus to study a function makes it possible to analyze minute behaviours in the function. calculus is an in-depth study of functions, and differential calculus studies how fast or slow a function changes. A function's rate of change can be found by analysing the slope of the graph of a function.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I: n^{th} derivative – Standard results – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula.

UNIT II: Total differential coefficients – Euler's theorem - Partial derivatives of a function of two functions - Equations of tangent and normal - Taylor expansions of single and double variables.

UNIT III: Maxima and Minima of two variables – Lagrange's method of undetermined multipliers - Angle of intersection of curves – Sub tangent and Sub Normal. -

UNIT IV: Angle between the radius vector and tangent – Angle between the intersection of two curves – Polar sub tangent and sub normal.

UNIT V: Circle, radius and Centre of curvature – Cartesian formula for radius of curvature – envelope.

Suggestive practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related Case studies of the children in different areas of interest of the above title / content and submit the report.

Suggestive mode of transaction

Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

Pres. Text Book (section):

- Calculus Vol.-I,

T. K. Manickavachagom Pillai, Printers and Pub. (May1992 Edition)

Unit 1 : Chapter 3, Unit 2: Chapter 8, Unit 3: Chapter 8, 9, Unit 4, Chapter- 9, Unit 5 :

Chapter 10 (Section 1)

Reference Books

- Calculus (2nd Edition), Lipman Bers and Frank Karal, HoltMcDougal, 1976.
- Thomas' Calculus 12th Edition, George B.Thomas, Maurice D.Weirand Joel Hass, Pearson Education, 2015.

e-Learning Sources

<http://ndl.iitkgp.ac.in><http://ocw.mit.edu>

<http://mathforum.org>

ABILITY ENHANCEMENT & VALUE-ADDED COURSES

TAMIL LANGUAGE**Ist SEMESTER**

நாள்: தமிழ் - I

Title of the Paper: TAMIL I

பாடத்திட்டம் (Syllabus)**கவிதை இலக்கியம்**

- | | | |
|-------------------------|---|------------------------------|
| 1. தமிழ் | - | மகாகவி பாரதியார் |
| 2. கோவில் வழிபாடு | - | கவிமணி தேசிக விநாயகம் பிள்ளை |
| 3. நீங்களே சொல்லுங்கள் | - | பாவேந்தர் பாரதிதாசன் |
| 4. ஆக்கம் சேர்ப்போம் | - | கவிஞரேறு வாணிதாசன் |
| 5. கழைக் கூத்தாடி | - | கவிஞர் தமிழொளி |
| 6. தமிழக நிலை | - | கவிஞர் புதுவைச்சிவம் |
| 7. தமிழில் பெயரிடுங்கள் | - | உவமைக் கவிஞர் சுரதா |
| 8. பெரியார் | - | கவிஞர் வாலி |
| 9. ஒரு வண்டி சென்றியூ | - | ஈரோடு தமிழன்பன் |
| 10. ஒவ்வொரு புல்லையும் | - | இன்குலாப் |

சிறுகதை இலக்கியம்

- | | | |
|---------------------|---|----------------------|
| 1. பாதுகை | - | பிரபஞ்சன் |
| 2. பூ | - | பாவண்ணன் |
| 3. அன்பளிப்பு | - | கு. அழகிரிசாமி |
| 4. அற்றது பற்றெனில் | - | இந்திரா பார்த்தசாரதி |
| 5. நிலை நிறுத்தல் | - | கி. ராஜநாராயணன் |

நாடக இலக்கியம்

- | | | |
|--------------------------|---|------------------|
| 1. அனார்கலி | - | கவிஞர் கண்ணதாசன் |
| 2. ஒநாயும் வீட்டு நாயும் | - | பாரதியார் |

இலக்கிய வரலாறு

மரபுகவிதை, புதுக்கவிதை, ஹைக்கூ, சிறுகதை, நாடகம் ஆகியவற்றின் தோற்றம் வளர்ச்சி குறித்த வரலாறு

பாடத்திட்டத் தொகுப்பு நூல்:

பொதுத் தமிழ் - முதலாண்டு - தமிழ் (முதல் மற்றும் இரண்டாம் பருவப் பாடங்கள்)
புதுவைப் பல்கலைக்கழகம், புதுச்சேரி - 2015

Language French – I :

Prescribed Textbook : *FESTIVAL 1* - Méthode de Français

Authors : Sylvie POISSON-QUINTON

Michèle MAHEO-LE COADIC

Anne VERGNE-SIRIEYS

Edition : CLE International, Nouvelle Édition révisée : 2009.

Portions : Unités : 1, 2, 3.

MALAYALAM LANGUAGE

Semester-1

മലയാളകവിത

കാല്പനികത മുതൽ ആധുനികതവര മലയാളകവിതയിൽ ഉണ്ടായ ഭാവുകത്വപരിണാമം പരിചയപ്പെടുക. കവിതയുടെ രൂപപരവും ഭാവപരവുമായ വൈവിധ്യം തിരിച്ചറിയുവാനും ആസ്വദിക്കുവാനുമുള്ള ശേഷി കൈവരിക്കുകയാണ് പഠനത്തിന്റെ ഉദ്ദേശ്യം

പാഠഭാഗങ്ങൾ വിശദപഠനത്തിനുള്ളവയാണ്. ഒരു ഖണ്ഡകാവ്യവും തെരഞ്ഞെടുത്ത പത്തു കവിതകളുമാണ് വിശദപഠനത്തിനായി നിർദ്ദേശിക്കുന്നത്. പാഠ്യഭാഗം അഞ്ച് യൂനിറ്റുകളായി തിരിച്ചിരിക്കുന്നു. എല്ലാ യൂനിറ്റുകളിൽനിന്നും ചോദ്യങ്ങൾ ചോദിക്കണം.

യൂനിറ്റ് 1. ഖണ്ഡകാവ്യം. കുമാരനാശാൻ - ചിന്താവിഷ്ണുയായ സീത

യൂനിറ്റ് 2. പി. കുഞ്ഞിരാമൻനായർ - സൗന്ദര്യപൂജ
ഇടേശ്ശേരി ഗോവിന്ദൻനായർ - വിവാഹസമ്മാനം
വൈലാപിള്ളി ശ്രീധരമനോൻ - യുഗപരിവർത്തനം

യൂനിറ്റ് 3. എൻ.വി.കൃഷ്ണവാര്യർ - എലികൾ

അക്കിത്തം അച്യുതൻനമ്പൂതിരി - പണ്ടത്തെ മേശാന്തി
സുഗതകുമാരി - ബീഹാർ

യൂനിറ്റ് 4. കടമ്മനിട്ട രാമകൃഷ്ണൻ - ശാന്ത
വിജയലക്ഷ്മി - മൃഗശിക്ഷകൻ

യൂനിറ്റ് 5. പി. പി. രാമചന്ദ്രൻ - ലളിതം
കെ.ആർ. ടോണി - അന്ധകാണ്ഡം

അധികവായനയ്ക്ക് നിർദ്ദേശിക്കുന്ന പുസ്തകങ്ങൾ:

മലയാളകവിതാസാഹിത്യചരിത്രം- ഡോ എം.ലീലാവതി.

മലയാളകവിതാപഠനങ്ങൾ- സച്ചിദാനന്ദൻ

TELUGU LANGUAGE**I Semester****TELUGU - I**

Old Poetry, Modern Poetry, Short Stories & Grammar

ప్రాచీన కవిత్వం (Old Poetry)

1. గంగా శంకరుల కథ - నన్నయ

(ఆంధ్ర మహాభారతం - ఆదిపర్వం - చతుర్థాశ్వాసం 121వ పద్యం నుండి 125 వ పద్యం వరకు)

2. ద్రౌపది పరిదేవనం - తిక్కన

(ఆంధ్ర మహాభారతం - ఉద్యోగ పర్వం - తృతీయాశ్వాసం 100వ పద్యం నుండి 125వ పద్యం వరకు)

ఆధునిక కవిత్వం (Modern Poetry)

3. కన్యక - గురజాడ అప్పారావు

4. దేశచరిత్రలు - శ్రీశ్రీ

కథానికలు

5. చింతల తోపు - పాపినేని శివశంకర్

6. సావుకూడు - బండి నారాయణస్వామి

వ్యాకరణం

7. సంధులు

సవర్ణదీర్ఘ, గుణ, వృద్ధి, యణాదేశ, త్రిక, గసడదవాదేశ, రుగాగమ టుగాగమ,
అమ్రేడిత, అత్య, ఇత్యసంధులు

8. సమాసాలు

తత్పురుష, కర్మధారయ, ద్వంద్వ, ద్విగు, బహువ్రీహి

9. అక్షర దోషాలు

దోషాలు సరిదిద్ది సాధు రూపాలు రాయాలి.

HINDI LANGUAGE1st Semester**Paper-I सामान्य हिन्दी-I****पाठ्य विषय**

- उपन्यास
‘निर्मला’ - प्रेमचन्द, राजकमल प्रकाशन, दरियागंज दिल्ली
- हिन्दी अपठित
पल्लवन
पत्राचार
अनुवाद : अनुवाद की परिभाषा, अनुवाद का महत्व, अनुवादक की योग्यताएँ, अनुवाद के प्रकार और प्रक्रिया
पारिभाषिक शब्दावली (कार्यालयी शब्दावली)
हिन्दी में पदनाम
कंप्यूटर में हिन्दी का अनुप्रयोग : प्रारम्भिक परिचय

अंकविभाजन : पूर्णांक 100

व्याख्याएँ (निर्मला उपन्यास)	4 में से 2	$2 \times 7 \frac{1}{2} = 15$ अंक
आलोचनात्मक प्रश्न (निर्मला उपन्यास)	2 में से 1	$1 \times 15 = 15$ अंक
लघुत्तरी प्रश्न (निर्मला उपन्यास)	4 में से 2	$2 \times 5 = 10$ अंक
पल्लवन	2 में से 1	$1 \times 10 = 10$ अंक
पत्रालेखन	2 में से 1	$1 \times 15 = 15$ अंक
लघुत्तरी प्रश्न (अनुवाद)	5 में से 3	$3 \times 5 = 15$ अंक
लघुत्तरी प्रश्न (कंप्यूटर)	4 में से 2	$2 \times 5 = 10$ अंक
पारिभाषिक शब्दावली	15 में से 10	$10 \times 1 = 10$ अंक

अध्ययन के लिए सहायक पुस्तकें

- सामान्य हिन्दी, डॉ. विजयपाल सिंह, हिन्दी प्रचार संस्थान, वाराणसी
- व्यावहारिक हिन्दी, डॉ. महेन्द्र मित्तल, शबरी संस्थान, दिल्ली
- हिन्दी संक्षेपण, पल्लवन और पाठ बोधन, डॉ. हरदेव बाहरी, अभिव्यक्ति प्रकाशन, इलाहाबाद
- प्रयोजन मूलक हिन्दी, विनोद गोदरे, वाणी प्रकाशन, दिल्ली
- प्रेमचन्द और उनका युग, रामविलास शर्मा, राजकमल प्रकाशन, दिल्ली
- प्रेमचन्द के उपन्यासों का शिल्प विधान, कमलकिशोर गोयनका, सरस्वती प्रेस, दिल्ली
- संक्षेपण कैसे करें, डॉ. शैलेन्द्रनाथ श्रीवास्तव, भारतीभवन, पटना

5.3 Art Education (Performing and Visual) and Creative Expressions

Exemplar 1 - Puppetry

Credit:2

Semester:S-1 and S-7

5.3.1 About the Course

Engagement with various forms of art as self-expression and need to develop sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective, and psycho-motor dimensions among children, as well as that through one or another art form, children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, aesthetic judgment. This enables students as they grow into adults to have focused attention on making sense of and appreciating cultural productions.

Children enjoy artwork a lot. They explore and find meaning in artwork. Their psycho-motor skills get developed through art. The huge element of socialization is acquired through different forms of art. They get to know each other and understand each other and make friends through art. They develop their peer group through getting involved in art forms. Learning to work with others is also achieved through art. It gives them space to think independently, create and reflect. It is one space where all the three are involved- hand, head, and heart.

Therefore, educational practitioners that the students of MA Education aim to be, will need to bring an element of art in practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful. Additionally, they should be familiar with some critical debates in art education, even if their work is in other subject areas.

To this end in the first semester students will do one course that aims to help them recognize and appreciate the importance of aesthetic judgment, develop familiarity with an art form and basic skills to be creative and artful in their expressions. Skills develop from practice, therefore hands-on training in doing art will be emphasized in this course. This course aims to help students develop a habit of performing skillful activities that are essentially aesthetic and artful which is expected to contribute to other educational practices that they develop in other courses in the programme. Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and content of other subject areas wherever possible.

Puppetry

Puppetry is an integrated art form, which takes into its fold everything from fine arts to performance. Puppetry is one of the oldest forms of performing art. Puppetry has evolved over the years into a sophisticated form of art. The journey was very interesting with a lot of ups and downs. There are thousands of forms of puppetry from simple finger puppets to highly complex puppets played by more than 3 people. Each country has a puppet form, why country, each area in a country has a puppet form. Hence, in India you will find many, many forms of puppetry.

In puppetry there are two main aspects. One the designing and creating of puppets and the other playing or performing puppetry. These two skills are different. Designing will need a lot of

thinking, visualization, and technical skills while performance will need high level communication skills. Hence, together they make a consolidated a high range of skills. In this course, students are exposed to different forms of puppets and puppetry. There will be a discussion around the forms and the aesthetic sense of puppetry. Later the students are encouraged to prepare, design and create puppets. They then prepare script and play the puppets. This creation of the puppets together in small groups with a lot of discussions and give and take helps the students develop working together skills and conceptual understanding.

Learning Outcomes

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

- articulate the importance of aesthetics and art in elementary education,
- demonstrate their familiarity with and appreciation of puppetry,
- design puppets,
- practice and create a short puppetry show.

UNIT - I

Importance of Aesthetics and Art education (2 Sessions)

In this unit the basic idea of aesthetics and art, and ways in which the aesthetic dimension manifests itself in human life will be discussed. Using various examples of art, students will engage in identifying aesthetic aspects of daily life, develop aesthetic judgment, and gain familiarity with the role of art in education. Students will also be introduced to three aspects of art in education: The value of art itself and its use as an instrument in education; moral dimensions of works of art and the controversial distinction between the value of Popular art and High art.

UNIT - II

Designing Puppets (6 Sessions)

In this unit, students will learn about puppetry, its history and specifically about how puppets work. This unit will also discuss the imagination required to design puppets, visualize how puppets will be used and the technicalities of designing puppets. These will be learnt by designing puppets. Students will start with constructing finger puppets and move towards small shapes through papers, like Fish, birds, rat - then they will design masks, flat masks, and masks with dimensions. At the end they will design puppets with old newspaper. The puppets are designed with old newspapers and colour papers. They decorate it and design it in such a way that it can be played, performed. They prepare costumes and all other accessories.

UNIT - III

Performing the puppets (4 Sessions)

This unit will engage in performance of puppetry and the level of communication skills required to create a good engaging story and perform it with the help of puppets they have created. The performance will be expected to relate to some activity in the educational context. Students will perform the puppets they have designed. Initially each member will play their own puppets. Later they will play in pairs, later they will be formed into a small group and asked to prepare their own

skits with the puppets. They conclude by performing in small groups. Their learning is consolidated and reflected.

Discussion is held on how different aspects of puppet making can be incorporated in class room processes of young children. Adapting the individual and group exercises done during the puppetry course will be discussed to be used in the classroom situation.

5.3.3 Pedagogy

The Pedagogy is basically hand-on training. More emphasis is given to experiential learning. They do things and through doing learn about art and its connection to education. The process takes you through different forms of art- fine arts, playing with colours, costume designing, facial make - up, script writing, music, and performance.

5.3.4 Suggestive Mode of Assessment

Details to be determined by the faculty member as per applicable UGC norms.

Sl. no	Topics	Session flow
1	Aesthetics and art, art in everyday life.	Based on their experience
2	Importance of art. Appreciation of art.	Discussion
3	Art for art sake. Art with social responsibility. art for social change	Debate
4	The world of puppetry. Different forms of puppetry.	Presentations
5	History of puppetry	Lecture
6	Preparation- finger puppets	Hands on
7	Preparation of masks	Hands on
8	Preparing puppets	Hands on
9	Performing individually	Practice
10	Performing in pairs	Practice
11	Performing in groups – 3, 4, 5.	Practice
12	Assignments	Written.

5.3.5 Suggestive Reading Materials

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

5.3 Understanding India (Indian Ethos and Knowledge Systems)

Credit: 2

Semester: S-1

5.4.1 About the Course

At a time when the world finds itself deep in dynamism, led by technological innovations and environmental changes, there is a need for an inward-looking approach to building the young minds of a country. By looking inwards, one not only finds a sociological belongingness but also a spiritual and intellectual rooting in these changing times. The course provides an overview of India's heritage and knowledge traditions across key themes of economy, society, polity, law, environment, culture, ethics, science & technology, and philosophy. It places special emphasis on the application of these knowledge traditions, helping students to not only know and appreciate India's heritage and knowledge traditions but also to independently evaluate them through a multidisciplinary lens. This evaluation would produce valuable lessons for obtaining transferable and 21st-century skills. The course requires no pre-requisite knowledge or understanding. Spread over two years, the course will establish foundational knowledge and build upon it. It will allow students to have a basic understanding of the traditions of India and how it has evolved over the years. The course is designed to enable student teachers to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens; to evaluate the diverse traditions of India to distinguish its achievements and limitations, and to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

5.4.1 Learning Outcomes

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

- recognize the vast corpus of knowledge traditions of India, while developing an appreciation for it,
- apply their acquired research and critical thinking skills in multidisciplinary themes,
- summarize and pass on their learnings to their students of different Indian traditions in an easily digestible manner.

UNIT - I

Introduction to the Knowledge of India

- A. Definition & scope; Relevance of this knowledge.
- B. Need to revisit our ancient knowledge, traditions, and culture.

UNIT - II

Culture - Art and Literature

- A. Fine arts (traditional art forms, contemporary arts, arts & spirituality, arts and Identity, and art and globalization);
- B. Performing Arts (Indian dance systems, traditional Indian pieces of music, visual arts, folk arts, etc.,).
- C. Literature (Sanskrit literature, religious literature, Indian poetry, folk literature, Indian

fiction, Sangam literature, Kannada, Malayalam literature, Bengali literature, etc.

UNIT - III

Polity and Law

- A. Kingship & types of government (oligarchies, republics); Local administration (village administration);
- B. Basis of Law: Dharma & its sources; Criminal Justice: police, jails, and punishments; Lessons from Chanakyaniti; Lessons for modern-day India: Towards a tradition-driven equitable and just polity and law system.

UNIT - IV

Economy

- A. Overview of the Indian Economy from the Stone Age to the Guptas: The new culture of Urbanization (including castes, guilds, and other economic institutions; Harappan civilization economy; growth of agriculture and proliferation of new occupations; growth of writing);
- B. Internal & external trade and commerce, including trade routes, Indo-roman contacts, and maritime trade of South India; Temple economy.
- C. Land ownership - land grants & property rights, land revenue systems.
- D. Understanding Arthashastra: Ideas & Criticism; Locating relevance of ancient Indian economic thought in modern-day Indian Economy.

UNIT - V

Environment & Health

- A. Understanding Equilibrium between Society & Environment: Society's perceptions of natural resources like forests, land, water, and animals.
- B. Sustainable architecture & urban planning; Solving today's environmental challenges (best practices from indigenous knowledge, community-led efforts, etc.).
- C. India's Health Tradition: Ayurveda, Siddha, Ashtavaidya, Unani, and other schools of thought; Lessons from Sushruta Samhita and Charaka Samhita;
- D. Mental health in ancient India: towards time-tested concepts of mental wellness (concept of mind, dhyana, mind-body relationship, Ayurveda, yoga darshan, atman, etc.)

5.4.3 Suggestive Practicum

The modes of curriculum transaction will include lectures, Tutorials, and Practicum.

- Practicum will include organization of day trips that help student teachers watch events relating to visual and performing art; activities that enable student teachers to identify and record through photos, videos, etc. the elements of ancient architecture still existing in the city around them; organization of Individual and group presentations based on themes such as Polity, Law and Economy etc., organization of a 'Knowledge of India' day in the institution to celebrate the culture (food, clothes, etc.) that they would have been explored in lectures and tutorials; interactions with family members, elders, neighbors, and other members of society about the evolution of local systems and economy etc.

5.4.4 Suggestive Mode of Transaction

- Lectures will include learner-driven participatory sessions, and Guest lectures through experts and practitioners, such as fine arts and performing arts practitioners along with contemporary poets & writers of Indian literature.
- Tutorials will include Screening of documentaries and films followed by a discussion; Learner-driven discussions in the form of focus group discussions (FGDs), Socratic Discussions, etc.; Debate/discussion can be organized to explain India's Vaad tradition; discuss on how some of the ancient methods of teaching are relevant in today's time; discussions that help Identify ethical dilemmas in daily lives and understanding the importance of ancient ethics and values to resolve them.

5.4.5 Suggestive Mode of Assessment

The approaches to learning assessment will include, for example:

- Supporting the curiosity and interest of student teachers in the selected themes through a multi-modal approach, including regular assessments and actionable feedback that enable learners to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens.
- Enabling the student teachers to demonstrate critical analysis and independent thinking of the processes and events in the formulation & evolution of different traditions that help student teachers evaluate the diverse traditions of India to distinguish its achievements and limitations.
- Use of first-hand or second-hand experiences that enable student-teachers to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

5.4.6 Suggestive Reading Materials

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

SEMESTER-II

SEMESTER – II**Contents**

Course Code	Curricular Component	Name of the Course	Credits	Total	Page No
PHY202	Physics	Optics	4	12	51-52
PHY203		Kinetic Theory	4		53-54
PHY204		Chemistry Theory Chemistry Practical – I	3+1		55-57
CHE202	Chemistry	Principles of General Chemistry – II	4		58-60
CHE203		Physical Chemistry – I	4		61-62
CHE204		Physics Theory Physics Practical - I	3+1		63-64
MATH202	Mathematics	Analytical Geometry 3D	4		65-67
MATH203		Integral Calculus	4		68-69
MATH204		Mathematical Statistics - I	4		70-71
AEVL103	Ability Enhancement & Value Added Courses	Language-II English	4	8	72-74
AEV104		Understanding India (Indian Ethos & Knowledge System)	2		75-77
AEV105		Teacher & Society	2		78-80
Total Credits (for each discipline)				20	

MAJOR SUBJECT: PHYSICS**3.3 OPTICS****Credit: 4****Semester: S-2****3.3.1. About the course:**

This course is to learn and understand the Properties of lenses and principles of image formation. Student's gets comprehend the physics of aberrations and Optical instruments. They are familiarizing with the interference phenomena of light and the diffraction of light. Also, they know the fundamental concept of polarization.

3.3.2. Learning outcomes:

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

- recognize the phenomenon of interference, diffraction and polarization
- explain the working of optical instruments
- analyse simple problems in interference, diffraction and polarization.

UNIT I: INTERFERENCE

Wave nature of light – wavelength and frequency – coherence – Young's double slit experiment – intensity distribution in double slit interference pattern – interference from thin films – multiple films – antireflection coatings – Newton's rings – Michelson's interferometer.

UNIT II: FRAUNHOFER DIFFRACTION

Diffraction – single slit diffraction – intensity distribution in single slit diffraction – diffraction at a circular aperture – the airy pattern – interference and diffraction at a double slit – multiple slits – diffraction gratings – dispersion and resolving power.

UNIT III: FRESNEL DIFFRACTION

Shadows – Fresnel's half period zones – diffraction by a circular aperture – diffraction by a circular obstacle – zone plate – apertures and obstacles with straight edges – strip division of the wave front – Cornu's spiral – Fresnel's integrals – the straight edge.

UNIT IV: POLARIZATION

Light as an electromagnetic wave – E and B fields – polarization of electromagnetic waves – plane polarized light – polarizing sheets – Malus' Law – polarization by reflection – pile of plates polarizer – polarization by double refraction (birefringence) – wave plates – circular Polarization – polarization by scattering – polarization of sunlight by light scattering in the atmosphere.

UNIT V: OPTICAL INSTRUMENTS

The human eye – magnifiers – types of magnifiers – spectacle lenses – microscopes – microscope objectives – oculars and eyepieces – astronomical telescopes – Huygens eyepiece – Ramsden eyepiece – grating and prism spectrometers.

3.3.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.3.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.3.5. Suggestive readings:

1. **Richard L. Sutherland**, *Handbook of Nonlinear Optics*, (Marcel Decker Inc, New York, 2003).
2. **K.R. Nambiar**, *Lasers: Principles, Types and Applications* (New Age International Publishers Ltd, New Delhi, 2014).
3. **B.B. Laud**, *Lasers and Nonlinear Optics*, 3rd Edn. (New Age International Pvt. Ltd., New Delhi, 2011).
4. **R.W. Boyd**, *Nonlinear Optics*, 2nd Edn. (Academic Press, New York, 2003).
5. **W.T. Silfvast**, *Laser Fundamentals* (Cambridge University Press, Cambridge, 2003).
6. **Y.R. Shen**, *The Principles of Nonlinear Optics*, (Wiley & Sons, New Jersey, 2003).

3.4 KINETIC THEORY

Credit: 4

Semester: S-2

3.4.1. About the course:

This course is to learn and understand the basic concepts of temperature. It gives the detailed study of laws of thermodynamics and entropy.

3.4.2. Learning outcomes:

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

- relate the concept of temperature that underlies the laws of thermodynamics
- classify simple thermodynamic systems
- deduce the macroscopic properties of gas in terms of its molecular properties
- apply first law to study various thermodynamic processes
- estimate the change in entropy of the system.

UNIT I: TEMPERATURE

Temperature and thermal equilibrium – temperature scales: Celsius and Fahrenheit scales – measuring temperatures: constant-volume gas thermometer – International temperature scale – thermal expansion – ideal gas.

UNIT II: SIMPLE THERMODYNAMIC SYSTEMS

Thermodynamic equilibrium – equation of states – hydrostatic systems – mathematical theorems – stretched wire – surfaces – electrochemical cell – intensive and extensive coordinates.

UNIT III: MOLECULAR PROPERTIES OF GASES

Atomic nature of matter – molecular view of pressure – mean free path – distribution of molecular speeds – equation of state for real gases.

UNIT IV: FIRST LAW OF THERMODYNAMICS

First law of thermodynamics – heat capacity and specific heat – enthalpy – work done on or by ideal gas – internal energy of an ideal gas – heat capacities of an ideal gas – applications of first law of thermodynamics.

UNIT V: ENTROPY AND SECOND LAW OF THERMODYNAMICS

One-way processes – entropy change – entropy change for irreversible processes – second law of thermodynamics – entropy and performance of engines – entropy and performance of refrigerators.

3.4.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.4.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.4.5. Suggestive readings:

1. **D. A. McQuarrie**, *Statistical Mechanics* (Viva Books India, Viva Student Edition, 2018).
2. **S. C. Garg, R. M. Bansal and C. K. Gosh**, *Thermal Physics: with Kinetic Theory, Thermodynamics and Statistical Mechanics* (McGraw Hill Education, 2nd edition, 2017).
3. **B. K. Agarwal and M. Eisner**, *Statistical Mechanics* (New Age International Publishers, 3rd edition, 2013).
4. **R. K. Pathria and P. D. Beale**, *Statistical Mechanics* (Academic Press, 3rd edition, 2011).
5. **F. Reif**, *Fundamentals of Statistical and Thermal Physics* (Waveland Press, 2010).
6. **W. Greiner, L. Neise and H. Stocker**, *Thermodynamics and Statistical Mechanics* (Springer Verlag, New York, 1st edition, 1995).

3.1 MINOR – CHEMISTRY THEORY

Credit: 3

Semester: S-2

3.1.1. About the course:

This course deals with basics of physical chemistry, chemical equilibrium, electrochemistry, basics of radiochemistry and biochemistry.

3.1.2. Learning outcomes:

On successful completion of this course learners will be able to:

- Comprehend the evolution of electronic structure of atom
- Use quantum numbers and atomic orbital wave function equations to visualize the shapes of orbitals
- Recognize the relationship between position of an element in periodic table and its atomic properties and the periodic trend in properties
- Explain the concept of chemical bonding
- Analyse the properties of gases, liquids, solids and solutions

UNIT I: CHEMICAL EQUILIBRIUM

The Concept of Dynamic Equilibrium, The Equilibrium Constant (K), Heterogeneous Equilibria: Reactions involving Solids and Liquids, Calculating the Equilibrium Constant, The Reaction Quotient: Predicting the Direction of Change, Finding Equilibrium Concentrations, LeChatelier's Principle, solubility equilibria, complex ion equilibria

UNIT II: ACIDS AND BASES

Definitions, Acid strength and acid dissociation constant, auto ionization of water and pH, strong and weak acids, base solutions, buffers, acid-base properties of ions, polyprotic acids, Lewis concept.

UNIT III: IONIC EQUILIBRIUM AND ELECTROCHEMISTRY

Buffers, range and capacity, titration pH curves - Balancing redox reactions, Galvanic cells and spontaneous chemical reactions, standard electrode potential, cell potential, free energy and equilibrium constant, corrosion.

UNIT IV: RADIOACTIVITY AND METALLURGY

Discovery, types, valley of stability of nucleus, detection, kinetics of radioactivity, fission, mass defect and nuclear energy, fusion, nuclear transmutation and trans-uranium elements, application in medicine – natural distribution of metals, metallurgical processes, metal structure and alloys, basic information about transition metals.

UNIT V: ORGANIC CHEMISTRY AND BIOCHEMISTRY

Nature of carbon, hydrocarbons, hydrocarbon reactions, aromatic hydrocarbons, functional groups: alcohols, aldehydes, ketones, carboxylic acids, esters, ethers, amines – Lipids, carbohydrates, proteins and amino acids, protein structure, nucleic acids, DNA.

3.1.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.1.4. Suggestive mode of assessment:

Assignments, class test, problem solving, Semester examination.

3.1.5. Suggestive readings:

1. Chemistry A Molecular approach, Nivaldo J Tro, 4ed, Pearson, 2017
2. Chemistry: The Central Science, Theodore L. Brown, H. Eugene LeMay, Jr.,
3. Bruce E. Bursten, Catherine J. Murphy, Patrick M. Woodward, Matthew W. Stoltzfus, 13ed, Pearson, 2015, Stoltzfus, 13ed, Pearson, 2015
4. J.E.Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry: Principles of Structure and Reactivity, ISBN-13: 9788177581300, HarperCollin College Publishers, 4th Ed., 1993.
5. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, ISBN: 9789354245701, Wiley Inter science, 4th & 5th Ed., 1998
6. Neil Winterton, Jeff Leigh Modern Coordination Chemistry, ISBN: 9780854044696, RSC, 1960

3.1 MINOR 1: CHEMISTRY PRACTICAL – I

Credit: 1

Semester: S-2

3.1.1. Experiments:

- 1) Identification of well-known organic functional groups - Identification of elements present and functional groups.
- 2) Determination of phase transition temperature of phenol-water system.
- 3) Determination of equilibrium constant of $KI + I_2 = KI_3$
- 4) Phase diagram of two component and three component systems.
- 5) Electrochemistry experiments.
 - (i) Determination of electrode potential
 - (ii) pH titration involving strong/weak acids and strong/weak bases
 - (iii) Conductometry titration experiments
 - (iv) Conductivity of weak and strong electrolytes

3.1.2. Suggestive mode of transaction:

Demonstration, experimentation.

3.1.3. Suggestive mode of assessment:

In lab-experimentation and semester examination.

3.1.4. Suggestive readings:

1. Vogel's Textbook of Practical Organic Chemistry, Brian S. Furniss, Hannaford, Smith, Tatchae
l, Pearson India; 5th edition, ISBN: 978-8177589573.
2. Systematic Lab Experiments in Organic Chemistry, Arun Sethi, New Age International (P) Ltd. ISB
N: 978-8122428285.
3. C. Arora, S. Bhattacharya, Advanced Physical Chemistry Practical Guide, Bentham Books, ISBN: 9
78-1681089126.
4. B. O. Aher, A. B. Aher, V. A. Bairagi, P. A. Pathade, J. P. Bapurao, Practical book of physical chemistr
y, Walnut Publication, ISBN: 9788194208648.
5. V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Basic principles of practical chemistry, Su
ltn Chand & Sons, ISBN: 81-8054-776-8.

MAJOR SUBJECT: CHEMISTRY**3.3 PRINCIPLES OF GENERAL CHEMISTRY – II****Credit: 4****Semester: S-2****3.3.1. About the course:**

This course deals with basics of physical chemistry, chemical equilibrium, electrochemistry, basics of radiochemistry and biochemistry.

3.3.2. Learning outcome:

On successful completion of this course learners will be able to:

- Comprehend the evolution of electronic structure of atom
- Use quantum numbers and atomic orbital wave function equations to visualize the shapes of orbitals
- Recognize the relationship between position of an element in periodic table and its atomic properties and the periodic trend in properties
- Explain the concept of chemical bonding
- Analyze the properties of gases, liquids, solids and solutions

UNIT I : CHEMICAL EQUILIBRIUM

The Concept of Dynamic Equilibrium, The Equilibrium Constant (K), Heterogeneous Equilibria: Reactions involving Solids and Liquids, Calculating the Equilibrium Constant, The Reaction Quotient: Predicting the Direction of Change, Finding Equilibrium Concentrations, LeChâtelier's Principle, solubility equilibria, complex ion equilibria.

UNIT II : ACIDS AND BASES

Definitions, Acid strength and acid dissociation constant, auto ionization of water and pH, strong and weak acids, base solutions, buffers, acid-base properties of ions, polyprotic acids, Lewis concept.

UNIT III : IONIC EQUILIBRIUM AND ELECTROCHEMISTRY

Buffers, range and capacity, titration pH curves - Balancing redox reactions, Galvanic cells and spontaneous chemical reactions, standard electrode potential, cell potential, free energy and equilibrium constant, corrosion.

UNIT IV: RADIOACTIVITY AND METALLURGY

Discovery, types, valley of stability of nucleus, detection, kinetics of radioactivity, fission, mass defect and nuclear energy, fusion, nuclear transmutation and trans-uranium elements, application in medicine – natural distribution of metals, metallurgical processes, metal structure and alloys, basic information about transition metals.

UNIT V: ORGANIC CHEMISTRY AND BIOCHEMISTRY

Nature of carbon, hydrocarbons, hydrocarbon reactions, aromatic hydrocarbons, functional groups: alcohols, aldehydes, ketones, carboxylic acids, esters, ethers, amines – Lipids, carbohydrates, proteins and amino acids, protein structure, nucleic acids, DNA.

3.3.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.3.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.3.5. Suggestive Readings:

1. Chemistry A Molecular approach, Nivaldo J Tro, 4ed, Pearson, 2017
2. Chemistry: The Central Science, Theodore L. Brown, H. Eugene LeMay, Jr.,
3. Bruce E. Bursten, Catherine J. Murphy, Patrick M. Woodward, Matthew W. Stoltzfus, 13ed, Pearson, 2015
4. Stoltzfus, 13ed, Pearson, 2015
5. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry: Principles of Structure and Reactivity, ISBN-13: 9788177581300, HarperCollin College Publishers, 4th Ed., 1993.
6. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, ISBN: 9789354245701, Wiley Interscience, 4th & 5th Ed., 1998
7. Neil Winterton, Jeff Leigh Modern Coordination Chemistry, ISBN: 9780854044696, RSC, 1960

3.4 PHYSICAL CHEMISTRY – I

Credit: 4

Semester: S-2

3.4.1. About the course::

This course deals with kinetic theory of gases, properties of liquids, gases and solids, acids and bases.

3.4.2. Learning outcome:

On successful completion of this course learners will be able to:

- Illustrate the experimental observations of the behaviour of gases and to explain the properties in terms of microscopic organization.
- Develop an understanding of properties of Gases, Liquids, colloids and Solutions.
- Understand the shapes of molecules in terms of symmetries and their properties of matter in solid state to the structure.
- Understand of the concept of acids and bases, characteristics of non-aqueous solvents.
- Familiarize radioactivity as a nuclear phenomenon in understanding the nuclear reactions.

UNIT I : GASEOUS STATES

Review of kinetic theory of gases and van der Waals equation. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases based on Joule, Thomson effect.

UNIT II: MOLECULAR VELOCITIES

Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases (based on Joule-Thomson effect).

UNIT III : SOLID STATE

Explanation of the macroscopic properties of solids in terms of structure, bonding and defects. Definition of space lattice, unit cell. Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Law of symmetry. Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg equation. Predicting crystal structure. Defects in solids, Dielectric properties. Review a perfect gas connecting temperature with kinetic theory. Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of state. Critical Phenomena - PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, Derive a relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

UNIT IV: LIQUIDS

Accounting the Isotropic and intermediate behaviour of liquids as a link between solids and gases. Also tracing the role of liquids as solvents and reaction regulators. Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals - Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholesteric phases. Thermography and seven segment cells.

UNIT V: ACIDS AND BASES

A discussion on changing concepts of acids and bases involving concentrations and effects of solvent medium. Arrhenius, Bronsted-Lowry and Lewis concepts of acids and bases. Hard and Soft Acids and Bases (HSAB) - Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness. Non-aqueous solvents - Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2 .

3.4.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.4.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.4.5. Suggestive Readings:

1. Essentials of Physical Chemistry, Arun Bahl, B. S. Bahl, G. D. Tuli, S. Chand & Company Ltd, ISBN: 978-9352836093.
2. Principles of Physical Chemistry by Marron and Prutton, ISBN: 0023762306.
3. Elements of Physical Chemistry by Samuel Glasstone and Lewis, ISBN: 978-0333038437. Physical Chemistry, Atkins, P. W., and Paula, J. D., Oxford Press, ISBN: 0-7167-8759-8. Nuclear Chemistry: V. N. Dash, Sultan Chand & sons, ISBN: 81-8054-778-2.
4. Essentials of Nuclear Chemistry, Arnikaar, Harijeevan, 4th edition, New Age International, ISBN: 978-8122432039.

3.1 MINOR PHYSICS THEORY

Credit: 3

Semester: S-2

3.1.1. About the course:

This course is to learn and understand the basic concepts of temperature. It gives the detailed study of laws of thermodynamics and entropy.

3.1.2. Learning outcomes:

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

- relate the concept of temperature that underlies the laws of thermodynamics
- classify simple thermodynamic systems
- deduce the macroscopic properties of gas in terms of its molecular properties
- apply first law to study various thermodynamic processes
- estimate the change in entropy of the system.

UNIT I: TEMPERATURE

Temperature and thermal equilibrium – temperature scales: Celsius and Fahrenheit scales – measuring temperatures: constant-volume gas thermometer – International temperature scale – thermal expansion – ideal gas.

UNIT II: SIMPLE THERMODYNAMIC SYSTEMS

Thermodynamic equilibrium – equation of states – hydrostatic systems – mathematical theorems – stretched wire – surfaces – electrochemical cell – intensive and extensive coordinates.

UNIT III: MOLECULAR PROPERTIES OF GASES

Atomic nature of matter – molecular view of pressure – mean free path – distribution of molecular speeds – equation of state for real gases.

UNIT IV: FIRST LAW OF THERMODYNAMICS

First law of thermodynamics – heat capacity and specific heat – enthalpy – work done on or by ideal gas – internal energy of an ideal gas – heat capacities of an ideal gas – applications of first law of thermodynamics.

3.1.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion.

3.1.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations.

3.1.5. Suggestive readings:

1. **D. A. McQuarrie**, *Statistical Mechanics* (Viva Books India, Viva Student Edition, 2018).
2. **S. C. Garg, R. M. Bansal and C. K. Gosh**, *Thermal Physics: with Kinetic Theory, Thermodynamics and Statistical Mechanics* (McGraw Hill Education, 2nd edition, 2017).
3. **B. K. Agarwal and M. Eisner**, *Statistical Mechanics* (New Age International Publishers, 3rd edition, 2013).

4. **R. K. Pathria** and **P. D. Beale**, *Statistical Mechanics* (Academic Press, 3rd edition, 2011).
5. **F. Reif**, *Fundamentals of Statistical and Thermal Physics* (Waveland Press, 2010).
6. **W. Greiner**, **L. Neise** and **H. Stocker**, *Thermodynamics and Statistical Mechanics* (Springer Verlag, New York, 1st edition, 1995).

3.1 MINOR PHYSICS PRACTICAL – I

Credit: 1

Semester: S-2

3.1.1. Experiments:

1. Young's modulus - Uniform bending – Pin and microscope method.
2. Rigidity modulus - Torsional pendulum with masses.
3. Poiseuille's flow method – comparison of viscosity.
4. Specific Heat capacity of a liquid - Joule's calorimeter.
5. Thermal conductivity of a bad conductor - Lee's disc method

3.1.2. Suggestive mode of transaction:

Experimentation, Demonstration

3.1.3. Suggestive mode of assessment:

In lab- experimentation, Semester examinations

3.1.4. Suggestive readings:

1. Practical Physics and Electronics, C.C. Ouseph et al, 1 st Ed., S. Visawanathan Pvt. Ltd., 2005.
2. Practical Physics, M.N. Srinivasan et al, 1 st Ed., Sultan Chand and Sons, 2005.
3. A Textbook of Practical Physics, H.P. Shrivastava, 1 st Ed., ABD Publishers, 2006.

MAJOR SUBJECT: MATHEMATICS**CORE 3: ANALYTICAL GEOMETRY**

Credit: 4
Semester: S-2

About the Course:

Although both Descartes and Fermat suggested using three coordinates to study curves and surfaces in space, three-dimensional analytic geometry developed slowly until about 1730, when the Swiss mathematicians Leonhard Euler and Jakob Hermann and the French mathematician Alexis Clairaut produced general equations for cylinders, cones, and surfaces of revolution.

Newton made the remarkable claim that all plane cubics arise from those in his third standard form by projection between planes. In 1748 Euler used equations for rotations and translations in space to transform the general quadric surface so that its principal axes coincide with the coordinate axes.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I: Angle between 2 lines-projections-direction cosines-relation between the direction cosines of a straight line-the projection of the line joining $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ on any line with d.c.'s l, m, n -
 direction cosines of any line joining 2 points-angle between the lines whose direction cosines are (l_1, m_1, n_1) and (l_2, m_2, n_2) .

UNIT II: General equation, angle between two planes, length of perpendicular from a given point to a plane, equations of the plane bisecting the angle between two planes.

UNIT III: Symmetrical form, line through two points, reduction of unsymmetrical form to the symmetrical form - condition for a line to lie on a plane - plane through a line - condition for the two lines to be coplanar (Cartesian form) - equation of the plane containing two lines - To find the shortest distance between two skew lines - equation of the shortest Distance in Cartesian.

UNIT IV: Equation of a sphere with given Centre and radius - general equation of a sphere-diameter form - and circular section.

UNIT V: Equation of a Cone with its vertex at the origin - equation of a quadratic cone with given vertex and given guiding curve - necessary condition for general equation of second degree to represent a cone - circular cone - equation of circular cone with given vertex - axis and

semi vertical angle.

Suggestive practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report.

Suggestive mode of transaction

Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment.

Suggestive Reading Materials

Prescribed Text: A Text Book of Analytical Geometry of Three dimensions by T.K.Manickavachagom Pillai and T.Natarajan S. Viswanathan Printers. Publishers) (2008).

Reference books:

1. Text Book of Analytic Geometry -2D,
P. Duraipandian, Emerald Publishers (1968)
- Simplified Course in Solid Geometry(3D) by H.K.Dasse, H.C.Saxena, M.D.Raisinghanian –
S.Chand& Company

e-LearningSource

<http://ndl.iitkgp.ac.in><http://ocw.mit.edu> <http://mathforum.org>

CORE 4: INTEGRAL CALCULUS

Credit: 4

Semester: S-2

About the Course:

Integral calculus helps in finding the anti-derivatives of a function. These anti-derivatives are also called the integrals of the function. The process of finding the anti-derivative of a function is called integration. The inverse process of finding derivatives is finding the integrals. Integral Calculus is the branch of calculus where we study integrals and their properties. Integration is an essential concept which is the inverse process of differentiation. Both the integral and differential calculus are related to each other by the fundamental theorem of calculus.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I: Integration of rational algebraic functions – Integration of irrational algebraic functions - Properties of definite integrals.

UNIT II: Integration by parts – Bernoulli’s formula – Reduction formulae.

UNIT III: Evaluation of double integral – Changing of order of integration- Double integral in Polar co-ordinates – Triple integral.

UNIT IV: Jacobian – Change of variables in the case of two variable and three variables – Transformation from Cartesian to polar co-ordinate - Transformation from Cartesian to spherical co-ordinates.

UNIT V: Properties – relation between Beta and Gamma functions -Recurrence formula

Suggestive Practicum

- Solve / workout any one Chapter’s Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction

- Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project

work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment.

Suggestive Reading Materials

Calculus Volume II, S.Narayanan and T.K. Manickavasagam Pillai (2008) Unit I : Chapter 1 : 7.3, 7.4, 7.5, 8, 11

Unit II : Chapter 1: 12,13,

Unit III: Chapter 5 : 2.1, 2.2, 3.1, 4

Unit IV : Chapter 6: 1.1, 1.2, 2.1,2.2,2.3,2.4

Unit v: Chapter 7: 2.1, 2.2, 2.3, 3, 4, 5

Reference books

1. *Integral Calculus*, N. P. Bali, Laxmi Publications, Delhi, (1991)
2. *Calculus*(2nd Edition), Lipman Bers and Frank Karal, HoltMcDougal, 1976.
3. Thomas' *Calculus* 12th Edition, George B.Thomas, Maurice D.Weir and Joel Hass, Pearson Education, 2015.

e-LearningSource

<http://ndl.iitkgp.ac.in><http://ocw.mit.edu> <http://mathforum.org>

<http://ndl.iitkgp.ac.in><http://ocw.mit.edu>

<http://mathforum.org>

Ancillary-2: MATHEMATICAL STATISTICS- I**Credit: 4****Semester: 2****About the Course**

This graduate level mathematics course covers decision theory, estimation, confidence intervals, and hypothesis testing. The course also introduces students to large sample theory. Other topics covered include asymptotic efficiency of estimates, exponential families, and sequential analysis. Mathematical statistics is the application of Statistics, which was initially conceived as the science of the state the collection and analysis of facts about a country: its economy, and, military, population, and so forth.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I: Random variables – Distribution function – Discrete random variable –Continuous random variable – Continuous distribution function – Two dimensional random variables – Joint probability function – Mathematical expectation and variance.

UNIT II: Moment generating function – Properties of MGF – Cumulants – Properties of Cumulants – Characteristic function – Properties of characteristic function – Tchebychev's inequality.

UNIT III: Binomial distribution – Moments of binomial distribution – Recurrence relation for the moments of binomial distribution – MGF of Binomial distribution – Characteristic function of Binomial distribution – Fitting a binomial distribution.

UNIT IV: Poisson distribution – Moments of the Poisson distribution – Recurrence relation for moments of Poisson distribution – Moment generating function of Poisson distribution – Characteristic function of Poisson distribution – Fitting a Poisson distribution.

UNIT V: Normal distribution – Properties of normal distribution – Mode, Median, MGF, Moments Points of inflexion, Median deviation about mean, Area property of Normal distribution – Problems using area Properties.

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report.

Suggestive mode of transaction

- Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

- Assessment will be based on the Test / Examination and Assignment.

Suggestive Reading Materials***Prescribed Text***

Fundamentals of Mathematical Statistics by S.C.Gupta, V.K.Kapoor, SultanChand and Sons , 11th edition

Unit I : 5.1 to 5.4, 6.1 to 6.9, Unit II : 6.10 to 6.13 Unit III : 7.2

Unit IV : 7.3, Unit V : 8.2.1 to 8.2.11

Reference Books

1. *Statistical methods by S.P.Gupta – Sultan Chand.*
2. *Statistics(Theory and Practice) by R.S.N.Pillai & V. Bagavathy -S.Chand & Co.*
3. *Robert V. Hogg and Allen T. Craig , Introduction to Mathematical Statistics(Fifth Edition) Pearson Education, 2005*

e-LearningSource

<http://ndl.iitkgp.ac.in>

<http://ocw.mit.edu>

<http://mathforum.org>

5.1 Language 2 (Other than L1)

Credit: 4

Semester: S-2

5.2.1 About the Course

The course aims to prepare the students to teach language at the school level. It focuses on training the students to the sounds systems of languages, word formation processes, sentence formation, semantic and pragmatic aspects of languages. The course intends to enable the learners to integrate all the four language skills using different genres. The major aim of this course is to empower the learners to contribute to the discourses on various issues and themes. The course also orients the students to the use of different technology and digital media for developing their own communicative skills as well as the school students they would teach in the future. The course helps improve basic communication skills such as listening, speaking, reading, and writing skills among L2 language learners. The course is designed to enhance knowledge of grammar of L2 and enable the students to formulate grammatically correct and contextually appropriate sentences and words and empower the students with summarizing skills, oral presentations skills effectively. The course also seeks to enhance students' critical thinking capacities and demonstrate effective communication skills and provide hands-on activities to student teachers to develop their linguistic skills through practical sessions.

5.2.2 Learning Outcomes

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

- demonstrate reading, writing, listening, speaking, and thinking abilities in L2,
- recognize the link between language and mental skills and demonstrate their knowledge and skills effectively for all purposes,
- build inter-personal relationships and enhance social skills.

UNIT - I

Language, Society, and learning

- A. Bi-/Multilingualism and scholastic achievements; need to promote multilingualism; Language variation and social variation; languages, dialects and varieties, cultural transmission of language, language, and gender; language and identity; language and power; constitutional provisions and National Education Policy 2020.
- B. Language acquisition and Language learning; language learning from mother tongue to other tongues; advantages of learning other languages; language and education; notion of first language, second language and others.

UNIT - II

Speech and Writing

- A. Writing Systems: Speech and writing; arbitrariness in language; types of writing systems.
- B. Classification sessions of speech sounds: vowels, consonants, and

others; suprasegmental: stress, pitch, tone, intonation, and juncture; Acoustic phonetics.

UNIT - III

Understanding Grammar

- A. Word and meaning; parts of speech, grammatical categories; word formation: affixation, compounding, reduplication, vocabulary building.
- B. Sentence and its constituents: simple, complex, and compound sentences; Semantics and pragmatics: lexical meaning- synonymy, antonymy, meronymy, grammatical meaning, speech acts.

UNIT - IV

Basic Communication Skills in L2

- A. Pronunciation and listening comprehension skills.
- B. Reading and reading comprehension skills.
- C. Effective writing skills; effective presentation and speaking skills; summarizing and paraphrasing skills.

UNIT - V

Critical Reading and Thinking Skills

- A. Components of critical thinking and reading; high order cognitive development; critical thinking and problem solving; rational inquiry.

5.2.3 Suggestive Practicum

1. Listen to a recorded speech and classify it based on sounds: vowels, consonants, and others; suprasegmental: stress, pitch, tone, intonation, and juncture; Acoustic phonetics.
2. Analyze sentences and their constituents as simple, complex, and compound sentences from written work.

5.2.4 Suggestive Mode of Transaction

Teaching this course will involve a mix of interactive lectures, tutorials, and practical involves such as discussion, role plays, projects, simulations, workshops and language-awareness activities. The teaching intends deeper approaches to learning involving in- class room discussion, developing the critical thinking/ problem solving abilities among the students and will also focus on situations where in our daily lives the one would be performing tasks that involve a natural integration of language skills. The students are expected to read assigned chapters/ articles before the session and the course requires active participation from the students.

5.2.5 Suggestive Mode of Assessment

The assessment of the learner will be primarily based on the assessment of both linguistic and communicative skills using a battery of tests and test types, group work and projects.

5.2.6 Suggestive Reading Materials

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

5.3 Understanding India (Indian Ethos and Knowledge Systems)

Credit: 2

Semester:S-2

5.3.1 About the Course

At a time when the world finds itself deep in dynamism, led by technological innovations and environmental changes, there is a need for an inward-looking approach to building the young minds of a country. By looking inwards, one not only finds a sociological belongingness but also a spiritual and intellectual rooting in these changing times. The course provides an overview of India's heritage and knowledge traditions across key themes of economy, society, polity, law, environment, culture, ethics, science & technology, and philosophy. It places special emphasis on the application of these knowledge traditions, helping students to not only know and appreciate India's heritage and knowledge traditions but also to independently evaluate them through a multidisciplinary lens. This evaluation would produce valuable lessons for obtaining transferable and 21st-century skills. The course requires no pre-requisite knowledge or understanding. Spread across two years, the course will establish foundational knowledge and build upon it. It will allow students to have a basic understanding of the traditions of India and how it has evolved over the years. The course is designed to enable student teachers to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens; to evaluate the diverse traditions of India to distinguish its achievements and limitations, and to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

5.3.2 Learning Outcomes

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

- recognize the vast corpus of knowledge traditions of India, while developing an appreciation for it,
- apply their acquired research and critical thinking skills in multidisciplinary themes,
- summarize and pass on their learnings to their students of different Indian traditions in an easily digestible manner.

UNIT - I

Introduction of Knowledge of India

- A. Recap of the previous semester's definition and introduction.
- B. Recap of previous knowledge.

UNIT - II

Philosophy, Ethics & Values: Schools of Philosophy

- A. Vaisheshika, Nyaya, Samkhya, Yoga, Purva Mimamsa and Vedanta or Uttara Mimamsa (theory and the major thinkers) – and Jain, Buddhist, and Charvak traditions.
- B. Vedanta: philosophical systems (Advaita, Vishishtadvaita, Dvaita).
- C. Ethics, morality, and social dilemma (including self-leadership) and their relevance in today's time.
- D. How do Indians value spirituality? Spirituality and Social Responsibility; Importance of Spirituality in current times.
- E. Using ethics in a technologically volatile world: leading an ethical and modern life.
- F. Practical Vedanta for well-being (mindfulness, inter-connectedness, society-self

UNIT - III

Culture- Lifestyle

- A. Food (regional cuisines, ayurvedic diet, food and festival, vegetarianism, Jainism in food, food and hospitality, and globalization).
- B. Clothes (traditional Indian clothing, textile arts, religious costumes, clothing status, clothing, gender, globalization in clothing).
- C. Sports (traditional Indian sports, martial arts, sports, and gender, sports & globalization).
- D. The lifestyle of Yoga; adapting ancient lifestyle – A path towards longevity.

UNIT - IV

Science & Technology

- A. Arithmetic and logic.
- B. Natural sciences: math, physics, metallurgy, and chemistry.
- C. Astronomy: India's contributions to the world.
- D. Indian notions of time and space.
- E. Technology in the economy: agriculture, transportation, etc.

UNIT - V

Linguistic Traditions

- A. History of linguistics in India (conceptualizing ancient Indian linguistics, oral traditions, etc.).
- B. Language as Culture: Evolution of Languages over the years & language as building blocks to different cultures and society
- C. Language: Identity, culture, and History.

5.3.3 Suggestive Practicum

The modes of curriculum transaction will include lectures, Tutorials, and Practicum.

- Practicum will include organization of day trips that help student teachers watch events relating to visual and performing art; activities that enable student teachers to identify and record through photos, videos, etc. the elements of ancient architecture still existing in the city around them; organization of Individual and group presentations based on themes such as Polity, Law and Economy etc., organization of a 'Knowledge of India' day in the institution to celebrate the culture (food, clothes, etc.) that they would have been explored in lectures and tutorials; interactions with family members, elders, neighbors, and other members of society about the evolution of local systems and economy etc.

5.3.4 Suggestive Mode of Transaction

- Lectures will include learner-driven participatory sessions, and Guest lectures through experts and practitioners, such as fine arts and performing arts practitioners along with contemporary poets & writers of Indian literature.
- Tutorials will include Screening of documentaries and films followed by a discussion; Learner-driven discussions in the form of focus group discussions (FGDs), Socratic Discussions, etc.; Debate/discussion can be organized to explain India's Vaad tradition; discuss on how some of the ancient methods of teaching are relevant in today's time; discussions that help Identify ethical dilemmas in daily lives and understanding the importance of ancient ethics and values to resolve the.

5.3.5 Suggestive Mode of Assessment

The approaches to learning assessment will include, for example:

- Supporting the curiosity and interest of student teachers in the selected themes through a multi-modal approach, including regular assessments and actionable feedback that enable learners to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens.
- Enabling the student teachers to demonstrate critical analysis and independent thinking of the processes and events in the formulation & evolution of different traditions that help student teachers evaluate the diverse traditions of India to distinguish its achievements and limitations.
- Use of first-hand or second-hand experiences that enable student teachers to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

5.3.6 Suggestive Reading Materials

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

5.4 Teacher and Society

Credit:2

Semester:S-2

5.4.1 About the Course

Teachers unarguably have the key role in nurturing young lives and shaping positive and inspired future generations. Emphasizing on the crucial role of teachers NEP 2020 states “teachers truly shape the future of our children - and, therefore, the future of our nation.”. “The high respect for teachers and the high status of the teaching profession must be restored to inspire the best to enter the teaching profession. The motivation and empowerment of teachers is required to ensure the best possible future for our children and our nation.” (NEP Para 5.1). The NEP in its introductory section states, “the teacher must be at the centre of the fundamental reforms in the education system” and highlights the need to “help re-establish teachers, at all levels, as the most respected and essential members of our society, because they truly shape our next generation of citizens”. (NEP 2020, Introduction). The policy also stresses the need to “do everything to empower teachers and help them to do their job as effectively as possible.” It is recognized that teachers are second to mothers in having the opportunity to work with children during the most impressionable years in their life and shape opinions, form ideas about personal and social goals and about society and life, contributing so much to the development of both individuals and society.

The focus of the course on ‘Teacher & Society’ is on developing an understanding among student teachers of the roles of teachers in the emerging Indian society, including the changing roles of teachers in the context of the global flows of people, culture and resources that are shaping society, and the application of technologies that are constantly redefining not only the educational landscape but also the human relationships and social norms which are continuously undergoing change which entails a recalibration of the teacher roles aligned to the current and future realities and preparing teachers for the volatile, uncertain, complex and ambiguous world. The course enables the students to understand the roles and obligations of teachers as an architect of the society based upon the cultural ethos, traditions, and diversity. The student teachers shall be equipped with the knowledge, capacities and value system that enables them to act as an agent for fostering national integration, a feeling of pride in the cultural heritage and achievements of India. This course also aims to ensure that student teachers understand their responsibility for producing a future generation that undertakes its responsibility as an awakened citizen who avoids wastage of national resources and takes up a proactive role for the emergence of India as a strong and disciplined nation.

In addition to these, the course also seeks to enable each of the student teachers to respond to the needs of students from diverse cultural, linguistic, social and economic backgrounds; to be sensitive to gender issues, promote tolerance and social cohesion, provide special attention to students with learning disabilities, learn and apply new pedagogies and technologies, keep pace with current educational developments and initiatives; and keep oneself professionally engaged to update/upgrade knowledge and practice. Student teachers will be encouraged to comprehend how societal structures, context and historical patterns shape teacher identities on one hand and how teacher identities, beliefs, values, convictions and commitment shape the ethics, culture, norms and values on the other; thus, impacting the larger societal thoughts and actions. The course also explores the relationship of the teacher with education development, community and society through different course units that talk of the teacher as a person and as a professional, the socio-cultural and technological contexts of the teacher and how they impact the teaching-learning process, the multiple roles, identities and expectations of a teacher. It invites the student teachers to be reflexive of one’s thoughts, beliefs and actions and continuously take a gaze inside

out so as to unbiasedly engage children in a reflective dialogue.

The course explores the agentic role of a teacher, how it gets influenced and how it influences the education system. It concludes with the re-calibrating of roles of teacher and teaching beyond the curricular boundaries as an architect of an inclusive, harmonious, and developing India.

5.3.1 Learning Outcomes

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

- examine the relationship between teacher beliefs, values, character, life history, social and cultural context and teaching critically,
- explain the teacher roles and characteristics; the personal and professional self; the teacher as a communicator, the charismatic influencer, the reflective practitioner, competent, learner and much more and their significant role in nurturing the posterity.
- differentiate between the narrow curricular aims of education and the broader educational aims and their role in shaping self, school and society,
- demonstrate an ability to develop positive classrooms through engaging in the ethic of care,
- demonstrate an ability to critically reflect on personal and collective practice so as to improve learning and teaching,
- conceptualize teacher agency, its individual, contextual, and structural dimensions and how it gets impacted and in turn shapes education.

UNIT - I

Understanding the Teacher: Exploring the Personal and Professional Teacher

- A. Exploring the wider Personal and General Social Context of Teacher: Life History, Teacher Beliefs, Values and Aspirations, Diverse Identities, Social Contexts and Commitment to Learning and Education.
- B. Exploring the Professional Teacher: Qualifications, Education in teaching, Attitude, Aptitude, Experience and Exposure.
- C. The Charismatic Teacher, the Communicator Teacher, The Missionary Teacher, The Competent Practitioner, The Reflective Practitioner, The Learning Teacher.
- D. Reflexive Practice: Nurturing the Professional Capital through collaborative and/or collective engagement with self, others, the social context.

UNIT - II

Nurturing the Teacher: A Dialogue beyond the curricular goals, for Life and Posterity

- A. Teaching: One profession, many roles
- B. Teaching Character: Nurturing Teachers for Human Flourishing.
- C. Holistic Teacher Development: Nurturing the Panchakoshas.
- D. Teacher Values, Beliefs and current Philosophy of Teaching: A Reflective Dialogue.
- E. Developing an Ethic of Care in Teacher Education: Nurturing Teachers towards a pedagogy of care.

UNIT - III

Understanding and Fostering Teacher Agency: Role in shaping Education Systems of Tomorrow

- A. Teacher Agency: What is it and why does it matter?
- B. Individual, Cultural and Structural Dimensions of Teacher Agency.
- C. Teacher discourses, Philosophy, Relationships, Networks and Professional Development:

Shaping teacher agency and Creative insubordination.

- D. Challenges and Issues in fostering Teacher Agency: Performativity, Non-academic engagements, Systemic apathy, Policy and Practice gaps and others.
- E. Role of Teacher in shaping the educational policy, practice and reforms.

UNIT - IV

Teacher as an Architect of the New India: Shaping the Society of Tomorrow

- A. Engaging in Critical Education: Dialogues on power relations associated with Gender, Ethnicity, Culture, Disability, Class, Poverty, the reproduction of disadvantage and realizing the true human potential.
- B. Being a Critical Teacher: Raising debates around rapid technological advancement and impact on individual, family and social life; the growing isolation and impact on mental and social health and well-being, changing relationships between the 'state' and the 'market' and their impact on formal education; the conceptualization of teacher, teaching and teacher roles, 'globalization' and the reconstructed nationalism shaping the socio-political milieu and impact on social psyche, growing materialistic urge, sensory drives and the gradual deterioration of the individual and societal character.

5.3.2 Suggestive Practicum

1. Take up a case study of any one teacher education Institution.
2. Write a biography of any one of your favourite teachers/ Educationists.

5.5.3 Suggestive Mode of Transaction

Teacher and Society is a reformatory course that invites teachers to re-think teachers and teaching. It awakens and inspires teachers to realize broader educational aims through an action and reflection cycle. The approach therefore would include a blend of lectures, in-class seminars, thinking exercises, critical reflections, group-work, case-based approaches, and enquiry-based learning.

- Learners would also be exposed to case studies featuring teachers from a representative cross-section of Schools in India and critically analyse their exercise of agentic force in school improvement and the improvement of teaching practice.
- Situating themselves in the geo-political context, the learners will get to critically engage in some of the policy dialogues.
- Learners would reflect on their practice as pre-service interns, knowledge, skills, and understandings—and identify opportunities to apply course learnings to their school context.

5.5.5 Suggestive Mode of Assessment

Being a very thought-provoking course, the assessment would largely include critical thinking kind of assignments. The following are some exemplars.

1. Write your current teaching philosophy based on your beliefs and values.
2. Choose any one area of immediate societal concern like environmental degradation, increasing crime against women, cybercrimes, bullying or any other and draw an action plan that you as a teacher would undertake to mobilize self, school and society towards betterment.
3. Critical Reflections on popular debates around power relations associated with Gender, Ethnicity, Culture, Disability, Class, Poverty, and such others

These are just prototypes and institutes may choose either of these or think of other innovative assignments that would inculcate in the future teachers a sense of belonging for society.

5.5.6 Suggestive Reading Materials

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

SEMESTER-III

SEMESTER-III

Course Code	Curricular Component	Name of the Course	Credits	Total	Page No.
FE02	Foundations of Education	Child Development & Education Psychology	4	4	83-85
PHY205	Physics	Electricity	4	12	86-87
PHY206		Modern Physics	4		87-89
PHY207		Practical – B	4		90-90
CHE205	Chemistry	Inorganic Chemistry – I	4		91-92
CHE206		Physical Chemistry – II	4		93-94
CHE207		Practical – B	4		95-95
MATH205	Mathematics	Ordinary Differential Equations	4		96-97
MATH206		Abstract Algebra	4		98-99
MATH207		Numerical Methods	4		100-101
PEDP218	Stage – specific content - cum - Pedagogy	Basics of Pedagogy at Secondary Stage	4	4	102-104
PEDC218					
PEDM218					
Total credits (For each discipline)				20	

2.0 Child Development & Educational Psychology

Credit: 4
Semester: S-3

2.0.1 About the Course

To enable student teachers to understand the interplay of three different processes namely biological processes, cognitive processes, and socio-emotional processes that influence development of a child. Biological, cognitive, and socio-emotional processes are intricately interwoven with each other. Each of these processes plays a role in the development of a child whose body and mind are interdependent.

The course seeks to provide an understanding of the developmental characteristics of a child:

- during infancy that ranges from birth to 24 months of age,
- during Early Childhood stage which begins around age 3 and usually extends up to 6-7 years of age,
- Middle to Late Childhood stage which begins around 6-7 years to 10-11 years of age, and
- Adolescence stage which begins at approximately the age of 12 years, and which is a period of transition from childhood to early adulthood.

The course will introduce development across domains – physical development, cognitive development, language development, socio-emotional development, aesthetic development, moral development – during each of the above-mentioned developmental stages of a child.

Educational Psychology component of the course:

Informs student teachers about the various theories of learning and motivational states for learning and their implications for pedagogy. It includes the study of how people learn, pedagogical approaches that are required to improve student learning, teaching-learning processes that enable learners to attain the defined learning outcomes, and individual differences in learning. It provides opportunities to student teachers to explore the behavioral, cognitive and constructivist approach to facilitating student learning, and the emotional and social factors that influence the learning process.

2.0.2 Learning Outcomes

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

- describe the meaning, concept, characteristics, and factors affecting growth and development,
- use the knowledge of Indian concept of self,
- apply various problem solving and learning strategies in real classroom settings,
- identify the various approaches of the process of learning,
- explain group dynamics and apply strategies to facilitate group learning.

UNIT - I

Child Development

- A. Meaning and significance of understanding the process of Child Development
 - Biological, cognitive, socio-emotional, and moral.
- B. Developmental characteristics of a child during:
 - Infancy stage
 - Early Childhood stage
 - Middle to Late Childhood stage
 - Adolescence stage

- C. The Indian concept of self: Mind (मनस्), Intellect (बुद्धि), Memory (स्मिन्). Panch-koshIya Vikas (पञ्चकोशीय विकास).
- D. Educational Implications.

UNIT - II

Developmental Process

- A. Development across domains:
- Physical Development
 - Cognitive Development
 - Language Development
 - Socio-Emotional Development
 - Aesthetic Development
 - Moral Development
- During each of the above-mentioned developmental stages of a child.
- B. Factors affecting development.
- C. Individual differences:
- Children with special needs including developmental disorders.
 - Tools and Techniques for Identifying Learner with different abilities.
- D. Teachers' role and strategies to address the needs of learners with different learning abilities.

UNIT - III

Process of Learning

- A. Conceptual Clarity and significance.
- B. Approaches:
- Behaviorist
 - Cognitivist
 - Constructivist
 - Developmental
 - Information processing Model of learning
 - Shri Aurobindo's Integral approach
- C. Problem Solving and Learning Strategies: Inquiry and problem-based learning, Steps and Strategies in problem solving, Factors hindering problem solving.
- D. How to Learn: Significance and Strategies.

UNIT - IV

Motivation and Classroom Management

- A. Motivation
- Conceptual clarity, nature, and significance
 - Intrinsic and Extrinsic Motivation
 - Strategies for Motivation
- B. Classroom management
- Creating a positive learning environment
 - Planning space for learning
 - Managing behavioral problems
- C. Group dynamics:
- Classroom as a social group

- Characteristics of group
- Understanding group interaction-sociometry
- Strategies to facilitate group learning.

2.0.3 Suggestive Practicum

1. Spending day with a child and preparing a report based on our observations of children for:
 - A day from different economic status (low and affluent)
 - Focus on various factors: Physical, emotional, social, language, cultural and religious influencing the child on daily basis.
2. Observing children to understand the styles of children learning process.
3. Identifying the Learning Difficulties of Students in Different learning areas and the Possible Reason for them- Case Study Report.
4. Preparing Personalized Intervention plan for Students with Learning Difficulties.
5. Plan to use advanced technology to encourage talented / gifted children.
6. Encouraging gifted / talented students beyond the general school curriculum.
7. Familiarization and Reporting of Individual Psychological Tests.

2.0.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.0.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.0.6 Suggestive Reading Materials

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

MAJOR SUBJECTS: PHYSICS**3.5 ELECTRICITY****Credit: 4****Semester: S-3****3.5.1. About the course**

This course is intended to acquaint the students with the theory, construction and operation of electronic devices. To introduce the basics of digital communication methods. To introduce the construction and working of nonlinear electronic circuits.

3.5.2. Learning outcomes:

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

- recognize the development of electronics in discrete components
- develop a strong foundation in electronics
- design and analyse wave shaping, regulating, amplifier and switching circuits
- compare the functioning of unipolar and bipolar junction transistors.

UNIT-I: INTRODUCTION AND DIODE CIRCUITS

Thevenin's Theorem – Norton's Theorem - The half- wave rectifier- The transformer- The full-wave rectifier- The Bridge- rectifier- The Choke- input filter- The Capacitor- input Filter- - Clippers and Limiters Clampers- The Zener Diode- The Loaded Zener Regulator – Second approximation of Zener Diode- Zener Drop- out point.

UNIT-II: TRANSISTOR FUNDAMENTALS AND BIASING

The unbiased transistor – The biased transistor- transistor currents – The CE Connection - The base curve- Collector Curves- Transistor Approximation -- Variation in Current gain – The Load Line – The Operating Point - Recognizing Saturation – The transistor Switch- Emitter Bias - The effect of small changes - Voltage- Divider Bias- Accurate VDB Analysis- VDB Load and Q Point – Two- Supply Emitter Bias- Other Types of Bias - PNP transistor.

UNIT-III: VOLTAGE AMPLIFIERS

Base- Biased Amplifier- Emitter- Biased Amplifier- small- Signal Operation- AC Beta- AC Resistance of the Emitter Diode- Two transistor Models- Analysing an Amplifier- Voltage gain – The Loading Effect of Input Impedance- Multistage Amplifier- Swamped Amplifier.

UNIT-IV: POWER AMPLIFIERS

CC Amplifier - Output impedance - Darlington connections - amplifier terms – two load lines – Class A operation – Class B operation – Class B push-pull Emitter Follower.

UNIT-V: JFETS AND MOSFETS

JFETS- Basic ideas -Drain curves-The transconductance curve-Biasing in the Ohmic region- Biasing in the active region - Transconductance-JFET amplifiers- The JFET analog switch- MOSFETS-The depletion mode MOSFET- D-MOSFET curves – The enhancement - mode MOSFET - The ohmic region.

3.5.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion.

3.5.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations.

3.5.5. Suggestive readings:

1. Halliday, Resnick and Krane (2010), *Physics*, (5th ed.), Volume II, Singapore: John Wiley & Sons
2. Tewari K.K (2013), *Electricity and Magnetism*, (revised ed.), New Delhi, S. Chand & Company Ltd.
3. Arthur F. Kip (1969), *Fundamentals of Electricity and Magnetism*, Second edition, USA, McGraw-Hill Inc

3.6 MODERN PHYSICS

Credit: 4

Semester: S-3

3.6.1. About the course:

This course is intended to review different branches of physics. It gives an insight of Physics through various aspects

3.6.2. Learning outcomes:

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

- identify the properties of light and appreciate the wonders of it in nature
- interpret the behaviour of matter in electric and magnetic field
- acquire knowledge of crystal structures and the basic function of logic gates.

UNIT I: LIGHT

Nature of Light – sources of light – the speed of light – waves, wave fronts, and rays – reflection and refraction – total internal reflection – dispersion – polarization – polarizing filters – using polarizing filters – polarization by reflection – circular and elliptical polarization.

UNIT II: ELECTRICITY AND MAGNETISM

Electric Charge – conductors, insulators and induced charges – Coulomb's law – electric field and electric forces – electric field lines – Gauss's law – applications of Gauss's law – magnetism – magnetic field – magnetic field line and magnetic flux – motion of charged particles in magnetic field – applications of motion of charged particles. DEMONSTRATIONS: Magnetic field line of a bar magnet and horseshoe magnet.

UNIT III: MATERIAL SCIENCE

Fundamental definitions in crystallography – nomenclature of crystal directions – nomenclature of crystal planes: Miller indices – symmetry elements of a crystalline solid – crystal structures of important engineering materials. DEMONSTRATIONS: Models of crystal structures.

UNIT IV: NUCLEAR PHYSICS

Properties of nuclei – nuclear density – nuclides and isotopes – nuclear binding and nuclear structure – nuclear force – natural radioactivity – activities and half-lives – biological effects of radiation.

UNIT V: DIGITAL ELECTRONICS

Gates – inverters – OR gates – AND gates – Boolean algebra – NOR gates – NAND gates – De Morgan's first theorem – De Morgan's second theorem – Exclusive OR gates – the controlled inverters – Exclusive NOR gates – Boolean relations – sum of products method – algebraic simplification – Karnaugh maps – pairs, quads and octets – Karnaugh simplification – Don't care conditions. DEMONSTRATIONS Function of logic gates, De Morgan's theorem.

3.6.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion.

3.6.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations.

3.6.5. Suggestive readings:

1. Koonin, S. E. & Meredith, D. C., "Computational Physics - Fortran Version", Addison-Wesley, 1990. General Methods of computational physics mainly oriented toward quantum mechanics. (The older Basic version covers essentially the same material.)
2. Ziman, J. M. , "Elements of Advanced Quantum Theory"
3. Baym, G., "Lectures on Quantum Mechanics"
4. Mahan, G., "Many-Particle Physics, 2nd Ed."
5. Tinkham, M., "Group Theory and Quantum Mechanics"
6. Ashcroft & Mermin, "Solid State Physics"
7. Kittel, C., "Introduction to Solid State Physics"
8. Kittel, C., "Quantum Theory of Solids"
9. Madelung, O., "Introduction to Solid State Theory"
10. Ziman, J. M., "Principles of the Theory of Solids"
11. Jones & March, "Theoretical Solid State Physics, vol. 1"
12. Callaway, J., "Quantum Theory of the Solid State"
13. Harrison, W., "Solid State Theory" Slater, J., "Quantum Theory of Atoms, Molecules, and Solids", Callaway, J., "Energy Band Theory" Paul Allen Tipler, Ralph Llewellyn · 2003

3.7 PRACTICAL – B

Credit: 4

Semester: S-3

3.7.1. Learning outcomes:

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

- demonstrate the process of converting ac signals to dc using expereys
- design voltage, current and power amplifiers using transistors and JFETS
- understand and relate data and write concise reports with meaningful conclusions

3.7.2. Experiments

1. Study of network circuits with resistors (Thevenizing a circuit / Nortonizing a circuit)
2. Diode / Zener Diode characteristics
3. Clippers /Clampers
4. Full wave rectifier / Bridge rectifier &Filter using ExpEYES
5. Voltage Regulator using Zener Diode & IC 7805
6. Transistor biasing- Base bias & Voltage divider bias
7. Transistor biasing – Emitter feedback / Collector feedback & Emitter collector feedback bias
8. Emitter follower / Source follower
9. CE / CS amplifier
10. Swamped amplifier

3.7.3. Mode of transaction:

Experimentation, Demonstration

3.7.4. Mode of assessment:

In lab- experimentation, Semester examinations

3.7.5. Suggestive readings:

1. Albert P. Malvino & David J. Bates, (2009), Electronic Principles, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
2. Grob. B., (2007). Basic Electronics, (10th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
3. Jacob Millman & Christos C. Halkias, (2006). Electronic Devices and Circuits, New Delhi: Tata McGrawHill Publishing Company Ltd. Print

MAJOR SUBJECT: CHEMISTRY**3.5 INORGANIC CHEMISTRY – I****Credit: 4****Semester: S-3****3.5.1. About the course:**

This course deals with basics of inorganic chemistry, properties and compounds of Boron and Carbon group, properties of Halogens and noble gases and basics of nuclear chemistry.

3.5.2. Learning outcome:

On successful completion of this course learners will be able to:

- Understand periodic trends and chemistry of various elements.
- Students after completing this course may relate chemical properties of various elements with respect to their position in the periodic table.

Course Content:**UNIT I (HYDROGEN AND HYDRIDES, ALKALI AND ALKALINE EARTH METALS)**

Hydrogen and Hydrides: Electronic structure, abundance, preparation and properties, isotopes, ortho- and para hydrogen; Hydrides: ionic, covalent, metallic and intermediate hydrides; Hydrogen bonding. Alkali metals: Introduction, halides, oxides and hydroxides, salts of oxo-acids, aqueous solution chemistry, complexes and organometallic compounds. Alkaline Earth metals: Introduction, halides, oxides and hydroxides, salts of oxoacids, aqueous solution chemistry, complexes and organometallic compounds.

UNIT II (BORON AND CARBON GROUP – BASIC TREATMENT)

Boron group: Introduction, diborane and hydrogen compounds of the other elements, metal borides, halides and complex halides of B, Al, Ga, In and Tl, oxides, oxo-acids, oxo-anions and hydroxides; nitrogen derivatives; Al, Ga, In and Tl salts of oxo-acids and aqueous solution chemistry, organometallic compounds.

UNIT III (CARBON GROUP)

Introduction, Intercalation compounds of graphite, hydrides, carbides and silicides, halides and complex halides; oxides and oxo-acids of carbon; oxides and oxo-acids and hydroxides of Si, Ge, Sn and Pb; Silicates; Silicones; Sulphides; Cyanogen, its derivatives and silicon nitride; aqueous solution chemistry and oxo-acid salts of Sn and Pb; Organometallic compounds.

UNIT IV (HALOGENS AND NOBLE GASES- BASIC TREATMENT)

Introduction; hydrogen halides; general considerations of halides; interhalogen compounds and polyhalogeno ions; oxides and oxyfluorides of Cl, Br and I; oxoacids of halogens and their salts; aqueous solution chemistry; organic derivatives. Noble gases: Introduction; compounds of Xe, Kr and Rn; Chemical properties, structure and bonding.

UNIT V (Nuclear Chemistry- Basic treatment)

Introduction; nuclear binding energy; radio-activity and nuclear reactions; nuclear fission and fusion; spectroscopic techniques based on nuclear properties; separation of stable isotopes and unstable isotopes; applications of isotopes.

3.5.3 Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.5.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.5.5. Suggestive Readings:

1. A. G. Sharpe, Inorganic Chemistry, 3rd Edition, Addison-Wesley, 1999.
Further Reading
2. J. D. Lee, A New Concise Inorganic Chemistry, 3rd Edition., ELBS, 1987.
3. D. F. Shriver, P. W. Atkins, C. H. Langford, Inorganic Chemistry, ELBS. 1990
4. G.L.MiesslerandD.A.Tarr,InorganicChemistry,3rdEd.ISBN:9780321811059,PearsonPrenticeHall, 2005
5. J.E.House, InorganicChemistry,ISBN:9780128143698,Elsevier,2008
6. C. E. Housecroft and A. G. Sharpe, Inorganic Chemistry, ISBN: 9780273742753, PrenticeHall,2005.
7. J.E.Huheey,E.A.KeiterandR.L.Keiter,InorganicChemistry:PrinciplesofStructureandReactivity, ISBN-13:9788177581300, HarperCollinCollegePublishers,4thEd.,1993.
8. F.A.CottonandG.Wilkinson,AdvancedInorganicChemistry,ISBN:9789354245701,WileyInterscience, 4th& 5thEd., 1998
9. Neil Winterton, Jeff Leigh Modern Coordination Chemistry, ISBN: 9780854044696, RSC,1960

3.6 PHYSICAL CHEMISTRY – II

Credit: 4

Semester: S-3

3.6.1. About the course:

This course deals with electrodes, cells, electrochemistry, thermal and photochemical process, chemical kinetics of reaction and theory of electrolytes.

3.6.2. Learning outcome:

On successful completion of this course learners will be able to:

- Explain the nature of Electrolytic conduction involving theories of electrolytes.
- Understand the processes that occur at electrodes and in electrolytes and to apply emf method to study different types of reactions.
- Understand the kinetics of chemical reactions.
- Have knowledge about the commercial cells and their applications
- Obtain information about the basic photophysical and photochemical processes.

UNIT I: ELECTROCHEMISTRY – I

Types of reversible electrodes – gas-metal ion, metal-metal ion, metal-metal insoluble salt, Amalgam and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes – standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells – Computation of cell EMF, Calculation of thermodynamic quantities of cell reactions (G, H and K), Chemical cells with and without transport.

UNIT II: ELECTROCHEMISTRY II

Concentration cell with and without transport, liquid junction potential, Definition of pH and pKa determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods, polarization, over potential and hydrogen overvoltage Power storage, Lead Battery, Ni-Cd cells, Fuel Cells, Hydrogen-Oxygen cell. Thermodynamic and Kinetic basis of corrosion, methods of inhibition of corrosion.

UNIT III CHEMICAL KINETICS:

Factors influence a chemical reaction and theories of reaction rates. Chemical kinetics and its scope, rate of reaction. Concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half life and mean life. Arrhenius equation, concept of activation energy, Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

UNIT IV: SURFACE PHENOMENA

Absorption and adsorption (definition, examples and differences), types of adsorptions-physical and chemical (definition, examples and differences between them) properties, factors influencing the adsorption of gases on solids. Adsorption isotherms -definition, Mathematical expression for Freundlich and Langmuir's adsorption isotherms. Applications of adsorptions. Catalysis - Definition, general characteristics, action of catalytic promoters and inhibitors. Homogeneous catalysis (definition and examples), Heterogeneous catalysis (definition and examples) , enzyme catalysis (definition and examples). Mechanism of enzyme catalysed reaction (lock and key mechanism).

UNIT V: PHOTOCHEMISTRY

Discussing the Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry - Grothus– Drapper law, Stark – Einstein law, Jablonski diagram showing various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radioactive processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions–energy transfer processes (simple examples), Chemiluminescence.

3.6.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.6.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.6.5. Suggestive Readings:

1. Photochemistry by Gurudeep, Raj Goel Publishing House, ISBN: 8182835275.
2. Principles of Physical Chemistry by Puri, Sharma, Pathania, 47th Edition Vishal Publishing Co. ISBN: 81-88646-74-1.
3. Elements of Physical Chemistry by Samuel Glasstone and Lewis, ISBN: 978-0333038437. Principles of Physical Chemistry by Marron and Prutton, ISBN: 978-8120417588.

3.7 PRACTICAL – B

Credit: 4

Semester: S-3

3.7.1. About the course:

This course deals with electrochemistry, equilibrium constants, conductometry.

3.7.2. Learning outcome:

On successful completion of this course learners will be able to:

- Determine of phase transition temperature.
- Do electrochemistry experiments.
- Do conductometry experiments.
- Perform ph titration.

1) Identification of well-known organic functional groups - Identification of elements present and functional groups.

2) Determination of phase transition temperature of phenol-water system.

3) Determination of equilibrium constant of $KI + I_2 = KI_3$

4) Phase diagram of two component and three component systems.

5) Electrochemistry experiments.

(i) Determination of electrode potential

(ii) pH titration involving strong/weak acids and strong/weak bases

6. Conductometry titration experiments

Conductivity of weak and strong electrolytes

7) Mini-lab in organic synthesis

(i) Nitration of naphthalene

(ii) Ozazone formation

(iii) Bromination of hydrocarbons

8. Inorganic qualitative analysis: Identifying anions and cations present in the given mixture of inorganic salts. The mixture shall contain an inferring anion.

9. Volumetric analysis involving redox titrations and complexometric titrations.

10. Volumetric analysis involving iodometry.

3.7.3. Suggestive mode of transaction:

Demonstration, experimentation.

3.7.4. Suggestive mode of Assessment:

In lab-experimentation and semester examination.

3.7.5. Suggestive Readings:

1. Vogel's Textbook of Practical Organic Chemistry, Brian S. Furniss, Hannaford, Smith, Tatchael, Pearson India; 5th edition, ISBN: 978-8177589573.

2. Systematic Lab Experiments in Organic Chemistry, Arun Sethi, New Age International (P) Ltd. ISBN: 978-8122428285.

3. C. Arora, S. Bhattacharya, Advanced Physical Chemistry Practical Guide, Bentham Books, ISBN: 978-1681089126.

4. B.O. Aher, A.B. Aher, V.A. Bairagi, P.A. Pathade, J.P. Bapurao, Practical book of physical chemistry, Walnut Publication, ISBN: 9788194208648.

5. V. Venkateswaran, R. Veeraswamy, A.R. Kulandaivelu, Basic principles of practical chemistry, Sultan Chand & Sons, ISBN: 81-8054-776-8.

MAJOR SUBJECT: MATHEMATICS**CORE 05: ORDINARY DIFFERENTIAL EQUATIONS****Credit: 4****Semester: S-3****About the Course:**

An ordinary differential equation (also abbreviated as ODE), in Mathematics, is an equation which consists of one or more functions of one independent variable along with their derivatives. A differential equation is an equation that contains a function with one or more derivatives. Ordinary differential equations (ODE) are a fundamental part of the mathematical vocabulary used to describe natural phenomena. The course emphasizes classical methods for finding exact solution formulas.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories. You will learn to identify whether an ODE can be solved explicitly, or whether it is necessary to solve it numerically.

UNIT I: Exact differential equations – Equations of the First, but of higher degree –Equations solvable for dy/dx , solvable for y , solvable for x , Clairaut's form

UNIT II: Linear Differential equations with constant co-efficients - Lineardifferential equations with variable coefficients.

UNIT III: Method of Variation of parameters – Simultaneous Linear differential equationswith constant coefficients.

UNIT IV: functions – derivatives and integrals of transforms –transforms of step function – and impulse functions – transforms of periodicfunctions.

UNIT V: Inverse Laplace transforms – convolution theorem – initial and final value theorem – solution of linear ODE of second order with constantcoefficients using Laplace transform.

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report.

Suggestive mode of transaction

- Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

- Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials***Prescribed Text(specify sections clearly)***

1. *Calculus III* S.Narayanan and T.K. Manicavachagom Pillay , for Units I,II and III
2. *Engineering Mathematics - II* by Dr. M.B.K. Moorthy for Unit IV and Unit V

Reference Books

1. *Introductory course in Differential equations* , D.A.Murray, Orient Longman (1967)
2. *Advance Engineering Mathematics* , Erwin Kreyzsig, Wiley India Edition (2010)
3. *Engineering Mathematics* , M.K.Venkataraman, National Publications ,Chennai (2009)
4. *Boyce and Di Prima, Differential Equations and Boundary Value Problems*, Wiley, 10th edition 2012

e-Learning Source

<http://ndl.iitkgp.ac.in>

<http://ocw.mit.edu>

<http://mathforum.org>

ABSTRACT ALGEBRA

Credit: 4

Semester: S-3

About the Course:

Abstract algebra is the branch of algebra dealing with the study of algebraic systems or structures with one or more mathematical operations associated with elements with an identifiable pattern, differing from the usual number systems. The main purpose of abstract algebra is analysing a set endowed with one or more operations with special characteristics or properties to learn about the relationships between those properties of the operations in a precise way, as well as the consequences and possible results of their associations.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I: Definition of Group - examples of groups - Some preliminary lemmas -Subgroups.

UNIT II: A counting principle - Normal subgroups and Quotient Groups –Homomorphisms.

UNIT III: Automorphisms - Cayley's theorem - Permutation groups.

UNIT IV: Definition of Ring- examples of a rings - Some special classes of rings -Homomorphisms – Ideals and quotients rings.

UNIT V: More ideals and quotients rings -The field of quotients of an integraldomain.

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction

- Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment.

Suggestive Reading Materials

Prescribed Text(specifysections clearly)

I.N. Herstein, Topics in Algebra (Second Edition), John Wiley & Sons (2003) Unit I : Sections 2.1 to 2.4

Unit II : Sections 2.5 to 2.7(except applications 1 & 2 of 2.7)

Unit III: Sections 2.8 to 2.10

Unit IV: Sections 3.1 to 3.3 Unit V : Sections 3.4,3.6

ReferenceBooks

1. *A First course in Algebra* by J. B. Fraleigh, Addison Wesley.
2. *Modern Algebra* by M.L. Santiago, (TMG)
3. *Abstract Algebra*(3rd Edition), I.N.Herstein, John Wiley, 1996.

e-LearningSource

<http://ndl.iitkgp.ac.in>

<http://ocw.mit.edu>

<http://mathforum.org>

CORE 7: NUMERICAL METHODS**Credit: 4****Semester: S-3****About the Course**

Numerical methods are techniques that are used to approximate Mathematical procedures. It contains solution of system of linear equations, roots of non-linear equations, interpolation, numerical differentiation, and integration. It plays an important role for solving various engineering sciences problems. Therefore, it has tremendous applications in diverse fields in engineering sciences.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I: Numerical solution of algebraic and transcendental equations – Bolzano's bisection method - Successive approximation method – Regula falsi method – Newton-Raphson method.

UNIT II: Numerical solution of simultaneous linear algebraic equations – Gauss elimination method - Gauss Jordan elimination method – Gauss Seidel iteration method.

UNIT III: Finite difference operator - Interpolation – Newton-Gregory forward and backward interpolation – Newton's divided difference formula – Lagrange's interpolation formula for uneven intervals – Gauss interpolation formula – Numerical differentiation – Numerical Integration – Trapezoidal rule – Simpson's $1/3^{\text{rd}}$ rule.

UNIT IV: Numerical solutions of Ordinary differential equations of first and second order – Simultaneous equations – Taylor series method – Picard's method.

UNIT V: Euler's method – Improved Euler's Method - Modified Euler's Method – Runge-Kutta method of second and fourth order – Milne's predictor corrector method.

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related.
- Case studies of the children in different areas of interest of the above title / content and submit the report.

Suggestive mode of transaction

- Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials**Prescribed Text(specify sections clearly)**

Numerical Method in Science and Engineering, M.K.Venkataraman, National Publication Co, Chennai(2001)

Unit 1: Chapter 3 and 4

Unit 2: Chapter 5

Unit 3: Chapter 6 and 9

Unit 4: Chapter 11 (Relevant portions) Unit 5: Chapter 11 (Relevant portions)

Reference Books

Computer oriented Numerical Methods by V. Rajaram – PHI(P) Ltd.

e-Learning Source

<http://ndl.iitkgp.ac.in>

<http://ocw.mit.edu>

<http://mathforum.org>

4.4.1 Basics of Pedagogy at Secondary Stage

Credit: 4
Semester: S-3

4.4.1.1 About the Course

This course deals with diverse range of topics of basics of pedagogy at secondary stage that will equip student teachers with valuable knowledge, capacities and competencies. This course comprises four units and a practicum. This course prepares student teachers to understand secondary-stage learners and design teaching accordingly. This course also aims to equip teachers with the necessary tools, knowledge, and competencies to continuously evolve as professionals and create a positive and transformative impact on their students and society as a whole. In this course a strong foundation will be established by exploring the fundamental principles and concepts that support basics of pedagogy in the light aims and objectives of the curriculum. This course emphasizes understanding learners and their backgrounds comprehensively so that an engaging and supportive learning environment, that fosters a need for learning, can be created for facilitating learner's holistic development. This course is designed to equip student teachers with a wide array of teaching learning strategies. It also focuses on innovative and transformative approaches to education, aiming to create lifelong learners equipped to thrive in an ever-changing world. Through professional development opportunities, student teachers will be better prepared to meet the ever-changing demands of the educational landscape and inspire the next generation of learners.

4.4.1.2 Learning Outcomes

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

- build comprehensive understanding of secondary stage learners,
- assess the physical, mental, social, and emotional growth of secondary stage learners,
- develop skills to observe and recognize the unique capabilities and strengths of secondary stage learner,
- discuss the necessary knowledge and skills to implement effective teaching and learning strategies,
- create enriching and inclusive learning environments to foster values-based education,
- develop a deeper understanding of various pedagogical approaches and their impact on learners,
- determine the knowledge to make informed decisions about instructional practices,
- explain the crucial role of pedagogy in facilitating effective learning experiences for students,
- outline knowledge and skills necessary for continuous professional development.

UNIT - I

Understanding Secondary Stage Learners

- A. Understanding the learners and learner background
 - i. The physical, mental, social, and emotional growth of learners
 - ii. Thought processes and cognitive skills of learners.
 - iii. Psychological and social orientations of learners
 - iv. Social and academic lives of learners
 - v. Conflicts and challenges of secondary learners
 - vi. Characteristics of secondary stage learners
- B. Observing the unique capabilities of a child

UNIT - II**Strategies of Teaching and Learning**

- A. Understanding teaching and learning strategies:
 - i. Concept, characteristics and functions of teaching
 - ii. Making abstract concepts enjoyable by relating them to real-life situations,
 - iii. Promoting multidisciplinary learning through integration of different disciplines
 - iv. Promoting learner participation and engagement in learning
 - v. Building values through art integrated activities, community engagement etc.
 - vi. Promoting multidisciplinary learning through integration of different disciplines
 - vii. Promoting health and social sensitivities
 - viii. Developing respect toward cultural heritage
 - ix. Making classrooms inclusive and joyful learning spaces
- B. Relationship between Aims and Values of Education, Curriculum and Pedagogy

UNIT - III**Pedagogical Approaches**

- A. Pedagogical approaches: constructivist approach; collaborative approach; reflective approach; integrative approach, inquiry- based approach; other contemporary approaches, art-integrated learning, sports- integrated learning.
- B. Types of pedagogy: social pedagogy; critical pedagogy; culturally responsive pedagogy; Socratic pedagogy in inclusive setup.
- C. Role of pedagogy in effective learning: how does pedagogy impact the learner?

UNIT - IV**Continuous Professional Development of Teacher**

- A. Meaning and need, professional and ethical competencies and need for updating content and pedagogical competencies to develop their professional competencies.
- B. Professional development activities: seminars, conferences, orientation programmes, workshops, online and offline courses, competitions, publications, development of teaching portfolio, capacity building programmes, and teacher exchange programmes.
- C. Development of professional competencies to deal with gender issues, equity and inclusion, ethical issues, environmental issues, human health and well-being, population, human rights, and various issues (emotional, mental, physical issues related to pandemic (for example covid-19).

4.4.1.3 Suggestive Practicum (Any Three)

1. Analyze NEP 2020 with reference to pedagogical aspects of the concerned subject.
2. Analyze and reflect on the qualities of an 'Innovative Teacher' in Context of National Professional Standards for Teachers (NPST) and National Mentoring Mission (NMM).
3. Explore different platforms such as National Teacher's Portal, NISHTHA, DIKSHA, and SWAYAM for an online course and prepare a report.
4. Participate in a workshop or seminar to explore the concept of Continuous Professional Development (CPD), its significance in lifelong learning and prepare a write up on the findings.
5. Develop teaching learning strategies to address the needs of diverse learners in context of gender, equity and inclusion and prepare a PowerPoint presentation.

6. Raise awareness on the ethical and social challenges in education through field trip and create an e-portfolio.
7. Any other project assigned by HEI.

4.4.1.4 Suggestive Mode of Transaction

Lecture cum discussion, project-based method, problem solving method, experiential learning, art integrated learning, sports integrated learning, ICT integrated learning, interactive methods such as group discussions, peer tutoring, workshops, observations, and presentations.

4.4.1.5 Suggestive Mode of Assessment

Portfolio creation, written tests, classroom presentations, seminars, assignments, practicum, sessional, terminal semester examinations (As per UGC norms).

4.4.1.6 Suggestive Reading Materials

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India (English and Hindi)
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.
- National Policy on Education 1968, 1986 and 2020.

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

SEMESTER-IV

SEMESTER-IV**Contents**

Course Code	Curricular Component	Name of the Course	Credits	Total	Page No.
FE03	Foundations of Education	Philosophical & Sociological perspectives of Education - I	4	4	107-109
PHY208	Physics	Magnetism and Electro Dynamics	4	12	110-111
PHY209		Solid State Physics	4		112-112
PHY210		Chemistry Theory Chemistry Practical - II	3+1		114-116
CHE208	Chemistry	Organic Chemistry – I (Functionalizing Hydro Carbons)	4		117-119
CHE209		Introduction to Quantum Chemistry & Molecular Symmetry	4		119-120
CHE210		Physics Theory Physics Practical – II	3+1		121-123
MATH208	Mathematics	Vector Calculus	4		124-125
MATH209		Linear Algebra	4		126-126
MATH210		Mathematical Statistics - II	4		127-128
PEDP219	Stage – specific content - cum - Pedagogy	Content cum pedagogy of Physical Sciences at Secondary stage – Course - I (Physics)	4	4	131-132
PEDC219		Content cum pedagogy of Physical Sciences at Secondary stage – Course - I (Chemistry)	4		
PEDM219		Content cum pedagogy of Mathematics at Secondary stage – Course - I (Mathematics)	4		129-130
Total Credits (For Each Discipline)				20	

2.2 Philosophical & Sociological Perspectives of Education – I

Credit: 4
Semester: S-4

2.3.1 About the Course

The course aims at enabling student teachers to explore educational philosophy, including the concept, nature and scope; the aims of educational philosophy; relationship between philosophy and education; Indian philosophical traditions and their implications for education; some of the key philosophical schools of thought such as idealism, naturalism, pragmatism, progressivism and existentialism and their implication for educational practices. The course also would provide an analysis of the Western schools of philosophy and their approaches etc.

2.3.2 Learning Outcomes

- To encourage students to explore the nature of knowledge, the nature of human beings, the nature of society and its aims and the educational implications of these understandings.
- To engage the prospective teachers to read and acquaint themselves with the meaning of terms like Vidya, Avidya, Shiksha, Education etc. and to facilitate them to understand and differentiate them through reflections on these terms on the basis of ancient Indian texts.
- To facilitate prospective teachers to engage themselves in peer groups for sharing of their real-life reflective experiences regarding socio-cultural and philosophical living and facilitate them to conceptualize the meaning of terms like philosophical, social and cultural traditions in Indian educational context.
- To orient and engage prospective teachers to read, observe and understand the vision of some great Indian and global educators and categorically reflect on vision/aim, process of education and the contemporary relevance.

UNIT - I

Education and Philosophy

- Conceptual clarity, nature and relationships.
- Aims of studying philosophical perspective of education.
- Branches of Philosophy and their educational implications: Metaphysics (तत्त्वि मीमाणांसा), Epistemology (ज्ञानमीमाणांसा), Axiology (मूल्यमीमाणांसा)
- Understanding Indian Perspective of Education
 - Meaning, nature and aims of education with special reference to Vedic, Buddhist, Jain, Sikh and Islamic traditions.
 - Understanding the terms Darshana, Para and Apra Vidya, Avidya, Shiksha, Samvaad, Panchkosha, Gurukulam, Acharya, Guru, Shishya, Upadhyaya, Jigyasa, Swadhyaya.
- Understanding Western Perspective of Education
 - Meaning, Nature and aims of education with reference to Cognitive, Behaviorist and Developmental theories of Education.

UNIT - II**Philosophical Schools and Education**

A. Conceptual Clarity of the following schools of thoughts with their implications for educational practices:

- **Bharatiya:** Samakhya, Yoga, Nyaya, Vaisheshika, Mimansa, Vedanta
- **Western:** Idealism, Naturalism, Pragmatism, Progressivism.

UNIT - III**Educational Thinkers**

A. Deliberations on aims, process and educational institutions developed on thoughts of following thinkers and practitioners:

- **Bharatiya:** Swami Vivekananda, Sri Aurobindo Ghosh, Gurudev Rabindra Nath Tagore, J. Krishnamurti, Mahamana Madan Mohan Malaviya, Mahatma Gandhi, Gijubhai Badheka.
- **Western:** J. Rousse, Maria Montessori, Friedrich Froebel, John Dewey.

UNIT - IV**Value Education**

- A. Conceptual Clarity, Significance and Types of Values.
- B. Indian Traditional Values.
- C. Guru-Shishya-Parampara and Educational Values.
- D. Convocation message in Taittiriya Upanishad.
- E. Values enshrined in Indian Constitution.
- F. NEP, 2020 and Values with special reference to 21st Century.
- G. Pedagogical Issues.

2.3.3 Suggestive Practicum

1. Individual/group assignments/tasks in various forms like writing small paragraphs/brief notes, conceptualizations on specific terms etc.
2. Institutional visits in small groups in coordination to institutions related to different thinker/s and preparation of a report followed by individual/group presentation.
3. Sharing of student experiences (in groups) related to readings on great thinkers help them to reshape their concept and enable them to develop vision, mission and objectives for a school and their plan to accomplish the objectives in form of a group report.
4. Identification and reporting of Indian perspective related to educational aims, student-teacher characteristics, methods, evaluation procedure, convocation etc. based on critical study of life and thoughts of thinkers.

2.3.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Organized lectures using variety of media.
- Small group discussion, panel interactions, small theme based seminars, group discussions, cooperative teaching and team teaching, engagement of in reading of primary or secondary sources of literature (Original texts, reference books etc.) related to different aspects of life and education of Great Educators, case studies, short term project work etc.
- Critically examining their experiences to carve out their world and life view and further analyze them from philosophical point of view to reshape their perspective. They will engage prospective teachers in the development of comparative educational

charts related to vision, aims, process, institution etc. They will also lead to reading- based interactions and critical reflections related to process and significance of entry/admission rituals, convocation system etc.

2.3.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.3.6 Suggestive Reading Materials

Teachers may suggest books/readings as per the need of the learners and learning content

MAJOR SUBJECT: PHYSICS**3.8 MAGNETISM AND ELECTRODYNAMICS****Credit: 4****Semester: S-4****3.8.1. About the course**

The course on electromagnetic theory is framed, to understand the fundamental theories that explain electrostatics and magnetostatics. The students can illustrate the application of electrostatics in macroscopic media and couple the electrostatics and magnetostatics phenomena and explain the elementary ideas of electromagnetic theory. They can extend the electrodynamics principle for explaining the electromagnetic optical wave propagation

3.8.2. Learning outcomes:

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

- explain the basics of electrostatics and magnetism • interpret the dielectric behaviour of matter in an electric field
- apply vector analysis to electricity
- calculate forces, fields and potentials related to physical situations

UNIT I: ELECTRIC CHARGE AND FIELD

Electric charge – Coulomb’s law – continuous charge distributions – the electric field – electric field of point charges – electric field of continuous charge distributions – electric field lines – a point charge in an electric field – a dipole in an electric field – Nuclear model of the atom.

UNIT II: GAUSS’ LAW

The flux of a vector field – the flux of the electric field – Gauss’ law – applications of Gauss law – Gauss’ law and conductors – experimental tests of Gauss’ law and Coulomb’s law.

UNIT III: ELECTRIC POTENTIAL

Potential energy – electric potential energy – electric potential – calculating the potential from the field – potential due to point charge – electric potential of continuous charge distribution – calculating the field from the potential – equipotential surfaces – the potential of a charged conductor – the electrostatic accelerator.

UNIT IV: THE MAGNETIC FIELD AND INDUCTANCE

Magnetic force on a moving charge – circulating charges – the Hall effect – magnetic force on a current carrying wire – torque on a current loop – inductor – self-inductance – calculation of self-inductance in solenoid, two parallel wires, two coaxial cylinders and toroidal coil.

UNIT V: ELECTRICAL PROPERTIES AND CAPACITANCE

A conductor in an electric field: dynamic conditions – ohmic materials – ohms law – Insulator in an electric field - capacitors – capacitance – calculating the capacitance – capacitors in series and parallel – energy storage in an electric field – capacitor with dielectric.

3.8.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.8.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.8.5. Suggestive readings:

1. David Halliday, Robert Resnick and Kenneth S.Krane, *Physics*, 5th Edition, 2, Singapore: John Wiley & Sons, 2002, Chapters: 33.1-33.5, 34.1-34.6, 35, 36, 37.1-37.5, 38.1-38.6.
2. Arthur Kip, *Fundamentals of Electricity and Magnetism*, Second Edition, USA: McGraw Hill Inc, 1969. Print.
3. David J.Griffths, *Introduction to Electrodynamics*, Second edition, New Delhi: Prentice Hall of India Private Limited, 1997. Print.
4. Paul Lorrain and Dale Corson, *Electromagnetic Field and Waves*, Second Edition, Delhi: CBS Publishers and Distributors, 1986. Print.

3.9 SOLID STATE PHYSICS

Credit: 4

Semester: S-4

3.9.1. About the course:

The aim of this course is to provide an extended knowledge of the principles and techniques of solid-state physics. The course covers the physical understanding of matter from an atomic view point. Topics covered include the structure, thermal, electrical, magnetic and superconductivity properties of matter. The course has a theoretical lecture component and makes extensive use of examples and exercises to demonstrate the material properties.

3.9.2. Learning outcomes:

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

- acquire a clear understanding of crystal structures
- know about magnetic properties of materials and defects
- understand the occurrence of superconductivity
- develop problem solving skills

UNIT-I: CRYSTAL STRUCTURES AND INTERATOMIC FORCES

The crystalline state-basic definitions - the fourteen Bravais lattices - elements of symmetry-nomenclature of crystal directions and crystal planes; Miller indices-examples of simple crystal structures-amorphous solids and liquids - interatomic forces -types of bonding.

UNIT-II: X-RAY, NEUTRON, AND ELECTRON DIFFRACTION IN CRYSTALS

Generation and absorption of X-rays - Bragg's law-scattering from an atom - scattering from a crystal-the reciprocal lattice and X-ray diffraction - the diffraction condition and Bragg's law - scattering from liquids-experimental techniques-other X-ray applications in solid-state physics-neutron diffraction - electron diffraction.

UNIT-III: SEMICONDUCTORS AND DEFECTS IN SOLIDS

Crystal structure and bonding-band structure -electrical conductivity, mobility -types of imperfection-vacancies diffusion- dislocation and the mechanical strength of metals.

UNIT-IV: MAGNETISM

Basic formulas: magnetic dipole moment, torque on the dipole- gyromagnetic ratio- Larmor frequency- magnetic susceptibility - classification of materials - Langevin diamagnetism – para magnetism – anti ferromagnetism and ferrimagnetism – soft and hard materials - Curie-Weiss law - ferromagnetic domains.

UNIT-V: SUPERCONDUCTIVITY

Zero resistance-perfect diamagnetism, the Meissner effect-the critical field-theory of superconductivity: BCS theory – Type I and Type II superconductors- tunnelling and the Josephson effect.

3.9.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.9.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.9.5. Suggestive readings:

1. **C. Kittel**, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi, 2006.
2. **N. W. Ashcroft and N. D. Mermin**, Solid State Physics, Harcourt College Publishers, Philadelphia, 1976.
3. **J. S. Blakemore**, Solid State Physics, Second Edition, Cambridge University Press, Cambridge, London, 1985.
4. **A. J. Dekker**, Solid State Physics, Published by Macmillan India (2000).
5. **T. P. Sheahen**, Introduction to High-Temperature Superconductors, Plenum press, New York, 1994.
7. **S. O. Pillai**, Solid State Physics, Seventh Edition, New Age International, New Delhi, 2014.
8. **J. R. Christman**: Fundamentals of Solid State Physics, John Wiley & Sons, NY, 1988.
10. **J.P. Srivastava**: Elements of Solid State Physics, Prentice-Hall of India, 2006 Ashcroft & Mermin, "Solid State Physics"

3.2 MINOR – CHEMISTRY THEORY

Credit: 3

Semester: S-4

3.2.1. About the course:

This course discusses chemical kinetics, catalysis, spectroscopic techniques and stereo chemistry. It also deals with coordination chemistry and basic concepts of volumetric analysis.

3.2.2. Learning outcomes:

At the end of the course, the students will be able to

- explain reaction rate parameters, enthalpy, Hess's law and Bomb calorimeter.
- describe the theoretical aspects of volumetric analysis.
- apply the concepts of co-ordination chemistry to explain properties and applications of coordination complexes.
- state and analyses the stereochemistry of organic compounds.
- illustrate the principles and applications of UV-Vis, IR, NMR and mass spectroscopy techniques.

UNIT - I: CHEMICAL KINETICS AND THERMOCHEMISTRY

Rate, order & molecularity of a reaction – rate equations – First, second and zero order reactions – half life time of a reaction – effect of temperature on reaction rate – activation energy – Arrhenius equation – enzyme catalysis – Michaelis-Menten hypothesis and its applications
Internal energy changes in chemical reaction – enthalpy of reaction at constant volume and at constant pressure – definitions with an example for enthalpy of combustion, neutralization, dissociation, formation – Hess's law and its applications – Bomb Calorimeter

UNIT – II: CONCEPTS OF VOLUMETRIC ANALYSIS

General principle – types of titrations – requirements for titrimetric analysis – definition & problems on concentration terms: molarity, formality, normality, wt%, ppm, milliequivalence and millimoles – primary and secondary standards, criteria for primary standards – endpoint and equivalence point - theory of indicators – phenolphthalein, diphenylamine, EBT

UNIT - III: CO-ORDINATION CHEMISTRY

Coordination compounds – shapes of d- orbitals – Werner's theory – coordination number – types of ligands – nomenclature – concept of EAN – Paulings theory – CFT – CFSE – crystal field splitting in Octahedral field – spectrochemical series – chelation – application of complexes in qualitative, volumetric and gravimetric analysis

UNIT – IV: STEREOCHEMISTRY

Stereochemistry and stereoisomerism – tetrahedral carbon – optical activity – plane polarized light – polarimeter – specific rotation – chiral centers – enantiomers and optical activity – specification of R and S configurations – diastereomers – meso structures – racemic modification – resolution – Geometrical isomers – E/Z nomenclature.

UNIT – V: BASIC SPECTROSCOPIC TECHNIQUES

UV spectroscopy techniques – Introduction, Principle and Applications to organic compounds & bioinorganic molecules viz., haemoglobin, cytochrome, chlorophyll
IR spectroscopy, NMR spectroscopy and Mass spectrometry techniques – Introduction, Principle and Applications to Organic compounds.

3.2.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.2.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.2.5. Suggestive readings:

1. Resnick, Halliday, Krane, Physics – Volume I, John Wiley and Sons, Fifth Edition (2004).
2. Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill, New Delhi, (2008). 15
3. Resnick, Halliday, Krane, Physics – Volume II, John Wiley and Sons, Fifth Edition (2002).
4. Jenkins & White, Fundamentals of optics, Tata McGraw Hill, New Delhi, Fourth edition, (1976)
5. Jerold Touger, Introductory Physics, Wiley Student Edition, New Delhi, 2006
6. Serway & Faugher, College Physics, Thomson Brooks, Sixth Edition, (2005)

3.2 MINOR - CHEMISTRY PRACTICAL – II

Credit: 1

Semester: S-4

3.2.1. Experiments:

1. Gravimetric analysis
 - a) Estimation of barium ions as barium sulphate.
 - b) Estimation of lead as lead chromate.
 - c) Estimation of aluminum as its 8-hydroxyquinoline complex
 - d) Estimation of Ni as Ni DMG complex.
2. Separation of given organic mixture and analysis.
3. Chromatographic techniques TLC, Paper and Column chromatography.
4. Determination of first order rate constant. – Acid hydrolysis of ester
5. Determination of second order rate constant – Base hydrolysis of ester

3.2.2. Suggestive mode of transaction:

Demonstration, experimentation.

3.2.3. Suggestive mode of assessment:

In lab-experimentation and semester examination.

3.2.4. Suggestive readings:

1. Vogel's Textbook of Practical Organic Chemistry, Brian S. Furniss, Hannaford, Smith, Tatchael, Pearson India; 5th edition, ISBN: 978-8177589573.
2. Systematic Lab Experiments in Organic Chemistry, Arun Sethi, New Age International (P) Ltd. ISBN: 978-8122428285.
3. C. Arora, S. Bhattacharya, Advanced Physical Chemistry Practical Guide, Bentham Books, ISBN: 978-1681089126.
4. B. O. Aher, A. B. Aher, V. A. Bairagi, P. A. Pathade, J. P. Bapurao, Practical book of physical chemistry, Walnut Publication, ISBN: 9788194208648.
5. V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Basic principles of practical chemistry, Sultan Chand & Sons, ISBN: 81-8054-776-8.

MAJOR SUBJECT: CHEMISTRY
3.8 ORGANIC CHEMISTRY – I
(FUNCTIONALIZING HYDROCARBONS)

Credit: 4

Semester: S-4

3.8.1. About the course:

This course deals with basics of organic chemistry, hydrocarbons, functionalization of hydrocarbons, stereochemistry, isomers and aromatic systems.

3.8.2. Learning outcome:

On successful completion of this course learners will be able to:

- The diversity and complexity of binary compound of carbon with hydrogen.
- The effect of structural features on physical and chemical properties.
- The structure and functionalization of hydrocarbons.

UNIT I: INTRODUCTION TO ORGANIC CHEMISTRY

Structure and bonding – types of bonding and shapes of molecules - hybridization, oxidation number, formal charges, resonance; intermolecular forces, introduction to functional groups. Nomenclature of organic compounds.

UNIT II: INTRODUCTORY STEREOCHEMISTRY

Types of isomers – constitutional isomers and stereoisomers; configurational isomers, conformational isomers – ethane, butane, cyclohexane; symmetry elements, chirality -compounds with one and two stereogenic centers, optical activity; configurational nomenclature (R/S), representation of stereoisomers – Fischer projection, sawhorse, Newman projection formulae, achiral diastereomers.

UNIT III: FUNCTIONALIZATION OF ALKANES

Free radical halogenation and other oxidations. Introduction to C–H activation/ functionalization.

UNIT IV: FUNCTIONALIZATION OF ALKENES, DIENES AND ALKYNES

All addition reactions

UNIT V: CHEMISTRY OF AROMATIC HYDROCARBONS

Aromaticity, Huckel rule, inductive and mesomeric effect, structure and reactions of benzene, Activity and orientation of substituted benzenes. Introduction to other aromatic systems.

3.8.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.8.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.8.5. Suggestive Readings:

1. Organic Chemistry, P. Y. Bruice, Pearson Education, 7ed, 2013

2. Organic Chemistry as Second Language, David R Klein, 2004, John Wiley and Sons, USA.
3. Arrow Pushing in Organic Chemistry, Daniel. E. Levy, 2008, John Wiley and Sons, USA
4. Organic Chemistry, W. H. Brown, C. S. Foote, B. L. Iverson and E. V. Anslyn, Brooks/Cole Cengage Learning, 6ed,

3.9 INTRODUCTION TO QUANTUM CHEMISTRY AND MOLECULAR SYMMETRY**Credit: 4****Semester: S-4****3.9.1. About the course:**

This course deals with blackbody radiation, classical wave equation and general principles in quantum mechanics.

3.9.2. Learning outcome:

On successful completion of this course learners will be able to:

- Apply the postulates of quantum mechanics to simple systems of chemical interest, such as the particle-in-a-box, harmonic oscillator, rigid rotor, hydrogenic atoms, hybrid orbitals.
- Students shall be able to visualize atomic orbitals of hydrogenic atoms
- Shall have ability to solve introductory problems in quantum mechanics
- Shall have ability to identify various molecular symmetry elements and their operations and construct group multiplication table and character table.

UNIT I: BLACKBODY RADIATION -photoelectric effect - Hydrogen emission and Rydberg formula - Louis de Broglie postulate - Bohr theory – Heisenberg Uncertainty.

UNIT II: CLASSICAL WAVE EQUATION - oscillating string - superposition of normal modes - vibrating membrane - Schrodinger equation and particle in a box – Eigen values - quantized energy values and quantum number – uncertainty principle -probabilistic interpretation of wave function - free particles – particle in rectangular well – tunnelling.

UNIT III: POSTULATES AND GENERAL PRINCIPLES IN QUANTUM MECHANICS - properties of operators, Eigen functions, Eigen values, normalization, orthogonality, commuting and non-commuting operators.

UNIT IV: SOLUTION TO HARMONIC OSCILLATOR - solution to rigid rotor - solution to hydrogen atom - quantum numbers - atomic orbitals - Hybrid atomic orbitals - construction and visualization of hybrid atomic orbitals - sp, sp², sp³, dsp², dsp³, d²sp³ - shape and directional behaviour.

UNIT V: SYMMETRY ELEMENTS AND OPERATIONS, point groups, non-degenerate representations.

3.9.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.9.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.9.5. Suggestive Readings:

1. Physical Chemistry, A molecular approach, Donald A McQuarrie and John D Simon, 1998, Viva Books Limited
2. Unit5: Molecular symmetry and Group Theory, A programd introduction to chemical applications, Alan Vincent, 2ed, John Wiley, 2001
3. Quantum Chemistry, Ira N Levine, 7ed, Pearson, 2014
4. Chemical Application of Group Theory, F A Cotton, 3ed, John Wiley, 1990

3.2 MINOR- PHYSICS THEORY

Credit: 3

Semester: S-4

3.2.1. About the course:

The aim of this course is to provide an extended knowledge of the principles and techniques of solid-state physics. The course covers the physical understanding of matter from an atomic view point. Topics covered include the structure, thermal, electrical, magnetic and superconductivity properties of matter. The course has a theoretical lecture component and makes extensive use of examples and exercises to demonstrate the material properties.

3.2.2. Learning outcomes:

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

- acquire a clear understanding of crystal structures
- know about magnetic properties of materials and defects
- understand the occurrence of superconductivity
- develop problem solving skills

UNIT-I: CRYSTAL STRUCTURES AND INTERATOMIC FORCES

The crystalline state-basic definitions - the fourteen Bravais lattices - elements of symmetry-nomenclature of crystal directions and crystal planes; Miller indices-examples of simple crystal structures-amorphous solids and liquids - interatomic forces -types of bonding.

UNIT-II: X-RAY, NEUTRON, AND ELECTRON DIFFRACTION IN CRYSTALS

Generation and absorption of X-rays - Bragg's law-scattering from an atom - scattering from a crystal-the reciprocal lattice and X-ray diffraction - the diffraction condition and Bragg's law - scattering from liquids-experimental techniques-other X-ray applications in solid-state physics-neutron diffraction - electron diffraction.

UNIT-III: SEMICONDUCTORS AND DEFECTS IN SOLIDS

Crystal structure and bonding-band structure -electrical conductivity, mobility -types of imperfection-vacancies diffusion- dislocation and the mechanical strength of metals.

UNIT-IV: MAGNETISM

Basic formulas: magnetic dipole moment, torque on the dipole- gyromagnetic ratio- Larmor frequency- magnetic susceptibility - classification of materials - Langevin diamagnetism – para magnetism – anti ferromagnetism and ferrimagnetism – soft and hard materials - Curie-Weiss law - ferromagnetic domains.

3.2.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion.

3.2.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations.

3.2.5. Suggestive readings:

1. **C. Kittel**, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi, 2006.
2. **N. W. Ashcroft and N. D. Mermin**, Solid State Physics, Harcourt College Publishers, Philadelphia, 1976.
3. **J. S. Blakemore**, Solid State Physics, Second Edition, Cambridge University Press, Cambridge, London, 1985.
4. **A. J. Dekker**, Solid State Physics, Published by Macmillan India (2000).
5. **T. P. Sheahen**, Introduction to High-Temperature Superconductors, Plenum press, New York, 1994.
7. **S. O. Pillai**, Solid State Physics, Seventh Edition, New Age International, New Delhi, 2014.
8. **J. R. Christman**: Fundamentals of Solid State Physics, John Wiley & Sons, NY, 1988.
10. **J.P. Srivastava**: Elements of Solid State Physics, Prentice-Hall of India, 2006 Ashcroft & Mermin, "Solid State Physics"

3.2 MINOR PHYSICS PRACTICAL-II

Credit: 1

Semester: S-4

3.2.1. Learning outcomes:

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

- demonstrate the process of converting ac signals to dc using expeyes
- design voltage, current and power amplifiers using transistors and JFETS
- understand and relate data and write concise reports with meaningful conclusions

3.2.2. Experiments

1. Study of network circuits with resistors (Thevenizing a circuit / Nortonizing a circuit)
2. Diode / Zener Diode characteristics
3. Clippers /Clampers
4. Full wave rectifier / Bridge rectifier & Filter using ExpEYES
5. Voltage Regulator using Zener Diode & IC 7805

3.2.3. Mode of transaction:

Experimentation, Demonstration

3.2.4. Mode of assessment:

In lab- experimentation, Semester examinations

3.2.5. Suggestive readings:

4. Albert P. Malvino & David J. Bates, (2009), Electronic Principles, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
5. Grob. B., (2007). Basic Electronics, (10th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
6. Jacob Millman & Christos C. Halkias, (2006). Electronic Devices and Circuits, New Delhi: Tata McGrawHill Publishing Company Ltd. Print

MAJOR SUBJECT: MATHEMATICS**CORE 08: VECTOR CALCULUS****Credit: 4****Semester: S-4****About the Course**

vector Calculus, also known as vector analysis, deals with the differentiation and integration of vector field, especially in the three-dimensional Euclidean space. Vector fields represent the distribution of a vector to each point in the subset of space. Vector calculus plays an important role in differential geometry and in the study of partial differential equations.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I: Gradient of a scalar function –properties – directional derivatives – Divergence of a vector function – Curl of a vector function –related problems

UNIT II: Vector identities – Line integrals – related problems

UNIT III: Surface integrals – Volume integrals

UNIT IV: Green's theorem – Stokes's theorem – Verification of theorems

UNIT V: Gauss divergence theorem – Verification of theorem

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report.

Suggestive mode of transaction

- Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment.

Suggestive Reading Materials**Prescribed Text:**

1. Vector Analysis- P.Duraipandian, Laxmi Duraipandian, EmeraldPublishers pvt. Ltd. 1990

ReferenceBooks

1. Engineering Mathematics – II by Dr.M.B.K.Moorthy
2. Vector Analysis, Murray R. Spiegel, Seymour Lipschutz and DennisSpellman, 2nd Edition, Schaum's outline, McGraw Hill 2009.

e-LearningSource

<http://ndl.iitkgp.ac.in>

CORE 9: LINEAR ALGEBRA**Credit: 4****Semester: S-4****About the Course**

Linear algebra is the branch of mathematics concerning linear equations such as: vector space, dual spaces, matrices.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I	Vector spaces - Elementary Concepts - subspaces
UNIT II	Linear independence - Bases - Dual spaces
UNIT III	Inner product spaces
UNIT IV	Algebra of Linear transformations - Characteristic roots.
UNIT V	Matrices: Canonical forms - triangular forms

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction • Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

Prescribed Text	Topics in Algebra – I.N Herstein, Wiley Eastern Limited
	Chapter -4: Sections 4.1 – 4.4
	Chapter -5; Sections 6.1—6.4

Ancillary- 2: MATHEMATICAL STATISTICS- II**Credit: 5****Semester: S-4****About the Course**

This course is an extension of part-I of Mathematical Statistics, Mathematical statistics is the application of Statistics using t test, chi square test ,correlation methods, sampling techniques and testing of hypothesis.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I	Correlation – Properties - Rank Correlation – Bivariate correlation
UNIT II	Regression – Properties – Regression equations
UNIT III	Sampling – Types of sampling – Parameter and statistics – Test of significance – Null hypothesis – Alternate hypothesis – Procedures in testing of hypothesis – errors in sampling critical region – level of significance
UNIT IV	Test of significance of large sampling – Test of significance of single mean – Test of significance of difference between two means – test of significance of proportion – test of significance of difference between two proportions – test of significance of difference between two standard deviations
UNIT V	Chi square test (definition) – chi square test for test of goodness of fit – independence of attributes – student’s t – distribution (definition) – t-test for single mean – t- test for difference between two means – t–test for dependent sample – t-test for co-efficient of correlation

Suggestive Practicum

- Solve / workout any one Chapter’s Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction • Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment.

Suggestive Reading Materials

Prescribed Text (specify sections clearly) *Fundamentals of Mathematical Statistics by S.C.Gupta, V.K.Kapoor, Sultan Chand and Sons, 11th edition*
 Unit I : 10.1 to 10.6
 Unit II : 10.7
 Unit III : 12.1 to 12.7
 Unit IV : 12.8 – 12.15
 Unit V : 13.1, 13.7, 14.1, 14.2

Reference Books

1. *Statistical methods by S.P.Gupta – Sultan Chand.*
2. *Statistics(Theory and Practice) by R.S.N.Pillai& V. Bagavathy - S.Chand& Co.*
3. *Robert V. Hogg and Allen T. Craig , Introduction to Mathematical Statistics (Fifth Edition) Pearson Education, 2005*

e-Learning Source

<http://ndl.iitkgp.ac.in>
<http://ocw.mit.edu>
<http://mathforum.org>

4 Content cum Pedagogy of Mathematics at Secondary Stage - Course (I)

Credit: 2
Semester: S-4

4.4.3.1 About the Course

Mathematics is an important school subject and students are expected to master computational and problem-solving skills with the help of mathematical concepts and reasoning during study. Teaching of Mathematics is not only concerned with the computational know-how of the subject but is also concerned with pedagogical content knowledge and communication leading to its meaningful learning amongst students. This course enables the student-teachers to understand the nature of mathematical knowledge and the mathematics curriculum at secondary stage. The objectives of teaching Mathematics should not be limited to the development of computational skills but to enable mathematical reasoning to solve problems of life. Student teachers will develop skills to formulate classroom objectives as well as plan for development of the values through Mathematics. Student teachers will have a thorough understanding of Mathematics content and their relevant specific pedagogy for the effective learning of Mathematics. They would be exposed to various pedagogical approaches, methods, and techniques so that they will be able to create a learner friendly classroom environment.

4.4.3.2 Learning Outcomes

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

- appraise the contribution of Indian Knowledge Systems in development of Mathematics,
- explain the nature of Mathematics as an important subject for human development,
- interpret the recommendation of the various policy documents in reference to Mathematics education,
- classify the aims and objectives of teaching Mathematics,
- formulate objectives based on learning outcomes for Mathematics teaching,
- select and demonstrate various approaches and methods of teaching Mathematics,
- plan strategies to inculcate values through teaching Mathematics.

UNIT - I**Nature, Scope and Historical Perspective of Mathematics**

- A. Development of Mathematics from a historical perspective.
- B. Nature of Mathematical Knowledge – Axioms and Postulates, Conjectures, Proofs in Mathematics: inductive - deductive reasoning, theorems, mathematical modeling.
- C. Importance of Mathematics knowledge in everyday life.
- D. Recommendations of various committees, commissions and policies related to Mathematics education at Secondary stage (especially in National Education Policies and National Curriculum Frameworks).

UNIT - II**Aims and Objectives of Teaching Mathematics**

- A. Aims and objectives of teaching Mathematics at secondary stage.
- B. Learning outcomes and competencies of teaching Mathematics at secondary stage.
- C. Linkages of Mathematics with other school subjects and place in school curriculum.
- D. Inculcation of values through teaching of Mathematics.

UNIT - III**Pedagogical Aspects of Mathematics**

- A. Implication of various approaches of teaching Mathematics – inductive deductive, analytical synthetical, constructivist, blended learning, experiential learning, transdisciplinary, interdisciplinary, and multidisciplinary.

- B. Learner-centric and participative methods of teaching of Mathematics: lecture cum demonstration, problem-solving, laboratory, project based.
- C. Analytical pedagogical concerns in teaching of Mathematics for higher order thinking skills such as critical, creative, decision making, reflective, collaborative, and cooperative.
- D. Techniques of teaching learning Mathematics: oral, written, drill work, homework, self-study, group study, supervised study, concept-mapping, learning, art and sports integrated learning.

4.4.3.3 Suggestive Practicum (Any Three)

1. Prepare a collage/ biographic sketch on the contribution of Indian mathematician.
2. Present a paper on comparison of nature of mathematical knowledge with other school subjects.
3. Formulate objectives based on learning outcomes and experiential learning for any one unit of secondary Mathematics.
4. Develop strategy to connect any three topics for value inculcation in teaching of Mathematics.
5. Analyze the content of one chapter of Mathematics textbook and develop concept maps at secondary stage.
6. Select and list approaches and methods for teaching various topics of secondary stage Mathematics.
7. Any other project assigned by HEI.

4.4.3.4 Suggestive Mode of Transaction

Demonstration, field-based experience, library visits, classroom discussions, self-study, field observations, assignment preparation, classroom presentations, discussion forums, observation, research report, engaging in dialogue, flipped classroom.

4.4.3.5 Suggestive Mode of Assessment

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

4.4.3.6 Suggestive Reading Material

- MESE 001(2003) Teaching and Learning Mathematics. IGNOU series
- NCERT Publications: Pedagogy of Mathematics (Code-13074)

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

Credit: 2
Semester: S-4

4.4.4.1 About the Course

The focus of the National Education Policy (NEP) 2020 is on the holistic development of students. To achieve the objectives, interventions from quality teachers are vital. Sound pedagogical content knowledge and teaching methods are the determinants of a teacher's quality and professionalism. Teacher education programme strongly emphasizes pedagogy, its principles, and the practices of teaching and learning. Pedagogical knowledge and approaches refer to the specialized knowledge of the teacher for creating an active, child-centered, and inclusive teaching-learning environment for the students and need to be developed among the student teachers. This pedagogical course in Physical Sciences is intended to enhance the pedagogical content knowledge of student teachers through different learning approaches and methods. This course comprises three units and a practicum. The course is devoted to developing an understanding of the nature and scope of Physical Sciences and the aims and objectives of teaching Physical Sciences and its linkages with other disciplines. Historical/policy perspectives of Physical Sciences are discussed in unit second. Physical Sciences is conceptualized in very broad terms by relating it to technology, society, humans, and sustainable development. It also focuses on the place of Physical Sciences in school curriculum including an emphasis on how to build inclusive classrooms. It focuses on pedagogical concerns of Physical Sciences. Critical, creative, and analytical pedagogical concerns in teaching Physical Sciences with special reference to higher-order thinking are also placed in unit third.

4.4.4.2 Learning Outcomes

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

- explain nature, scope and importance of Physical Sciences,
- illustrate aims and objectives of teaching Physical Sciences for sustainable development of society,
- outline linkages between Physical Sciences and other subjects,
- identify the values and importance of Physical Sciences and alternative knowledge systems,
- summarize the historical/policies perspective of Physical Sciences,
- examine pedagogical concerns of Physical Sciences,
- categorize approaches and methods of teaching learning Physical Sciences,
- apply appropriate pedagogy in teaching learning the concepts of Physical Sciences.

UNIT - I

Nature, Scope and Historical Perspective of Physical Sciences

- A. Nature, scope, and importance of Physical Sciences.
- B. Historical perspective of Physical Sciences.
- C. Contributions of Indian (ancient and modern) and other scientists.
- D. Physical Sciences, society and human and sustainable development.
- E. Recommendations/suggestions of various committees, commissions, and policies in reference to Physical Sciences.

UNIT - II

Aims and Objectives of Physical Sciences

- A. Aims and objectives of teaching Physical Sciences.
- B. Learning outcomes and competencies of teaching Physical Sciences at secondary stage.
- C. Linkages of Physical Sciences with other school subjects and place of the Physical Sciences in school curriculum.
- D. Values of Physical Sciences: scientific attitude and appreciating other systems of knowledge / alternative knowledge systems.

UNIT - III

Pedagogical Aspects of Physical Sciences

- A. Implication of various approaches - inductive deductive, constructivist, experiential learning, art integrated learning, sports integrated learning, blended learning, interdisciplinary and multidisciplinary approaches in Physical Sciences.
- B. Analytical pedagogical concerns in teaching of Physical Sciences for higher order thinking skills such as critical, creative, communication, decision making, reflective.
- C. Methods of teaching learning Physical Sciences: learner-centric and group-centric, lecture cum demonstration, activity based, discussion, problem-solving, laboratory, stem and steam, project based, scientific inquiry, hands on activity, discovery, experimentation, concept-mapping, collaborative and cooperative learning.

4.4.4.3 Suggestive Practicum (Any Three)

1. Explore contributions of Indian scientists in the development of Physical Sciences and make presentations on historical development of Physical Sciences.
2. Analyze recommendations of policies/commissions in context of Physical Sciences.
3. Develop concept maps on different concepts of Physical Sciences.
4. Identify and integrate values in Physical Sciences concepts.
5. Demonstrate different pedagogical approaches and strategies for transacting concepts of Physical Sciences.
6. Prepare write-ups on the teaching of science using interdisciplinary and multidisciplinary approaches as recommended in NEP 2020.
7. Any other project assigned by HEI.

4.4.4.4 Suggestive Mode of Transaction

Lecture cum discussion/demonstration, hands-on activities, experiential learning, art and environment integrated learning, sports integrated learning.

4.4.4.5 Suggestive Mode of Assessment

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

4.4.4.6 Suggestive Reading Material

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

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

SEMESTER-V

Semester 5**Contents**

Course Code	Curricular Component	Name of the Course	Credits	Total	Page No.
PHY211	Physics	Electronics	4	12	135-136
PHY212		Quantum Mechanics	4		137-138
PHY213		Electro Magnetic Waves	2		139-140
PHY214		Practical – C	2		141-141
CHE211	Chemistry	InOrganic Chemistry – II	4		142-142
CHE212		Organic Chemistry – II (Functional Group Transformation)	4		143-143
CHE213		Equilibrium Thermodynamics	2		144-144
CHE214		Practical – C	2		145-145
MATH211	Mathematics	Partial Differential Equations	4		146-147
MATH212		Real Analysis – I	4		148-149
MATH213		Complex Analysis – I	4		150-151
PEDP220	Stage – specific content - cum - Pedagogy	Content cum Pedagogy of Physical Sciences at Secondary stage - Course (II) (Physics)	4		4
PEDC220		Content cum Pedagogy of Physical Sciences at Secondary stage - Course (II) (Chemistry)	4		
PEDM220		Content cum Pedagogy of Mathematics at Secondary stage - Course (II) (Mathematics)	4	152-153	
AEV106	Ability Enhancement & Value Added Courses	ICT in Education	2	2	157-159
SE222	School Experience	Pre-Internship Practice (Demonstration Lesson, Peer Teaching)	2	2	160-163
Total Credits				20	

PHYSICS
SEMESTER – V
3.10 ELECTRONICS

Credit: 4

Semester: S-5

About the course:

This course is intended to learn and understand the theory and construction of basic electric circuits. It gives an overall insight of semiconductor devices, operational amplifiers and its applications.

3.10.2. Learning outcomes:

To acquaint the students with the theory, construction and operation of electronic devices.

To introduce the basics of digital communication methods.

To introduce the construction and working of nonlinear electronic circuits.

UNIT 1: SEMICONDUCTOR DEVICES

Metal – Semiconductor contacts (Ohmic and Schottky) - Schottky barrier diode - Zener diode - Varactor diode - Tunnel diode - Characteristics of FET and MOSFET. Light emitting diode (LED)- Laser diode – Photodiode – Phototransistors and Photovoltaic device.

UNIT 2: ANALOG ELECTRONICS

Operational Amplifiers: Introduction - differential amplifiers – Op-Amp Parameters – feedback comparators - mathematical operations – analog simulation circuits – active filters -oscillators –instrumentation amplifier-isolation amplifiers – active diode circuits. OTAs – sample & hold circuits. Voltage regulators: principle and operations.

UNIT 3: APPLICATION OF OPERATIONAL AMPLIFIER

Analog computation (differentiator, integrator, divider, multiplier, Frequency doubling, squarer, comparator, logarithmic amplifier, log and antilog amplifier - Phase - locked Loop (PLL) - solving 2nd order linear and nonlinear differential (Duffing and van der Pol oscillator) equations.

UNIT 4: DIGITAL COMMUNICATION

Basic theory - Pulse amplitude modulation (PAM), Pulse width modulation (PWM), Pulse position modulation (PPM), Pulse code modulation (PCM). Communication schemes: Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), Frequency Shift Keying (FSK) and Differential Phase Shift Keying (DPSK).

UNIT 5: NON-LINEAR CIRCUIT ELEMENTS AND OSCILLATORS

Introduction - Piecewise linear (PWL) circuit elements – Negative Impedance Converter (NIC) - Chua's diode - Memristive Elements (Flux and Charge control) - autonomous and non-autonomous nonlinear circuits - Chua's oscillator - Lorenz oscillator - Duffing's oscillator - MLC oscillator - Memristive oscillators (memristive Chua's oscillator, Diode Bridge-Based Memristive oscillator)

3.10.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.10.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.10.5. Suggestive readings:

1. Govindhan Dhanaraj, Kullaiyah Byrappa, Vishwanath Prasad, Michael Dudley (Eds.), Hand book of Crystal Growth Springer Heidelberg Dordrecht London New York, 2010.
2. J. C. Brice, Crystal Growth Processes, John Wiley and Sons, New York, 1986.
3. P. Santhana Ragavan and P. Ramasamy, Crystal Growth Processes and Methods (KRU Publications, Kumbakonam, 2001.
4. A.C. Zettlemoyer, Nucleation (Edited), Marcel Dekker, Inc. New York, 1969.
5. J.W. Mullin, Crystallization, Elsevier, Butterworth-Heinemann, London, 2004.
6. A.W. Vere, Crystal Growth: Principles and Progress by 1987, Plenum Press, New York.
7. Ichiro Sunagawa, Crystals: Growth, Morphology and Perfection, Cambridge University Press, Cambridge, 2005.
8. B.R. Pamplin, Crystal Growth, Pergamon Press, Oxford. 1975.
9. K. Sangwal, Elementary Crystal Growth (Edited), SAAN Publishers, Lublin, 1994.
10. Introduction to Crystal Growth Principles and Practice H.L. Bhat, CRC Press, Taylor & Francis Group, Boca Raton, Florida, 2015.
11. R. Rodriguez-Clemente and c. Paorici, Crystalline Materials: Growth and Characterization (Etd.), Trans Tech Publications Ltd, Switzerland, 1991.
12. Sam Zhang, Lin Ki, Ashok Kumar, Materials Characterization Techniques, CRC Press, Taylor & Francis Group, Boca Raton, Florida, 2009 Albert P. Malvino & David J. Bates,(2009),*Electronic Principles*, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
13. Grob. B., (2007). *Basic Electronics*, (10th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd.Print.
14. Jacob Millman & Christos C. Halkias, (2006).
15. *Electronic Devices and Circuits*, New Delhi: Tata McGraw-Hill Publishing Company Ltd. PrintUser's Manual Experiments for Young Engineers and Scientists.
16. Manual Experiments for Young Engineers and Scientists <http://expeyes.in/Documents/eyes17-a4.pdf>.

3.11. QUANTUM MECHANICS

Credit: 4

Semester: S-5

3.11.1. About the course:

The course is on the fundamental topics of quantum mechanics. The course starts with the introduction of postulates of quantum mechanics, operator formalism. The topics covered range from exactly solvable systems, time-independent and time-dependent perturbation theories, orbital and spin angular momenta and relativistic quantum mechanics. The skill for solving simple systems is cultivated.

3.11.2. Learning outcomes:

- The fundamental topics of quantum mechanics.
- The course starts with the introduction of postulates of quantum mechanics, operator formalism.
- The topics covered range from exactly solvable systems, time-independent and time-dependent perturbation theories, orbital and spin angular momenta and relativistic quantum mechanics.
- The skill for solving simple systems is cultivated.

UNIT 1: SCHRODINGER EQUATION AND OPERATOR FORMALISM

Time-dependent Schrodinger equation – Physical meaning and conditions on admissible wave function – Conservation of probability – Expectation value – Ehrenfest's theorem – Conditions for allowed transitions
Operator Formulation: Linear operator – Adjoint and self-adjoint operators – Completeness – Physical interpretation of eigenvalues and eigenfunctions – Commutator – Simultaneous eigenfunctions – Heisenberg uncertainty relation.

UNIT 2: EXACTLY SOLVABLE BOUND STATE PROBLEMS

Linear harmonic oscillator: Eigenvalues and eigenfunctions by solving the one-dimensional Schrodinger equation – Particle in a box – Rectangular barrier potential – Tunnel effect – Rigid rotator.

UNIT 3: PERTURBATION THEORY

Time-independent perturbation theory for non-degenerate states – Application to linear harmonic oscillator with perturbation – and anharmonic oscillator with perturbation x^3 and x^4 – Perturbation theory for degenerate states – Stark effect in hydrogen atom – Time dependent perturbation theory: Constant perturbation – Transition probability – Harmonic perturbation.

UNIT 4: ANGULAR MOMENTUM

Components of orbital angular momentum L – Commutation relations among the components of L , L^2 and L_z – Ladder operators L_{\pm} -- Expectation values – Eigen spectra through commutation relations – Properties of eigenvalues of L^2 -- Components of spin operator.

UNIT 5: RELATIVISTIC QUANTUM MECHANICS

Klein – Gordon equation for a free particle – Dirac equation for a free particle – Dirac matrices and their properties – Probability and current densities – Plane wave solutions – Negative energy states – Zitterbewegung: jittery motion of a free particle – Spin of a Dirac particle.

3.11.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.11.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.11.5. Suggestive readings:

1. C. Kittel, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi, 2006.
2. N. W. Ashcrof and N. D. Mermin, Solid State Physics, Harcourt College Publishers, Philadelphia, 1976.
3. J. S. Blakemore, Solid State Physics, Second Edition, Cambridge University Press, Cambridge, London, 1985.
4. A. J. Dekker, Solid State Physics, Published by Macmillan India (2000).
5. T. P. Sheahen, Introduction to High-Temperature Superconductors, Plenum press, New York, 1994.
7. S. O. Pillai, Solid State Physics, Seventh Edition, New Age International, New Delhi, 2014.
8. J. R. Christman: Fundamentals of Solid State Physics, John Wiley & Sons, NY, 1988.
10. J.P. Srivastava: Elements of Solid State Physics, Prentice-Hall of India, 2006

3.12. ELECTROMAGNETIC WAVES**Credit: 2****Semester: S-5****3.12.1. About the course:**

The course on electromagnetic theory is framed, (i) To understand the fundamental theories that explain electrostatics and magnetostatics, (ii) To illustrate the application of electrostatics in macroscopic media, (iii) To couple the electrostatics and magnetostatics phenomena and explain the elementary ideas of electromagnetic theory and (iv) To extend the electrodynamics principle for explaining the electromagnetic optical wave propagation

3.12.1. Learning outcomes:

The electromagnetic theory is framed,

- (i) To understand the fundamental theories that explain electrostatics and magnetostatics,
- (ii) To illustrate the application of electrostatics in macroscopic media,
- (iii) To couple the electrostatics and magnetostatics phenomena and explain the elementary ideas of electromagnetic theory.

UNIT 1: ELECTROSTATICS

Coulomb's law – Gauss' law – Divergence and curl of electrostatic field – Electric field and potential due to an electric dipole – Poisson and Laplace Equations – Boundary conditions and uniqueness theorem – Green's theorem – Method of Images – Illustrations: Point charge in the presence of (i) a grounded conducting sphere (ii) an insulated conducting sphere (iii) a charged and insulated sphere – Conducting sphere in a uniform electric field.

UNIT 2: ELECTROSTATICS OF MACROSCOPIC MEDIA

Electric quadra pole and multipole - Multipole expansion of electric field – Dielectric polarization – External field of a dielectric medium – Electric field in a material medium – Field due to a polarized sphere – Dielectric sphere in a uniform field Molecular field in dielectric: The Clausius Mossotti relation – Electrostatic energy in dielectric media.

UNIT 3: MAGNETOSTATICS AND INDUCTION

Biot and Savart law – Force between current carrying conductors – Lorentz force Ampere's law – Divergence and curl of magnetic induction – Comparison of electrostatics and magnetostatics – Magnetic vector potential – Magnetic field of a distant current loop – Magnetic field due to an infinite current carrying wire – Faraday's law of induction – Self and Mutual Inductance.

UNIT 4: ELECTROMAGNETICS

Maxwell's displacement current – Maxwell equations and its derivation – Maxwell equations in free space, linear isotropic medium and harmonically varying fields – Conservation of energy (Poynting's theorem) – Conservation of momentum for electromagnetic fields – Plane electromagnetic waves in (i) free space, (ii) nonconducting medium and (iii) conducting medium (isotropic and anisotropic).

UNIT 5: WAVE PROPAGATION

Polarization of electromagnetic waves (Linear, circular and elliptical polarization) – Reflection and refraction of electromagnetic waves at a plane interface between dielectrics – Fresnel's equation – Total

internal reflection – Propagation of electromagnetic waves between parallel conducting medium – Waveguides (i) circular (ii) cylindrical and (iii) rectangular.

3.12.1. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.12.1. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.12.1. Suggestive readings:

1. **J. D. Jackson**, *Classical Electrodynamics* (Wiley Eastern Ltd., New Delhi, 1999)
2. **D. Griffiths**, *Introduction to Electrodynamics* (Prentice-Hall of India, New Delhi, 1999)
3. **R. P. Feynman, R. B. Leighton and M. Sands**, *The Feynman Lectures on Physics: Vol. II* (Narosa Book Distributors, New Delhi, 1989)
4. **Satya Prakash**, *Electromagnetic Theory and Electrodynamics* (Kedar Nath Ram Nath, Meerut, 2015)

3.13. PHYSICS PRACTICAL - C

Credit: 2

Semester: S-5

3.13.1. Learning outcomes:

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

- explain the internal architecture and characteristics of an op-amp
- analyse the linear and nonlinear applications of op-amps
- develop the skill of observation, analysis and data interpretation
- write an effective lab report with meaningful conclusions

3.13.2. Experiments

1. Differential amplifier
2. Input offset voltage, input bias current, input impedance & CMRR of an op-amp
3. Op-amp circuits (Inverting amplifier, Non-inverting amplifier & Voltage follower)
4. Linear op-amp applications (Summing, difference and averaging amplifiers)
5. Non-linear op-amp applications (Comparators & Schmitt trigger)
6. Integrator/ Differentiator circuits

3.13.3. Suggestive mode of transaction:

Experimentation, Demonstration

3.13.4. Suggestive mode of assessment:

In lab- experimentation, Semester examinations

3.13.5. Suggestive readings:

1. Albert P. Malvino & David J. Bates, (2009). Electronic Principles, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
2. Grob B., (2007). Basic Electronics, (10th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
3. Jacob Millman & Christos C. Halkias, (2006). Electronic Devices and Circuits, New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.

Chemistry
3.11 INORGANIC CHEMISTRY – II

Credit: 4

Semester: S-5

3.11.1. About the course::

This course deals with basics of coordination chemistry, and properties of early, inner and late transition elements.

3.11.2. Learning outcome:

On successful completion of this course learners will be able to:

- Understand periodic trends and chemistry of various elements.
- Students after completing this course may relate chemical properties of various elements with respect to their position in the periodic table.
- Understand coordination compounds.

UNIT I (COORDINATION COMPOUNDS I)

Introduction, physical and chemical properties of transition elements; Introduction to coordination compounds; coordination numbers and geometries in transition metal complexes; nomenclature; isomerism in transition metal complexes – structural, geometrical and optical isomerism.

UNIT II (COORDINATION COMPOUNDS II)

Double salts and coordination compounds; Werner's work; effective atomic number; bonding in transition metal complexes Valence bond theory, crystal field theory (octahedral and tetrahedral complexes); magnetism.

UNIT III (EARLY TRANSITION ELEMENTS)

Introduction and the chemistry of Scandium group, Titanium group, Vanadium group, Chromium group and Manganese group,

UNIT IV (LATE TRANSITION ELEMENTS)

Introduction and the chemistry of Iron group, Cobalt group, Nickel group, Copper group and Zinc group.

UNIT V (INNER TRANSITION ELEMENTS)

Lanthanides: Introduction, occurrence, separation, oxidation states and general chemistry. Actinides: Introduction, isolation and general chemistry

3.11.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.11.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.11.5. Suggestive Readings:

1. D. F. Shriver, P. W. Atkins, C. H. Langford, Inorganic Chemistry, ELBS. 1990.
2. A. G. Sharpe, Inorganic Chemistry, 3ed, Addison-Wesley, 1999.
3. J. D. Lee, A New Concise Inorganic Chemistry, 3ed, ELBS, 1987.
4. B. Douglas, D. McDaniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3ed, John Wiley, 2001.

3.11 ORGANIC CHEMISTRY – II (FUNCTIONAL GROUP TRANSFORMATION)

Credit: 4

Semester: S-5

3.11.1. About the course:

This course deals with identifying electrophiles and nucleophiles, and also deals with substitution reaction, elimination reaction and electrophilic reaction of organic compounds.

3.11.2. Learning outcome:

On successful completion of this course learners will be able to:

- The diversity and complexity of binary compound of carbon with hydrogen.
- The effect of structural features on physical and chemical properties.
- The structure and functionalization of hydrocarbons and functional groups.

The Electrophiles and nucleophiles.

UNIT I IDENTIFYING AND GENERATING ELECTROPHILES AND NUCLEOPHILES:

Identifying electrophilic carbons and assigning oxidation number. Identifying and generating carbon nucleophiles and heteroatom nucleophiles.

UNIT II SUBSTITUTION AND ELIMINATION REACTIONS AT SP³ CARBON nucleophile and electrophiles, Substitution reactions - SN1, SN2 reaction mechanism, factors influencing SN1, SN2 reactions, activation of poor leaving groups, neighbouring group participation, elimination reactions E1, E2, E1cb reaction mechanisms factors affecting, substitutions vs eliminations.

UNIT III REACTIONS OF ELECTROPHILIC UNSATURATED CARBONS_

Reactions of carbon heteroatom multiple bonds, addition reactions to carbon heteroatom multiple bond, addition elimination reactions of carbon heteroatom multiple bond.

UNIT IV REACTIONS OF ELECTROPHILIC UNSATURATED CARBONS 2

Reactions of α -carbon to carbon heteroatom multiple bonds. Reactions of α , β unsaturated carbonyl compounds.

UNIT V INTRODUCTION TO RADICAL REACTIONS

Generation of carbon radicals, electrophilic and nucleophilic radical, types of radical reactions.

3.11.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.11.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.11.5. Suggestive Readings:

1. Organic Chemistry as Second Language, David R Klein, 2004, John Wiley and Sons, USA.
2. Arrow Pushing in Organic Chemistry, Daniel. E. Levy, 2008, John Wiley and Sons, USA
3. Organic Chemistry, W. H. Brown, C. S. Foote, B. L. Iverson and E. V. Anslyn, Brooks/Cole Cengage Learning, 6ed, 2012.
4. Organic Chemistry, P. Y. Bruice, Pearson Education, 7ed, 2013

3.12 EQUILIBRIUM CHEMICAL THERMODYNAMICS**Credit: 2****Semester: S-5****3.12.1. About the course:**

This course deals with first and second law of thermodynamics, joule Thomson effect, Entropy changes in physical properties and Maxwell relations.

3.12.2. Learning outcome:

- In this course, the point of view according to which thermodynamics is concerned with the study of macroscopic properties obtained from macroscopic laws.
- Students undergoing this course will be equipped to evaluate various thermochemical properties from different experimental variables.
- From solving problems, students may realise the connection between thermodynamics with biological systems and natural processes

Unit I: Behaviour of gases and liquids

Real gases, virial equation of state, gas liquid phases - molecular structure of liquids

Unit II First and second laws

First law of thermodynamics, Internal energy, work and heat, enthalpy, effect of enthalpy with temperature, thermochemistry – state functions and exact differentials – Joule Thomson effect – adiabatic changes – Entropy: definitions, Carnot cycle, Clausius inequality, entropy changes in physical processes, measurement of entropy - Third law: Nernst theorem and third law entropy

Unit III System properties and consequences

Helmholtz and Gibbs energies, spontaneous process, maximum work, Standard Gibbs energies – Maxwell relations, temperature, pressure effects on internal, Helmholtz, Gibbs energies, fugacity

3.12.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.12.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.12.5. Suggestive readings:

1. Physical Chemistry Thermodynamics, Structure, and Change, Peter W Atkins, Julio de Paula, 10ed, W H Freeman, 2014
2. Physical Chemistry, Robert G Mortimer, 3ed, Elsevier, 2008
3. Physical Chemistry, Thomas Engel and Philip Reid, 3ed, Pearson, 2013

3.13 PRACTICAL – C**Credit: 2****Semester: S-5****3.13.1. About the course:**

This course deals with chromatographic techniques, preparation method of gels and colloids, separation process of mixtures of compounds.

3.13.2. Learning outcome:

On successful completion of this course learners will be able to:

- Learn separation of organic mixtures.
- Understand and do chromatographic techniques.
- Prepare TLC plate and interpret data.

1. Gravimetric analysis
2. Estimation of barium ions as barium sulphate.
3. Estimation of lead as lead chromate.
4. Estimation of aluminum as its 8-hydroxyquinoline complex
5. Estimation of Ni as Ni DMG complex.
6. Separation of given organic mixture and analysis.
7. Chromatographic techniques TLC, Paper and Column chromatography.
8. Determination of first order rate constant. – Acid hydrolysis of ester
9. Determination of second order rate constant – Base hydrolysis of ester
10. Preparations of gels and colloids

3.13.3. Suggestive mode of transaction:

Demonstration, experimentation.

3.13.4. Suggestive mode of Assessment:

In lab-experimentation and semester examination.

3.13.5. Suggestive Readings:

1. B. Dey and M. V. Sitharaman, Laboratory Manual of Organic Chemistry, Revised by T.
2. R. Govindachari, Allied Publishers Ltd., New Delhi, 4th Revised Edn., 1992, ISBN: 9788170232520.
3. Vogel, Textbook of Practical Organic Chemistry, 5th Edn., ELBS, London, 1989. ISBN: 978-8177589573
4. O.P. Pandey, D. N. Bajpai, S. Giri, Practical Chemistry, S. Chand, ISBN: 978-8121908122.
5. C. Arora, S. Bhattacharya, Advanced Physical Chemistry Practical Guide, Bentham Books, ISBN: 978-1681089126.
6. B.O. Aher, A.B. Aher, V.A. Bairagi, P.A. Pathade, J.P. Bapurao, Practical book of physical chemistry, Walnut Publication, ISBN: 9788194208648.
7. V. Venkateswaran, R. Veeraswamy, A.R. Kulandaivelu, Basic principles of practical chemistry, Sultan Chand & Sons, ISBN: 81-8054-776-8.
8. C. Garland, J. Nibler and D. Shoemaker, *Experiments in Physical Chemistry*, McGraw-Hill Education; 8th Edn., 2008, ASIN: .ARWYTML00B.
9. S. Ratnani, S. Agrawal, S. Mishra, Practical Chemistry, McGraw Hill, ISBN: 978-070611221.

Mathematics

SEMESTER-V

CORE 10: PARTIAL DIFFERENTIAL EQUATION

Credits: 4

Semester: S-5

About the Course

A partial differential equation is an equation containing an unknown function of two or more variables and its partial derivatives with respect to these variables. The order of a partial differential equations is that of the highest-order derivatives.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I Formation of Partial differential equations – by elimination of arbitrary constants – by elimination of arbitrary functions – Singular integral – General integral.

UNIT II Standard types of first order equations – Standard 1,2,3,4 -Equations reducible to standard forms.

UNIT III Lagrange's equations - Charpit's Method.

UNIT IV Linear Partial Differential equation of Second and higher order with constant coefficients.

UNIT V One dimensional wave equations, heat equation, Laplace equation –Simple problems.

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction • Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

Prescribed Text (Specify Sections Clearly)

S.Narayanan and T.K. Manicavachagom Pillay, Calculus III Unit 1, 2, 3 : Chapter 4 Transforms and Partial differential equations by Dr. A. Singaravelu Unit 4 : Chapter 3 Unit 5 : Chapter 4

Reference Books

1. Introductory course in Differential equations, D.A. Murray, Orient Longman (1967)
2. Advance Engineering Mathematics, Erwin Kreyzsig, Wiley India Edition (2010)
3. Engineering Mathematics, M.K.Venkataraman, National Publications, Chennai (2009)
e-Learning Source <http://ndl.iitkgp.ac.in> <http://ocw.mit.edu> <http://mathforum.org>

CORE 11: REAL ANALYSIS- I**Credit: 4****Semester: S-5****About the Course**

Real analysis is a branch of mathematical analysis that analyses the behaviour of real numbers, sequences and series, and real functions. Convergence, limits, continuity, smoothness, differentiability, and integrability are some of the features of real-valued sequences and functions that real analysis explores.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I	Sets and elements — Operations on sets — Functions - Real valued functions - Equivalence— Countability— Realnumbers — Leastupperbound — Greatest lower bound.
UNIT II	Definition of sequence and subsequence — Limit of a sequence — Convergent sequence — Bounded sequence Monotone sequence - Operation on convergent sequence - Limit superior and limit inferior —Cauchy sequence
UNIT III	Convergence and divergence- Series with non - negative terms - Alternating series — Conditional convergence and absolute convergence- Tests for absolute convergence - Series whose terms form a non - increasing sequence — Summation by parts.
UNIT IV	Limit of a function on the real line - Metric spaces (Examples 4 and 5 under 4.2 c to be omitted) - Limits in metric spaces.
UNIT V	Functions continuous at a point on the real line Reformulation — Functions continuous on a metric space - Open sets and closed sets – Discontinuous functions on R

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report.

Suggestive mode of transaction

- Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

- Prescribed Text(specify sections clearly)** *Methods of Real Analysis, Treatment as in Richard R. Goldberg (1970)*
Unit 1 : Chapter 1, Unit 2, 3: Chapter 2 and Chapter 3 (up to 3.8)
Unit 4 : Chapter4, Unit 5 : Chapter5
- Reference Books**
1. *A First Course in Mathematical Analysis- D Somasundaram & B Choudhyri- Narosa Publishing house New Dehli*
 2. *Introduction to Calculus and Analysis, Vol.I, Richard Courant and Fritz John, Springer 1999.*
 3. *Introduction to Real Analysis, 4th Edition, Robert G. Bartle and Donald R. Sherbert, Wiley-2014.*

e-Learning Source <http://ndl.iitkgp.ac.in>
<http://ocw.mit.edu>
<http://mathforum.org>

SEMESTER-V

CORE 12: COMPLEX ANALYSIS- I

Credit: 4

Semester: S-5

About the Course

Complex analysis is known as one of the classical branches of mathematics and analyses complex numbers concurrently with their functions, limits, derivatives, manipulation, and other mathematical properties.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

- UNIT I** Complex numbers - Definitions - Algebraic properties - Cartesian co-ordinates - Triangular inequality - Polar Form - Powers and roots -Region inthe complex plane.
- UNIT II** Analytic functions - Functions of a complex variable - Mapping - Limit -Theorems on limits - Continuity - Derivatives - Differentiation formula - Cauchy Riemann equations - Sufficient conditions.
- UNIT III** Cauchy Riemann equations in polar form - Analytic functions -Harmonicfunctions.
- UNIT IV** Elementary functions - Exponential function - Trigonometric functions and their-
-properties - Hyperbolic functions - Logarithmic function – Branches - properties of logarithms - Complex exponents - Inversetrigonometric & hyperbolic functions.
- UNIT V** Mapping by elementary functions - The linear function $1/z$ - Linear fractional transformation - The function $w = \exp(z)$, $W = \sin z$,

$$W = \cos z, z^{1/2} - \text{Successive transformation } W = z + 1/z.$$

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content

related

- Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction • Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

Prescribed Text(specify sections clearly) *Complex Variables and Applications, James Ward Brown and Ruel V Churchill, McGraw - Hill, International Edition (2009)*

UNIT I -
chapter 1,
UNIT II -
chapter 2
UNIT III -
chapter 2
UNIT IV –
chapter3
UNIT V -
chapter 4

Reference Books

1. *Functions of a Complex variable* by B. S. Tyagi – KedarNath RamNath Publishers(P) Ltd.
2. *Complex Analysis* by P. Duraipandian and Kayalal Pachaiappa –S.Chand & Co.
3. S. Ponnusamy, *Foundations of Complex analysis*, (2nd Edition), Narosa, 2011.
4. V.Karunakaran, *Complex Analysis*, (2nd Edition), Narosa 2005

e-Learning Source

<http://ndl.iitkgp.ac.in>
<http://ocw.mit.edu>
<http://mathforum.org>

Content cum Pedagogy of Mathematics at Secondary Stage – Course (II)

Credit: 2
Semester: S-5

4.4.3.1 About the Course

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

4.4.3.2 Learning Outcomes

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

- discuss the nature and functions of various instructional resources,
- explore and utilize the teaching learning resources to support pedagogical experiences of Mathematics,
- organize and manage supportive activities for development of mathematical aptitude of secondary school students,
- plan appropriate experiences for teaching Mathematics,
- explore diverse backgrounds and interests' children bring to set up the inclusive classroom for Mathematics learning,
- elaborate technological tools for teaching and learning of Mathematics,
- integrate technology to judiciously facilitate learning for enhancing inclusive environment.

UNIT - I**Teaching Learning Resources**

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

UNIT - II**Content Analysis and Planning for Teaching Mathematics**

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

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

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

4.4.3.3 Suggestive Practicum (Any Three)

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

4.4.3.4 Suggestive Mode of Transaction

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

4.4.3.5 Suggestive Mode of Assessment

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

4.4.3.6 Suggestive Reading Materials

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

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

Content cum Pedagogy of Physical Sciences at Secondary Stage - Course (II)

Credit: 2
Semester: S-5

4.4.4.1 About the Course

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

4.4.4.2 Learning Outcomes

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

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

UNIT - I**Teaching Learning Resources**

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

UNIT - II**Content Analysis and Planning for Teaching Physical Sciences**

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

UNIT - III

ICT Integration and Applications

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

4.4.4.3 Suggestive Practicum (Any Three)

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

4.4.4.4 Suggestive Mode of Transaction

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

4.4.4.5 Suggestive Mode of Assessment

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

4.4.4.6 Suggestive Reading Materials

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

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

ICT IN EDUCATION**COURSE TITLE: Information & Communication Technology (ICT) in Education****Credit: 2****Semester: S-5****5.6.1 About the Course**

The present course focuses on moving beyond computer literacy and ICT-aided learning, to help student teachers interpret and adapt ICTs in line with educational aims and principles. The paper will orient the learners about the need for and importance of ICT in education. It will describe the importance of opensource software in education. Students will be given exposure to the various approaches and stages towards the use of ICT in education. Students are expected to develop reasonably good ICT skills in terms of the use of various computer software and ICT tools.

5.6.2 Learning Outcomes

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

- explain the concept, nature, and scope of ICT in education,
- describe the importance of open-source software in education,
- list and explain various approaches to the adoption and use of ICT in education,
- describe the importance of various emerging technologies in education,
- See relationship between the social, economic, and ethical issues associated with the use of ICT,
- list out the challenges of educational technology in India,
- use various technological tools for improving teaching-learning- assessment processes.

UNIT - I**Introduction to (ICT) in Education**

- A. Meaning, Nature, importance of Information Technology, Communication Technology & Information and Communication Technology (ICT) and Instructional Technology,
- B. Educational Technology and ICT in Education (Difference, Scope of ICT- Teaching, learning, Research & Publication Educational Administration and Assessment),
- C. Technology & Engagement: Internet, Collaborative learning through Online Discussion Forums, group assignments & Peer reviews,
- D. Meaning and Uses of Systems Approach in instructional design,
- E. Models of Development of Instructional Design (ADDIE, ASSURE, Dick and Carey Model Mason's),
- F. Flanders' Interaction Analysis Category System (FIACS),
- G. Challenges relating to Educational Technology.

UNIT - II**Emerging Technologies in Education**

- A. E-learning Concept, methods, and media (LMS, Virtual Universities, Massive OpenOnline Course (MOOCs), Indian MOOCs, Types of MOOCs: cMOOCs, xMOOCs & LMOOCs).
- B. Open Education Resources (Creative Commons, Concept, and application).
- C. Augmented reality, Virtual reality, Artificial intelligence, Mixed Reality & Gamification

in education (Meaning, history, importance, tools and uses).

- D. Cloud Computing & Internet of Things - Meaning, importance and uses.
- E. Ethical issues & safety in ICT- (Teaching, Learning and Research, Cyber bullying, Cyber security literacy & data protection, Online identity and privacy).

UNIT - III

ICT in Teaching-Learning & Assessment

- A. Concept, Approaches to integrating ICT in teaching and learning: Technological Pedagogical Content Knowledge (TPCK), Technology Integration Matrix (TIM).
- B. Implication of Learning Theories in ICT in Education: Behaviourism, Cognitivism & Constructivism.
- C. Developing functional skills to use discipline specific ICT tools (Geogebra, PhET, Stellarium, Open Street Map, Marble, Turtle Art, Technological tools for Mind mapping etc.).
- D. ICT and Assessment- Electronic assessment portfolio – Concept and types; e-portfolio tools.
- E. Online and offline assessment tools – Rubrics, survey tools, puzzle makers, test generators, reflective journal, question bank.
- F. ICT applications for Continuous and Comprehensive Evaluation (CCE).

5.6.3 Suggestive Practicum

1. Prepare an assessment tool on any one chapter of the textbook.
2. Explore any one online platform for MOOCs and prepare a report highlighting its structure and courses.

5.6.4 Suggestive Mode of Transaction

The pedagogy for the course ICT in Education should be designed to ensure that students have a good understanding of how to use technology for improving teaching-learning-assessment processes. It should provide a balance between theoretical knowledge and practical skills. The approaches to curriculum transaction may include the following:

- Active learning encourages student teachers to participate in discussions, brainstorming sessions, and problem-solving activities that help them develop critical thinking and problem-solving skills.
- Collaborative learning involves group projects and tasks that encourage student teachers to work collaboratively and learn from each other.
- Experiential learning involving Hands-on activities, field trips, and real-life scenarios that will give student teachers the opportunity to apply their knowledge and skills in a practical setting.
- Use of multimedia tools such as videos, interactive simulations, and animations that help enhance learning and make it more engaging.
- Self-directed and self-managed learning activities that encourage students to take charge of their learning process through independent research, self-reflection, and self-assessment which can promote lifelong learning.

5.6.4 Suggestive Mode of Assessment

The assessment for the course ICT in Education should evaluate students' knowledge, capacities, and attitudes towards the use of technology in education. The assessment methods will include the following:

- Project-based assessments involving projects that require student teachers to create an instructional/learning resource that incorporates ICT tools and then assess the quality of the

resource.

- Peer assessment helps students develop their critical thinking and evaluative capacities through group tasks requiring assessment by a group of the work of another group.
- Reflective journals requiring student teachers to maintain a reflective journal and to reflect on their learning experience involving the use of ICT tools in education.
- Online quizzes and tests involving online quizzes and tests that can assess students' knowledge of the theoretical aspects of ICT in education.

- Observation and feedback involving observation of performance of student teachers during classroom activities and providing feedback that help assess their practical skills in using ICT tools for improving teaching-learning-assessment processes.

5.6.6 Suggested Reading Materials

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

Pre-Internship Practice**Credit: 2****Semester: S-5****6.1.1 About the Course**

Pre-Internship is a vital component of the Teacher Education Programme. It is a prerequisite for the student teachers to experience a simulated classroom environment to prepare them for real-life situations. Student teachers get exposure in a conducive, guided environment to manage a classroom and learn pedagogic and classroom management skills and get an opportunity to have hands-on experience.

6.1.2 Learning Objectives:

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

- acquainted with various pedagogic practices, classroom management skills, assessment tools and learning standards,
- get experience of conducting classes by observing lessons transacted by teacher educators (demonstration lessons),
- develop lesson plans to transact them using appropriate pedagogies and learning resources,
- develop and practice teaching skills in a guided environment to be an effective teacher,
- be prepared for the school internship.

6.1.3 Suggestive Mode of Transaction

- Demonstration lesson (minimum 1 in each pedagogical subject)
- Peer Group teaching and peer observation (minimum 5 in each pedagogical subject)
- Observation of lessons by teacher educators during peer group teaching
- Reflective group discussions/workshops/seminars
- Preparation and presentation of the video content illustrating best classroom practices.

6.1.4 Content

The pre-internship will include activities relating to the stage-specific pedagogy courses, ability enhancement and value-added courses and foundation courses transacted during previous semesters. It will also include knowledge of pedagogy, formats of lesson plans, different ICT tools, schooling systems in India, principles of classroom management, assessment, and other relevant content.

6.1.5 Activities to be conducted:

- Observation of lessons transacted by teacher educators to identify pedagogic skills.
- Exposure to various types of lesson plans through workshops.
- Development of relevant Teaching Learning Materials (TLMs).
- Participation in screening and discussion of educational videos on pedagogy and assessment.
- Learning about inclusiveness in school education
- Orientation for Action Research/case study

6.1.5.1 Foundational Stage Orientation of student teachers to different pedagogic (flexible, multilevel, play/activity/story-based learning) and classroom management skills

- Observation of the lessons demonstrated by teacher educators/experts in the institute.
- Designing guided play/activities for each class/subject based on learning outcomes.
- Identify local toys/games to facilitate play activities and pedagogical practices.
- Study Foundational Stage Learning Standards in the NCF-FS
- Content analysis and development of the unit plan, concept map and lesson plan.
- Discussion on unit plan and lesson plan with teacher educators/experts
- Preparation of a Portfolio (for self-work) that the student-teacher will use to keep all her/his work.
- Develop a one-day teaching plan that caters to all domains of development and record the difference in children's engagement before and after implementing the new plan.
- Transaction of demonstration lesson plan in a guided situation in the institute in the macro group (get the feedback from the mentor and TE)
- Collection and development of warmup activities and trials with the student trainee for rapport building with the young children.
- Exploring available learning resources, local traditional stories, rhymes, riddles, and educational videos
- Developing local, low-cost, and innovative TLMs
- Reading and reflecting on inspiring books on pedagogic practices like '*Divaswapna*'

6.1.5.2 Preparatory Stage

- Orientation of student teachers to different pedagogic (play, discovery, and activity/project-based) and classroom management skills
- Observation of the lesson demonstrated by teacher educators/experts in the institute.
- Designing guided play/activities for each class/subject based on learning outcomes.
- Identify local toys/games to facilitate play activities and pedagogical practices.
- Study Preparatory Stage Learning Standards from the NCF
- Content analysis and development of the unit plan, concept map and lesson plan.
- Discussion on unit plan and lesson plan with teacher educators/experts
- Preparation of a Portfolio (for self-work) that the student-teacher will use to keep all her/his work.
- Exploring available learning resources and educational videos
- Developing local, low-cost and innovative TLMs
- Reading and reflecting on inspiring books on pedagogic practices like '*Divaswapna*'

6.1.5.3 Middle Stage

- Orientation of student teachers to different pedagogic practices like experiential learning, inter-relationship amongst different subjects, integration of Indian Knowledge Systems (IKS) and values in school subjects, and classroom management skills
- Observation of the lesson demonstrated by teacher educators/experts in the institute.
- Designing guided activities for each class/subject based on learning outcomes.
- Study Middle Stage Learning Standards in the NCF
- Content analysis and development of the unit plan, concept map and lesson plan.
- Discussion on unit plan and lesson plan with teacher educators/experts

- Preparation of a Portfolio (for self-work) that the student-teacher will use to keep all her/his work.
- Participate in discussions/reflective sessions for conceptualizing teaching-learning practices.
- Exploring available learning resources and educational videos
- Developing local, low-cost and innovative TLMs
- Reading and reflecting on inspiring books on pedagogic practices

6.1.5.4 Secondary Stage

- Orientation of student teachers to different pedagogic approaches like storytelling, art-integrated, sports-integrated, project-based, and ICT-integrated for developing critical thinking, attention to life aspirations, and greater flexibility and classroom management skills.
- Observation of the lesson demonstrated by teacher educators/experts in the institute.
- Designing guided activities, including a laboratory for each class/subject based on learning outcomes.
- Study Secondary Stage Learning Standards in the NCF
- Content analysis and development of the unit plan, concept map and lesson plan.
- Discussion on unit plan and lesson plan with teacher educators/experts
- Preparation of a Portfolio (for self-work) that the student-teacher will use to keep all her/his work.
- Participate in discussions/reflective sessions for conceptualizing teaching-learning practices.
- Exploring available learning resources and educational videos
- Developing local, low-cost, and innovative TLMs
- Reading and reflecting on inspiring books on pedagogic practices

6.1.6 Assessment

Competence/Artifact	Method of assessment	Assessed By	Credits
Classroom teaching skills and assessment tools (including learning standards)	Simulated Presentation	Teacher-Educator	1
Reflective group discussions/workshop	Observations	Teacher-Educator	0.5
Artefacts (Lesson Plans, TLM, Curated Videos) and action research procedures.	Evaluation	Teacher-Educator	0.5

6.1.7 Outcomes

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

1. describe the prerequisites of the internship,
2. demonstrate knowledge of pedagogic practices, classroom management skills, assessment tools and learning standards,
3. develop lessons plans and relevant Teaching Learning Materials (TLMs),
4. develop readiness to take up an internship programme.

SEMESTER-VI

SEMESTER-6

CONTENT

Course Code	Curricular Component	Name of the Course	Credits	Total	Page No.	
FE04	Foundations of Education	Assessment and Evaluation	2	4	166-168	
FE05		Inclusive Education	2		169-171	
PHY215	Physics	Nuclear Physics	4	8	172-173	
PHY216		Numerical Methods & Computational Physics	2		174-175	
PHY217		Practical – D	2		176-177	
CHE215	Chemistry	Inorganic Chemistry – III	4		177-178	
CHE216		Organic Chemistry – III (Bio Organic Chemistry)	2		179-179	
CHE217		Practical – D	2		180-181	
MATH214	Mathematics	Real Analysis – II	4		4	182-183
MATH215		Complex Analysis – II	4			184-185
PEDP221	Stage – specific content - cum - Pedagogy	Content cum Pedagogy of physical science at Secondary stage – Course (III) (physics)	4	4	188-190	
PEDC221		Content cum Pedagogy of physical science at Secondary stage – Course (III) (Chemistry)	4			
PEDM221		Content cum Pedagogy of Mathematical Sciences at Secondary stage - Course (III) (Mathematics)	4		186-187	
AEV107	Ability Enhancement & Value Added Courses	Mathematical and Quantative Reasoning	2	2	191-192	
SE223	School Experience	School Observation (Field Practice)	2	2	193-197	
Total Credits (for Each discipline)				20		

SEMESTER VI**COURSE TITLE: Assessment and Evaluation****Credit:2****Semester-6****2.4.1 About the Course**

The main thrust of this course on assessment and evaluation is to equip student teachers with the knowledge and capacities required to develop and implement approaches to assessment that is more regular and formative, is more competency-based, is appropriate for assessing learning outcomes relating to all domains of learning, is appropriate for testing not only subject-related learning but also generic learning outcomes such as problem solving, critical thinking, creative thinking, communication skills, judgement and decision making, ethical and moral reasoning etc.

2.4.2 Learning Outcomes

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

- use different approaches to assess and evaluate of student performance such as time-constrained examinations; closed/open-book tests; problem-based assignments; practical assignment reports; observation of practical skills; individual and group project reports; oral presentations; viva voce interviews; computerized adaptive testing; peer and self-assessment etc.,
- develop and use informal and formal diagnostic, formative, and summative assessment strategies to monitor student learning levels and help the teacher continuously revise teaching-learning processes to optimize learning and development for all students,
- develop an understanding among student teachers of the approaches to provide timely, effective, and appropriate feedback to students about their performance relative to the expected learning outcomes and organizing learning enhancement initiatives that are required to bridge the gap in student learning levels,
- present report on student achievement, making use of accurate and reliable record set.
- develop assessment “as”, “of”, and “for” learning that are aligned to the expected learning outcomes,
- design the progress card of students based on school-based assessment to make it a holistic, 360-degree, multidimensional report that reflects the progress as well as the performance of learners assessed through self-assessment and peer assessment, project-based and inquiry-based learning, quizzes, role plays, group work, portfolios, etc., along with teacher assessment that would provide students with valuable information on their strengths, areas of interest, and needed areas of improvement.

UNIT - I**Assessment and Education****A. Assessment and Evaluation**

- Meaning and significance of assessment and evaluation in educational field.
- Conceptual Clarity and purpose of Measurement, Assessment,

- Examination, Appraisal and Evaluation in Education.
 - Learning outcomes across the stages and assessment.
 - Taxonomy of Objectives (Revised in 2001) and Implications.
- B. Forms of Assessment
- Formative, Summative, diagnostic, prognostic.
 - Internal and External assessment.
 - Assessment For learning, of learning and as learning.
 - Authentic Assessment; Online Assessment.
- C. Improving Assessment and Evaluation in Schools: Brief Historical Review (1975, 1988, 2000, 2005, 2020)

UNIT - II

Process of Assessment and Evaluation

- A. Formative and Summative Assessment: Concept and Characteristics.
- B. Approaches to assess and evaluate student performance such as time-constrained examinations; closed/open-book tests; problem-based assignments; practical assignment reports; observation of practical skills; individual and group project reports; oral presentations; viva-voce interviews; computerized adaptive testing; peer and self-assessment etc.
- C. Assessing Higher Order Thinking Abilities: Problem solving, critical thinking, creative thinking, communication skills, judgement and decision making, ethical and moral reasoning.
- D. Tools and Techniques
- Observation, rating scale, check list, anecdotes, interviews.
 - Assessment of attitudes and interests.
 - Socio-metric techniques.
 - Criteria for assessment of social and personal behaviour.
 - Self-assessment and Peer Assessment.

UNIT - III

Analysis and Interpretation

- A. Analysis of students' performance and scores: credit and grading
- B. Graphical representation (Histogram, Frequency Curves)
- C. Interpretation of student's performance based on the analysis and their further uses in improving learner's performance: credit and grading, constructive feedback.
- D. Reporting student's performance: 360-degree progress reports, cumulative records and their uses, portfolios, PTA meetings, qualitative reporting based on the observations, descriptive indicators in report-cards.

2.4.3 Suggestive Practicum

1. Review of various education commission, Policies and reports and NCF 2005 to get a brief view of the recommendations on Assessment and Evaluation.
2. Constructing a unit test using table of specifications.
3. Construction of any one of the tools (rating scale, check list, observation schedule, etc.) and administering it to group of students or using it to observe the school and classroom environment and interpreting it.
4. Analysis of question papers of various Boards.

5. Analysis of report cards - State and Central (CBSE)
6. Preparing format of 360-degree report Card.
7. Review of learning outcomes by NCERT in different subject areas.
8. Interviews with teachers and students to study the assessment practices, issues and problems related to it followed by presentation.
9. Reviewing Assessment Discussions in NPE (2020).

2.4.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.4.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.4.6 Suggestive Reading Materials

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

SEMESTER VI
COURSE TITLE: INCLUSIVE EDUCATION

Credit:2
Semester:6

2.5.1 About the Course

This course seeks to orient student teachers to the approaches to bridging gender and social category gaps in terms of participation rates and student learning levels at all levels of school education. The course will provide orientation to the strategies pursued and required to improve participation and learning levels of children from Socio-Economically Disadvantaged Groups (SEDGs) that can be broadly categorized based on gender identities, particularly female and transgender individuals, socio-cultural identities (such as Scheduled Castes, Scheduled Tribes, OBCs, and minorities), geographical identities (such as students from remote locations, villages, small towns, and aspirational districts), disabilities (including learning disabilities), linguistic identities, and socio-economic conditions (such as migrant communities, low income households, children in vulnerable situations, including orphans and the urban poor).

2.5.2 Learning Outcomes

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

- ensure inclusion and equal participation in education of children with disabilities in the regular schooling process that allows students with and without disabilities learn together, ensuring their retention in the school system, and enabling them to achieve the defined learning outcomes,
- adapt teaching and learning process to meet the learning needs of different students with disabilities, including providing education and opportunities for participating in arts, sports, and vocation-related activities, making school buildings and compounds as well as other facilities barrier free and accessible for children with disabilities, supporting activities that help the provision of individualized learning environment and learning activities/resources, making available assistive devices and appropriate technology-based tools, as well as adequate and language-appropriate teaching-learning materials (e.g., textbooks in accessible formats such as large print and Braille) to help children with disabilities integrate more easily into classrooms and engage with teachers and their peers, using appropriate modes and means of communication, detecting specific learning disabilities in children at the earliest and taking appropriate measures to overcome them, monitoring completion of education and learning levels of students with disabilities etc.

UNIT - I

Inclusion and Education

A. Conceptual Clarity, relation, and significance with special reference to:

- UNCRPD, 2006,
- RPWD Act, 2016,

With special reference to Indian Context.

B. Clarity of various terms and phrases associated with Inclusive Education:

Integrated Education, Special Education, Impairment and Disability, Assessment and Evaluation, Curriculum, adaptation, modification and differentiation, universal design of learning.

- C. Shifting from Disability to the Inclusive view.
- D. Shifting Paradigms from Bio centric to Human Rights.
- E. Introductory reference of Policies/Acts with reference to educational implications for Children with Disabilities: Right to Education Act, 2009/ 2012, RPWD Act, 2016, UNCRPD, National Trust Act, 1999, National Educational Policy, 2020.

UNIT - II

Children with Disabilities and Marginalized Groups

- A. Nature and needs of children with sensory impairments: cognitive impairments and intellectual disability, physical disabilities, cerebral palsy, multiple disabilities.
- B. Specific needs of children with behavioral, emotional learning disabilities
- C. Health Problems.
- D. Educational needs of children belonging to Marginalized Groups.

UNIT - III

Pedagogical Issues

- A. Conceptual clarity and significance.
- B. Meeting the specific needs of Children with Disabilities with special reference to:
 - education and opportunities for participating in arts, sports, and vocation-related activities,
 - making school buildings and compounds as well as other facilities barrier free and accessible
 - supporting the learning activities and resources for individualized learning environment
 - making available assistive devices and appropriate technology-based tools,
 - language-appropriate teaching-learning materials (e.g., textbooks in accessible formats such as large print and Braille)
 - assessing strategies
- C. Designing strategies assessment for inclusive classrooms.

2.5.3 Suggestive Practicum

1. Developing a checklist for identifying the various needs of children with disabilities.
2. Visiting schools of different categories and talking to parents, teachers, and Children with and without disabilities and listing the problems faced by these children and the families at the local level in gaining access to education.
3. Analyzing RPWD Act 2016 and list its implications for CWD in inclusive settings.
4. Outlining the problems faced by children with Visual Disabilities while learning mathematics and EVS.
5. Giving a few exemplary adaptations based on the Preparatory Level textbooks.
6. Outlining the problems faced by children with hearing impairments while learning language. Give a few exemplar adaptations based on the primary level textbooks.
7. Students work in small groups of 10 or so to prepare a street play highlighting the meaning and provisions of inclusive education.
8. Analyzing the Context of NPE 2020 in the light of Inclusive Education.

2.5.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.5.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.5.6 Suggestive Reading Materials

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

PHYSICS**SEMESTER – VI****3.14. NUCLEAR PHYSICS****Credit: 4****Semester: S -6****3.14.1. About the course:**

The course of nuclear and particle physics is concerned (i) to study of the fundamentals of nucleus with deuteron system and explain the origin of nuclear forces, (ii) to illustrate different nuclear models that exposes the structure of nucleus, (iii) to explain the theories of various radioactive decays and nuclear reactions and (iv) to determine conservation of physical quantities and study high energy physics.

3.14.2. Learning outcomes:

- to study of the fundamentals of nucleus with deuteron system and explain the origin of nuclear forces,
- to illustrate different nuclear models that exposes the structure of nucleus,
- to explain the theories of various radioactive decays and nuclear reactions and
- to determine conservation of physical quantities and study high energy physics.

UNIT 1: TWO BODY PROBLEM AND NUCLEAR FORCES

The Deuteron – Ground state of deuteron – Magnetic dipole moment of deuteron – Properties of nuclear forces – Scattering cross section – High energy nucleon-nucleon scattering – Spin dependence – Charge symmetry – Charge independence – Repulsion at short distances – Meson theory of nuclear forces – Exchange forces.

UNIT 2: NUCLEAR MODELS

The degenerate gas model – Liquid drop model – Binding energy of nucleus – semi empirical mass formula (Bethe- Weizsacker formula) – Stability of nuclei against beta decay – Mass parabola – Fermi gas model – Alpha particle model – Shell model – Collective model – Optical model.

UNIT 3: RADIOACTIVE DECAYS (Alpha, Beta, Gamma radiations):

Law of radioactive decay – Half life, mean life and successive radioactive transformation – Alpha decay and barrier penetration – Gamow's theory of alpha decay – Pauli's hypothesis and Fermi theory of beta decay – selection rules – Electron captures – Absorption of Gamma rays by matter – Interaction of Gamma ray with matter – Internal conversion.

UNIT 4: NUCLEAR REACTION, FISSION AND FUSION

Types of reaction and conservation laws – Energetic of nuclear reactions – Isospin – Reaction cross section – Compound nucleus reactions - Breit -Wigner one level formula. II: Characteristics of fissions – Energy in fission – Fission reactors – Basic fusion processes – Characteristics of fusion – Solar fusion – Controlled fusion reactors

UNIT 5: ELEMENTARY PARTICLES

Classification of elementary particles: Leptons and Hadrons – Basic Conservation laws: Baryon number, Lepton number, Isospin and Hyper charge – Strange particles and Strangeness – Gell-Mann – Nishijima scheme – Eightfold way and super multiplet – SU (3) symmetry – Quark model and quark composition of mesons and baryons – Color and Flavor – Weak and Strong interactions – Standard model.

3.14.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion.

3.14.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations.

3.14.5. Suggestive readings:

1. M. L. Pandya & R.P.S. Yadav *Elements of Nuclear Physics* (Kedar Nath Ram Nath Delhi, 1995)
2. R. D. Evans: *The Atomic nucleus*, TMH publishing, 1955.
(E-book: <https://archive.org/stream/atomicnucleus032805mbp#page/n366/mode/1up>)
3. K. S. Krane, *Introductory Nuclear Physics* (John-Wiley, New York, 1987)
4. D.C. Tayal, *Nuclear Physics* (Himalaya Publishing House, New Delhi, 2004)
5. S. B. Patel, *Nuclear Physics: An Introduction* (Wiley-Eastern, New Delhi, 1991)
6. . D.C. Tayal, *Nuclear Physics* (Himalaya Publishing House, New Delhi, 2004)
7. S.N. Ghoshal, *Nuclear Physics* (S. Chand & Company, New Delhi, 2006)
8. R.A. Serway and R.J. Beichner, *Physics for Scientists and Engineers with Modern Physics*, 5th Ed. (Thomson Learning Inc., 2000) Chaps.
9. A. Beiser, *Concepts of Modern Physics*, 5th Ed. (McGraw-Hill, 1995)

3.15 NUMERICAL COMPUTATIONAL METHOD

Credit: 2

Semester: S-6

3.14.1 About the course:

The course consists of two parts. The first part aims developing C++ programming skills towards application to numerical methods. The second part concentrates on computational methods for curve fitting of data, interpolation, solutions of system of linear equations and one-dimensional nonlinear equations, numerical integration and differentiation of functions and solutions of ordinary differential equations including symplectic methods for conservative systems.

3.14.2. Learning outcomes:

The course consists of two parts. The first part aims developing C++ programming skills towards application to numerical methods. The second part concentrates on computational methods for curve fitting of data, interpolation, solutions of system of linear equations and one-dimensional nonlinear equations.

UNIT 1: C++ PROGRAMMING

Constants and variables – I/O operators and statements – Header files – Main function – Conditional statements – Switch statement – Void function – Function programme – Loops: for, while and do while statements – Arrays – Break, continue and goto statements.

UNIT 2: CURVE FITTING AND INTERPOLATION

Curve fitting: Method of least-squares – Normal equations – Straight-line fit – Exponential and power law fits. Interpolation: Newton interpolation polynomial – Linear interpolation – Higher-order polynomials – First-order divided differences – Gregory-Newton interpolation polynomials – Truncation error.

UNIT 3: SOLUTION OF LINEAR AND NON-LINEAR EQUATIONS

Simultaneous linear equations: Gauss elimination method – Jordan's modification – Inverse of a matrix by Gauss-Jordan method. Roots of nonlinear equations: Newton-Raphson method – Termination criteria – Pitfalls – Order of convergence.

UNIT 4: NUMERICAL INTEGRATION AND DIFFERENTIATION

Numerical Integration: Newton-Cotes quadrature formula – Trapezoidal, Simpson's 1/3 and 3/8 rules – Errors in the formulas – Composite Trapezoidal and Simpson's rules – Errors in the formulas. Numerical Differentiation: First-order derivative – Two and four-point formulas – Second order derivative – Three- and five-point formulas.

UNIT 5: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

First-order equations: First-order Euler method – Local and global truncation errors – Fourth-order Runge-Kutta method – Geometric description of the formula – Error Versus step size. Second-order equations: Euler methods and Fourth-order Runge-Kutta method – Symplectic methods for conservative linear harmonic oscillator.

3.14.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion .

3.14.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.14.5. Suggestive readings:

1. M. Lakshmanan and S. Rajasekar, *Nonlinear Dynamics: Integrability Chaos and Patterns* (Springer-Verlag, Berlin, 2003)
2. M. Lakshmanan and K. Murali, *Chaos in Nonlinear Oscillators*, (World Scientific, Singapore, 1996)
3. A. Fuchs, *Nonlinear Dynamics in Complex Systems: Theory and Applications for the Life-, Neuro- and Natural Sciences* (Springer, 2013)
4. S. H. Strogatz, *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering*, II Edition (CRC Press, 2014)
5. C. Misbah, *Complex Dynamics and Morphogenesis: An Introduction to Nonlinear Science* (Springer, 2017)
6. S. Wolfram, *A New Kind of Science*, (Wolfram Media Inc., 2002)
7. H. G. Schuster, *Deterministic Chaos: An Introduction* (Wiley-VCH, 2005)
8. J. R. Hubbard, *Programming with C++* (McGraw-Hill, New Delhi, 2006).
9. J. H. Mathews, *Numerical Methods for Mathematics, Science and Engineering* (Prentice-Hall of India, New Delhi, 1998).
10. S. Rajasekar, *Symplectic Integrators for Hamiltonian Systems* (Preprint, 2018).
11. Jin Li, A.D. Heap, *Environmental Modeling & Software* 53 (2014) 173-189.
12. https://www.lce.hut.fi/teaching/S-114.1100/lect_9.pdf.
13. https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods
14. S. Rajasekar and R. Velusamy, *Quantum Mechanics: The Fundamentals* (CRC Press, Boca Raton, 2015). W. H. Press, B. P. Flannery, S. A. Teukolsky, W. T. Vetterling, "Numerical Recipes, the Art of Scientific Computing". There are many versions. I am using the fortran version, 2nd Ed., Cambridge, 1992. This version is in the physics library on reserve.
15. Strang, G., "Introduction to Applied Mathematics", Wellesley-Cambridge Press, 1986.

3.16 PHYSICS PRACTICAL - D

Credit: 4

Semester: S -6

3.16.1. Learning outcome:

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

- explain the internal architecture and characteristics of an op-amp
- analyse the linear and nonlinear applications of op-amps
- design electronic circuits using ExpEYES and open-source software
- develop the skill of observation, analysis and data interpretation
- write an effective lab report with meaningful conclusions

3.16.2. Experiments

1. Astable Multivibrator using ExpEYES / VCO
2. Phase shift oscillator / Wien bridge oscillator
3. Active clippers
4. Second order low pass / high pass filters (LTspice)
5. First order lowpass and high pass filter

3.16.3. Suggestive mode of transaction:

Experimentation, Demonstration

3.16.4. Suggestive mode of assessment:

In lab- experimentation, Semester examinations.

3.16.5. Suggestive readings:

1. Albert P. Malvino & David J. Bates, (2009), Electronic Principles, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
2. Grob. B., (2007). Basic Electronics, (10th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
3. Jacob Millman & Christos C. Halkias, (2006). Electronic Devices and Circuits, New Delhi: Tata McGrawHill Publishing Company Ltd. Print.

Chemistry
Semester – VI

3.14 INORGANIC CHEMISTRY – III

Credit: 4

Semester: S-6

3.14.1. About the course:

This course deals with different forms of carbon, metallaboranes, Nitrogen group properties, Oxygen group properties and solid-state chemistry.

3.14.2. Learning outcome:

On successful completion of this course learners will be able to:

- Understand periodic trends and chemistry of various elements.
- Students after completing this course may relate chemical properties of various elements with respect to their position in the periodic table.
- To understand the boron and carbon groups in periodic table.
- To understand solid state chemistry.

UNIT I (BORON AND CARBON GROUPS-BASIC TREATMENT) compounds of boron with the electronegative elements, metallaboranes and carboranes. Compounds of carbon with the electronegative elements, diamond, graphite, fullerene, carbides.

UNIT II (NITROGEN GROUP- BASIC TREATMENT) Nitrogen group: Introduction; hydrides; nitrides, phosphides and arsenides; halides, oxo-halides and complex halides; Oxides, oxo-acids and sulphides of N, P, As, Sb and Bi; Phosphazenes; Aqueous solution chemistry; Organic derivatives. Nonaqueous ammonia.

UNIT III (OXYGEN GROUP- BASIC TREATMENT) Oxygen group: Introduction; Hydrides; Halides, Oxo-halides and complex halides, Oxides, Oxo-acids and their salts; Sulphur-nitrogen compounds; Aqueous solution chemistry of S, Se and Te; Organic derivatives. Nonaqueous SO₂.

UNIT IV (ACIDS AND BASES) Bronsted acids and bases: Bronsted acid, periodic trends in Bronsted acid, polyoxo compound formation; Lewis acids and bases: definitions, strengths, representative Lewis acids, heterogeneous acid-base reactions. HSAP principle and its applications.

UNIT V (SOLID STATE CHEMISTRY) Inorganic Solids: Ionic solids, close packing, radius ratio, Structure of ionic crystals, ionic radii, lattice energy; crystal structure, defects structures, insulators, semiconductors and superconductivity.

3.14.3. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.14.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.14.5. Suggestive Readings:

1. A. G. Sharpe, Inorganic Chemistry, 3ed, Addison-Wesley, 1999.
2. J. D. Lee, A New Concise Inorganic Chemistry, 3ed, ELBS, 1987.
3. B. Douglas, D. McDaniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3ed, John Wiley, 2001.
5. L. Jolly, Modern Inorganic Chemistry, 2ed, McGraw-Hill, 1991.
6. D. F. Shriver, P. W. Atkins, C. H. Langford, Inorganic Chemistry, ELBS. 1990.

**3.15 ORGANIC CHEMISTRY – III
(BIOORGANIC CHEMISTRY)****Credit: 2****Semester: S-6****3.15.1. About the course:**

This course deals with hetero-aromatics, chemistry of Carbohydrates and Lipids, structure and functions of amino acids, peptides and proteins.

3.15.2. Learning outcome:

On successful completion of this course learners will be able to:

- Learn effect of replacing carbon/s by heteroatom/s on properties of aromatic hydrocarbons.
- Apply the functional group transformations in synthesis of hetero-aromatics.
- Recognize the structure and chemistry of biomolecules.
- Characterize the simple organic molecules through spectroscopic techniques.

UNIT I CHEMISTRY OF HETEROAROMATICS

Chemistry of five and six-membered aromatic heterocycles with one hetero atom and benzo-fused hetero-aromatics with one/two heteroatoms.

UNIT II CHEMISTRY OF CARBOHYDRATES AND LIPIDS

The structure, functions and chemistry of carbohydrates and lipids.

UNIT III AMINO ACIDS, PEPTIDES AND PROTEINS

The structure, functions and chemistry of peptides, amino acids and proteins.

3.15.4. Suggestive mode of transaction:

Lectures, presentations, group discussions and demonstration method.

3.15.4. Suggestive mode of Assessment:

Assignments, class test, problem solving, Semester examination.

3.15.5. Suggestive Readings:

1. Organic Chemistry, P. Y. Bruice, Pearson Education, 7ed, 2013
Further Reading:
2. Heterocyclic Chemistry at a Glance, J. A. Joule and K. Mills, Blackwell Publishers, 2007, USA.
3. Heterocyclic Chemistry, Thomas L. Gilchrist, Pearson Education, 3ed, 2005, India.
4. Organic Chemistry, W. H. Brown, C. S. Foote, B. L. Iverson and E. V. Anslyn, Brooks/Cole Cengage Learning, 6ed, 2012.
5. Organic Chemistry, Leroy G. Wade, Pearson Education; 8ed, 2016, India

3.16 PRACTICAL – D**Credit: 2****Semester: S-6****3.16.1. About the course:**

This course deals with extraction process of compound, isolation process, preparation of organic compound and UV- Vis spectral recording and IR spectral recording.

3.16.2. Learning outcome:

On successful completion of this course learners will be able to:

- Extract caffeine from tea leaves.
- Perform one step organic compounds.
- Prepare a methyl orange indicator.
- Improve analytical skill.
- Record UV-Vis spectral values and interpret data.
- Record IR spectral values and interpret data.

1. Separation of cations in a given mixture through ion exchange column and estimation by volumetric / gravimetric methods
2. Extraction of caffeine
3. Isolation of nucleic acid from banana
4. One step synthesis of organic compounds
 - a) Preparation of chalcone.
5. Preparation of methyl orange.
6. Bromination of acetaConsult Course Tutoride
7. Reduction of carbonyl compounds.
8. UV-Vis spectral recording for simple organic inorganic compounds/ions –Theory is not necessary. Experiment should familiarize the techniques to the students
9. IR spectral recording for sample organic/inorganic compounds/ions – To familiarize the technique to the students
10. Solvent extraction of selected organic/inorganic compounds/ions

3.16.3. Suggestive mode of transaction:

Demonstration, experimentation.

3.16.4. Suggestive mode of Assessment:

In lab-experimentation and semester examination.

3.16.5. Suggestive Readings:

1. Mendham, J., Denney, R.C., Barnes, J.D.; Thomas, M.J.K. (2000); Vogel's Quantitative Chemical Analysis, PrenticeHall.ISBN:978-0582226289.
2. Harris,D.C.(2007),QuantitativeChemicalAnalysis,6thEd.,Freeman.ISBN:978-0716744641.
3. Wilson,K.;Walker,J.(2000),PrinciplesandTechniquesofPracticalBiochemistry,Cambridge University Press.ISBN: 978-0521651042.
4. Mikes,O.(2000),LaboratoryHandbookofChromatographicmethods,VanNostrandCompanyInc.ISBN: 978-0442053642.

5. Fifeild, F. W.; Kealey, D. (2000), Principles and Practice of Analytical Chemistry, Wiley. ISBN: 9780632053841.
6. Harris, D. C. (2007), Exploring Chemical Analysis, W. H. Freeman and Co. ISBN: 978-0716705710

Mathematics
SEMESTER-VI

CORE 12: REAL ANALYSIS- II

Credit: 4
Semester: S-6

About the Course

Real analysis-II is the continuation part-I, It is a branch of mathematical analysis that analyses the compact metric space sets of measure Derivatives hyperbolic functions.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

- UNIT I** More about open sets - Connected sets. Bounded sets and totally bounded sets - Complete metric spaces.
- UNIT II** Compact metric spaces Continuous functions on compact metric Spaces – Continuity of the inverse function- Uniform continuity.
- UNIT III** Sets of measure zero - Definition of the Riemann integral - Existence of the Riemann integral - Properties of the Riemann integral
- UNIT IV** Derivatives - Rolle's theorem - The Law of the Mean - Fundamental theorem of Calculus - Improper integrals.
- UNIT V** Hyperbolic function - The exponential function - The logarithmic function - Definition of x^a - The trigonometric function - Taylor Theorem - L'Hopital's rule.

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report
- Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

- Prescribed Text (specify sections clearly)** *Methods of Real Analysis, Treatment as in Richard R. Goldberg, (1970)*
Unit 1: 6.1 to 6.4
Unit 2: 6.5 to 6.8
Unit 3: 7.1 to 7.4
Unit 4: 7.5 to 7.10
Unit 5: 8.1 to 8.7
- Reference Books**
1. *First Course in Mathematical Analysis* by Dr.Somasundaram & B Choudhyri- Narosa Publishinghouse New Dehli
 2. *Real Analysis-* by Shanti Narayanan
- e-Learning Source** <http://ndl.iitkgp.ac.in>
<http://ocw.mit.edu>
<http://mathforum.org>

SEMESTER-VI
CORE 13: COMPLEX ANALYSIS- II

Credit: 4**Semester:S -6****About the Course**

Complex analysis-II is the continuation of Part-I, it is known as one of the classical branches of mathematics and analyses complex numbers concurrently with their functions, limits, derivatives, manipulation, and other mathematical properties. Complex analysis is the study of complex numbers together with their derivatives, manipulation, and other properties. Complex analysis is an extremely powerful tool with an unexpectedly large number of practical applications to the solution of physical problems.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I Contour integrals- - Examples - The Cauchy Goursat's theorem - A preliminary lemma - Proof of Cauchy Goursat's theorem - Simply and multiple connected domains.

UNIT II The Cauchy integral formula -Derivatives of analytic functions - Morera's theorem - Maximum moduli of functions-Liouville's theorem- The fundamental theorem of algebra.

UNIT III Convergence of sequences and series - Taylor series - Observations and examples – Laurent Series (statement only).

UNIT IV Singularities - Definitions and examples - Residues - The residue theorem - The principal part of a function - Residues and poles – zeros and poles of order m.

UNIT V

$$\text{Type 1: } \int_{-\infty}^{\infty} \frac{p(x)}{q(x)} dx$$

$$\text{Type 2: } \int_{-\infty}^{\infty} \frac{p(x)}{q(x)} \sin ax \, dx \text{ or } \int_{-\infty}^{\infty} \frac{p(x)}{q(x)} \cos ax \, dx$$

$$\text{Type 3: } \int_0^{2\pi} F(\sin \theta, \cos \theta) d\theta$$

where $p(x)$ and $q(x)$ are real polynomials with no factor in common and $q(x)$ has no real zeros.

Suggestive Practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.

- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction • Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

Prescribed Text(specify sections clearly)	Complex Variables and Applications, James Ward Brown and Ruel V Churchill, McGraw - Hill, International Edition (1990) Unit I : Chapter 4:Section 34-38 Unit II: Chapter 4 Section 39-43 Unit III:Chapter 5:Section 44-48 Unit IV:Chapter 6:Section 53-57 Unit V:Chapter 6:Section 58-60
Reference Books	<ol style="list-style-type: none"> 1. Functions of a Complex variable by B. S. Tyagi – KedarNath RamNathPublishers(P) Ltd. 2. Complex Analysis by P. Duraipandian and KayalalPachaiappa – S.Chand& Co. 3. S. Ponnusamy, Foundations of Complex analysis, (2nd Edition), Narosa,2011. 4. V.Karunakaran, Complex Analysis, (2nd Edition), Narosa 2005
<i>e-Learning Source</i>	http://ndl.iitkgp.ac.in http://ocw.mit.edu http://mathforum.org

Credit: 2
Semester: S-6

4.4.3.1 About the Course:

Development of 21st century skills are important for Mathematics teaching learning. Learning the imagination, spatial visualization, mathematical reasoning is important for novice learners. The course comprises three units describing 21st century skills for learning, assessment and evaluation and research and innovative practices in teaching learning Mathematics. This course also aims to improve skills and competencies required for Mathematics teachers to conduct effective learner assessments. The course describes various evaluation strategies and devices which can be efficiently used in the teaching learning of Mathematics and in the development of skills among the student teachers for improving student outcomes, conduct action research and school-based research in the teaching of Mathematics.

4.4.3.2 Learning Outcomes

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

- analyze the sources of the development of 21st century skills through Mathematics teaching and learning,
- determine role of teacher in facilitating learning and creating dynamic learning environment of Mathematics,
- describe need for and importance of assessment in the learning process of Mathematics,
- develop various types of tests for assessing students learning in Mathematics,
- design and develop innovative strategies and techniques for successful inteaching and learning Mathematics,
- conduct school- based research in Mathematics teaching,
- explain the various methods of exploring knowledge,
- explore innovative ideas for teaching and learning of Mathematics,
- assess the steps of action research.

UNIT - I

21st Century Skills for Learning Mathematics

- A. Need for and importance of how to learn 21st century skills such as practicing imagination, spatial visualization, mathematical reasoning, problem solving for learners and teachers of Mathematics.
- B. Psychological, sociological, and philosophical perspective of teaching learning and development of Mathematics.
- C. Qualities of a Mathematics teacher as professional.
- D. Role of a teacher in facilitating learning and creating dynamic learning environment of Mathematics.

UNIT - II

Assessment for Learning in Mathematics

- A. Meaning, need and organization of oral, written, and practical assessment in Mathematics.
- B. Construction of types of questions in Mathematics: objective, short answer, long answer, considerations for the marking different types of questions in Mathematics.
- C. Planning and developing teachers made tests in Mathematics - Table of Specification (TOS), question paper setting and preparing answer key.
- D. Tools to identify learning difficulties and provide corrective measures in Mathematics, concept of 360° assessment, holistic progress card and assessment of mathematical aspects of students.

UNIT - III

Research and Innovative Practices in Teaching of Mathematics

- A. Divergent thinking for innovation in psychological, sociological, and philosophical perspectives of Mathematics for quality learning experiences.
- B. Innovative practices in Mathematics.
- C. Research on issues of gender, class and culture in Mathematics learning and achievement - expectations, attitudes and stereotypes; access to higher Mathematics; interrogating the notion of 'Achievement Gap'; construction of learners' identity in a Mathematics classroom.
- D. Recent trends and research related to teaching learning of Mathematics – digital gaming, digital storytelling, using Artificial Intelligence for Mathematics teaching and learning.
- E. Action research for solving problems of teaching and learning of Mathematics: meaning, significance, steps, and planning.

4.4.3.3 Suggestive Practicum (Any Three)

1. List 21st century skills with reference to various topics of school Mathematics.
2. Writing a paper on recent trends and research related to teaching learning of Mathematics.
3. Prepare a scrap book for 'Mathematics in Print Media'.
4. Prepare a small video for recent trends of Mathematics in social media.
5. Plan a teacher made test for a unit of secondary Mathematics.
6. Prepare a report after using an innovative idea to teach a difficult topic of secondary Mathematics.
7. Plan for action research on any one problem of teaching learning Mathematics.
8. Any other project assigned by HEI.

4.4.3.4 Suggestive Mode of Transaction

Lecture cum discussion, group work, ICT enabled methods, activity based and art integrated demonstration, field-based experiences, library visits, self-study, field observations, assignment preparation, classroom presentations, discussion forums, observation, flip classroom, use of digital platform.

4.4.3.5 Suggestive Mode of Assessment

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

4.4.3.6 Suggestive Reading Material

- NCERT (2012). Pedagogy of Mathematics
- NCERT: Manual for Higher Secondary Mathematics Kit (Code- 3165)

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

Content cum Pedagogy of Physical Sciences at Secondary Stage - Course (III)

Credit: 2
Semester: S-6

4.4.4.1 About the Course

This course comprises three units and a practicum. It focuses on assessment and evaluation. It also focuses on assessment based on learning outcomes, strategies for continuous assessment, school-based assessment, formative and summative assessment including 360° assessment. Student teachers are expected to identify various concepts and processes, list learning and behavioral outcomes, find out about various activities and experiments, and identify relevant evaluation techniques and strategies. It focuses on Psychological, Sociological and Philosophical Perspective of Activity Oriented Classrooms in Physical Sciences. The importance of planning science learning and teaching in secondary schools. In this course student teachers will learn how to plan different types of activities in online and offline mode. It emphasizes how to integrate and use ICT in the classroom of Physical Sciences. Assessment serves the dual purpose of tracking the performance of the learners as well as feedback mechanism for effectiveness of teaching. Today's scenario emphasizes competency-based assessment practices and tests higher order thinking skills and conceptual clarity. Major reforms in assessment are need of the hour to stay vibrant and effective in the process of teaching learning of Physical Sciences.

4.4.4.2 Learning Outcomes

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

- explain the significance of acquiring 21st-century skills for Physical Sciences teaching,
- outline the need for and importance of assessment and evaluation in the teaching of Physical Sciences,
- appraise with various assessment strategies for continuous assessment in reference to teaching of Physical Sciences,
- utilize appropriate tools and techniques for assessment and evaluation in teaching learning of Physical Sciences,
- identify recent trends in research related to the teaching and learning and its implications in teaching learning of Physical Sciences,
- prepare unit test item based on TOSS and develop different types of test items,
- construct and administer different type of tests,
- plan offline and online activities for testing higher order thinking skills in teaching learning of Physical Sciences,
- relate ICT integration and elaborate its use in classroom situations,
- identify a problem in the context of Physical Sciences teaching learning and plan action research.

UNIT - I**21st Century Skills for Learning**

- A. Need for and importance of how to learn 21st century skills for learners and teachers of Physical Sciences.
- B. Psychological, sociological, and philosophical perspective of teaching and learning Physical Sciences.
- C. Qualities of a Physical Sciences teacher as professional for enhancing teaching learning skills.
- D. Role of a teacher in facilitating learning and creating dynamic learning environment of Physical Sciences.

UNIT - II**Assessment and Evaluation**

- A. Assessment and evaluation: need for and importance of Physical Sciences.
- B. Assessment based on learning outcomes, strategies for continuous assessment, school-based assessment, qualitative assessment; formative and summative assessment, formal, informal and 360° assessment.
- C. Performance assessment: assessment of group activities, field observations, recording and reporting, creating platform and portfolio management, assessment of laboratory skills, assignments, projects, and presentations.
- D. Tools and techniques of assessment and evaluation - unit test based on Table of Specification (TOS) and its importance, basic steps of question paper setting, types of test items and preparing answer key and criteria for school, assessment, and feedback mechanism in teaching learning the content of Physical Sciences.

UNIT - III**Research and Innovative Practices in Physical Sciences**

- A. Divergent thinking and innovation in psychological, sociological, and philosophical perspectives for quality learning experiences.
- B. Recent trends in research related to teaching learning of Physical Sciences.
- C. Action research: meaning, significance, steps and planning.
- D. Evidence-based practices and reflection, school-based research in Physical Sciences.

4.4.4.3 Suggestive Practicum (Any Three)

1. Prepare, administer, and analyze scores of an achievement test.
2. Explore AI based assessment tools and prepare an E-Portfolio for a student of Secondary Stage.
3. Conduct Simulated Teaching session for the concepts of Physical Sciences and observation by self, peer, and teacher.
4. Explore development of multidisciplinary projects and present using PowerPoint.
5. Interpret the concept of Physical Sciences with Psychological, Sociological and Philosophical Perspective.
6. Apply innovative practices in classroom teaching learning of Physical Sciences.
7. Make a presentation on the role of Physical Sciences in sustainable development of society.
8. Plan action research for Continuous Professional Development (CPD) of Physical Sciences teacher.
9. Any other project assigned by HEI.

4.4.4.4 Suggestive Mode of Transaction

Lecture cum discussion/demonstration, demonstration, discovery approach, project approach, inquiry approach, problem-solving, experiential learning.

4.4.4.5 Suggestive Mode of Assessment

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

4.4.4.6 Suggestive Reading Material

4-Year Integrated B.SC.B.Ed.

Pondicherry University

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

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

COURSE TITLE: Mathematical and Quantitative Reasoning**Credits: 2****Semester: S-6****5.7.1 About the Course**

This course introduces the student teachers to study the basic mathematical & quantitative reasoning for their practical usage. This course is designed to provide student teachers with the knowledge and capacities required to analyze, interpret, and communicate quantitative data. Student teachers will learn to think critically about data and use quantitative reasoning to solve real-life problems.

5.7.2 Learning Outcomes

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

- adapt mathematical reasoning to solve problems in the real world and explain some fundamental ideas and tenets in this field,
- analyze and interpret quantitative data,
- interpret & deduce the right conclusions from numerical representations like formulas, graphs, or tables,
- demonstrate critical thinking and problem-solving skills using mathematical and quantitative reasoning methods,
- evaluate operational matrix,
- analyze educational data and create educational model & use them in decision making,
- analyze and evaluate mathematical and quantitative reasoning problems and solutions.

UNIT - I**Introduction to mathematical and quantitative reasoning**

- A. Meaning, nature and scope of mathematical and quantitative reasoning.
- B. Importance of mathematical and quantitative reasoning in various fields.
- C. Types of quantitative reasoning.
- D. Usage of mathematical and quantitative reasoning.
- E. Concept of mathematization.

UNIT - II**Introduction to data in Education**

- A. Data requirement, different sources of data
- B. School enrolment: gross enrolment ratios, net enrolment ratios, educational progression: dropout rate, literacy: measures of literacy
- C. Indian censuses, details of different items on which Indian censuses collect data.
- D. Nationwide sample surveys, National family health survey, District level household survey, UDISE

UNIT - III**Data Analysis & Interpretation**

- A. Concept of data interpretation (equation, diagram, graph, tables)
- B. Statistical analysis of data in educational context and its applications (measures of central tendency, measures of variability, percentile)
- C. Visual and numerical representation of data and its application (bar diagram, histogram, pie charts)
- D. Learning analytics: concept, significance, types, levels, and its applications in educational context.

5.7.3 Suggestive Practicum

1. Take last 5 years UDISE data and analyze various indicators related to schools, teachers, and students.

5.7.4 Suggestive Mode of Transaction

The approaches to curriculum transaction will focus on developing the analytical and critical thinking skills of students, as well as their ability to apply mathematical and quantitative reasoning in real-life situations. Some of the approaches to curriculum transaction will include the following:

- Active Learning which involves active participation of student teachers in problem-solving situations, group discussions, and hands-on activities that help student teachers engage with the material and apply mathematical thinking and reasoning to solve problems.
- Real-World Applications involving the use of real-world examples to demonstrate the practical applications of mathematical concepts that help student teachers see the relevance of what they are learning and how it can be applied in various fields.
- Collaborative learning encourages student teachers to work together in small groups, where they can share ideas and help each other learn. This fosters a sense of community in the classroom and helps students develop teamwork and communication skills.
- Technology Integration involves the incorporation of technology tools such as calculators, spreadsheets, and interactive software to help student teachers visualize and solve mathematical problems more easily.
- Overall, a pedagogy that combines active learning, real-world applications, collaborative learning, technology integration, and effective assessment strategies that help student teachers develop a strong foundation in mathematical and quantitative reasoning.

5.7.4 Suggestive Mode of Assessment

Use of a variety of assessment methods such as quizzes, exams, group projects, and presentations to evaluate student learning. Providing timely feedback and offering opportunities for students to revise their work and improve their understanding.

5.7.6 Suggested Reading Materials

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

School Observation

Credit:2

Semester:S-6

6.2.1 About the Course

As school is the heart of the teacher education programme, the student teachers need to gain hands-on experiences from various activities organized by the school. School observation offers an opportunity to learn the processes and practices in a school setup. To expose the student teachers to various schooling systems (urban, rural, tribal, residential, non-residential, government, private, affiliated to different school boards like Central Board, State Board, International Board) prevailing in the country. School observation will also prepare the student teachers to build relationships with various stakeholders. The school observation by the student teachers is aimed at helping them build perspective in the schooling system, student needs, pedagogies, and assessment.

6.2.2 Learning Objectives

After completion of school observation program, student teachers will be able to:

- get acquainted with various schooling systems.
- experience the processes, practices, and overall environment of the school.
- establish a rapport with all the stakeholders of the school system.
- observe the process of conducting different activities in the school.
- study availability and the work of human resources, including members of school management (SMC), school head, teachers, administrative and support staff)
- observe the existing infrastructure available in the schools (classrooms, libraries, laboratories, playground, sanitation, drinking water facility, mid-day meal facility, inclusive facilities, safety and security, rainwater harvesting).
- observe and document the availability and usage of TLM, including ICT.
- study the available physical and digital documents, including UDISE data.
- study interpersonal relationships among the stakeholders.
- study various assessment processes adopted in different types of schools for holistic development of children.
- prepare and present a comprehensive profile of the schools observed (including classroom processes)
- study the engagement of parents and other community members in school activities.

6.2.3 Suggestive Mode of Transaction

- Observation
- Interaction
- Discussion
- Reviewing the available literature on the different schooling system
- Collection of relevant documents and data

Preparation for school observation

- Orientation on the school observation process
- Development of the observation formats/tools

School Observation (minimum three types of schools)

- Student teachers will go for school observation in small groups to observe and collect data by using the developed formats/tools.
- Analysis of the collected data
- Preparing a comprehensive profile of the schools observed

Post-school observation session

- Group-wise presentation of the school profile
- Discussion and Feedback
- Reflection on the understanding of various types of schooling systems.

6.2.4 Content

The school observation as a field-based activity will cover observation of school and classroom processes. The student teachers under the mentorship of teacher educators will visit schools, interact with teachers and students and other stakeholders, and relate the observation with the courses studied during the previous semesters, i.e. Foundations of Education, Disciplinary Courses, Pedagogy courses and Ability Enhancement & Value-Added Courses.

- Meaning and Nature of school observation process
- Difference between monitoring and observation
- Theory and practices of school observation components such as:
 1. Schooling system
 2. Rapport with all the stakeholders
 3. Office management procedures of different types of schools
 4. School environment in all perspectives
 5. Process of conducting curricular activities in the schooling process
 6. Existing infrastructure available in the school
 7. Utility of ICT and TLM facilities
 8. Interpersonal relationships among the stakeholders
 9. Various assessment processes adopted in different types of schools.
- 10. Engagement of parents and other community members in school activities.

6.2.5 Activities to be conducted.**6.2.5.1 Foundational Stage**

- Visit to preschool, Balvatika, and classes I and II (foundational stage/ standalone Anganwadi, standalone preschool, co-located Anganwadi and preschools/Balvatika sections in school set up)
- Collect information on the demography of students in preschool, classes I and II, linkage of foundational with the preparatory stage through interaction with teachers, students, and staff.
- To study the use of print materials like collages, flashcards and activities related to foundational literacy and numeracy through classroom observation.
- Observe the activities related to FLN, use of mother tongue as medium of instruction and handling classrooms with children from different home languages.
- Observation of pedagogic practices at preschool, classes I and II
- Observe the use of local/traditional toys, stories, rhymes, songs, games, riddles in the class.

- Observation of availability and usage of reading corners, fun zones,
- Observation of play areas across the foundational stage (both indoor and outdoor)
- Study the practices followed by the school for the growth and health of children- provision of supplementary nutrition, immunization, health check-ups, and referral services.
- Presentation of the classroom observations (play activities and FLN practices) and discussions in groups
- Observation of assessment tools and practices at foundational stage

6.2.5.1 Preparatory Stage

- Visit three types of schools with observation formats developed in the institute and get acquainted with various schooling systems. Establish rapport with all stakeholders.
- Collect information on the demography of students in classes III to V, the link of the preparatory stage with the foundational and middle stages through interaction with teachers, students, and staff.
- Observation of classroom practices to study toy-based, art-integrated, and sports-integrated pedagogy.
- Observe the activities related to holistic assessment as recommended in NEP 2020 and NCFSE.
- Observation of play areas across the preparatory stage (both indoor and outdoor)
- Observe school processes and the extent of transaction of the curriculum through play, discovery, and activity-based and prepare a report.
- Reflect on effective classroom teaching learning strategies.

6.2.5.2 Middle Stage

- Visit three types of middle schools with observation formats developed in the institute and get acquainted with various schooling systems. Establish rapport with all stakeholders.
- Collect information about the demography of students in classes VI to VIII and understand the linkage of the middle stage with the secondary and preparatory stages through interaction with teachers, students, and staff.
- Observe school processes and curriculum transactions through experiential learning and prepare a report.
- Interact with teachers and students and report on implementing ten bag-less days and skill development courses.
- Reflect on effective classroom teaching learning strategies.
- Observe integration of IKS, values, local resources in teaching learning process
- Observe practice and assessment of vocational education in the school.
- Observe the availability and usage of library resources, laboratories (General Science, Mathematics, Languages, Social Science, Computer), sports facilities, and art and music learning facilities.
- Study the provision of other student support services- guidance and counselling, scouts and guides, and health and wellness programme.

6.2.5.3 Secondary Stage

- Visit three types of secondary schools with observation formats developed in the institute and get acquainted with various schooling systems. Establish rapport with all stakeholders.
- Collect information about the demography of students in classes IX to XII and understand the linkage of the secondary stage with the middle stage and higher education through interaction with teachers, students and staff.
- Observe school processes and transactions of the curriculum through experiential learning and prepare a report.
- Interact with teachers and students and report on implementing ten bag-less days and internship opportunities to learn vocational subjects.
- Study the available opportunities for learning interdisciplinary subjects.
- Observe the availability and usage of library resources, laboratories (Atal Tinkering Lab, Physics, Chemistry, Biology, Mathematics, Languages, Social Science, Computer), sports facilities, and art and music learning facilities.
- Study the provision of other student support services- guidance and counselling, NCC, NSS, health and wellness programme.
- Observe the organization of various activities like classroom teaching-learning processes, laboratory activities, library activities, sports and games, debate/elocution/essay writing and other competitions.
- Interact with School heads and subject teachers to understand how students are evaluated by following different tools and techniques of evaluation, how examinations are conducted, how answers are assessed, and how the result is communicated to parents in atleast two different types of schools.

6.2.6 Assessment

Competence/Artifact	Method of assessment	Assessed By	Credits
Involvement and active participation during the school visit	Observations	Teacher Educator	0.5
Comprehensive school profile	Presentation & reflection	Teacher-Educator	1.5

6.2.7 Outcomes

Student teachers will be able to:

- describe various schooling systems,
- describe the processes, practices and overall environment of the school,
- establish rapport with the stakeholders of the school system state the process of conducting different activities in the school,
- describe the available school infrastructure (classrooms, libraries, laboratories, playground, sanitation, drinking water facility, mid-day meal facility, inclusive facilities, safety and security, rainwater harvesting),
- describe the availability and usage of ICT and TLMs,

- summarize the available documents in both physical and digital modes, including UDISE data,
- reflect upon relationships among the stakeholders,
- analyze various assessment processes adopted in different types of schools,
- prepare and present a comprehensive profile of the schools observed (including classroom processes).

6.2.8 Suggested Components for school observation report

- School information (Context, Vision and Mission, Association with the Board)
- School Infrastructure
- Provision for CWSN/Divyang Children
- Inclusiveness at all levels
- Teacher-Student Ratio
- Teaching-Learning process
 - Academic plan
 - Classroom activities
 - Assessment
- School Development Plan (SDP)
- Academic Calendar
- Administrative processes
 - Maintenance of students' records
 - Maintenance of teachers' records
- Cultural activities
- Sports activities
- Annual Day
- National and Social functions
- School Management
- School Discipline
- Interpersonal Relationships
- Understanding different types (socio-economic status, ability) of students and their needs
- Development of ICT and TLMs
- Engagement of parents and community members in the school activity
- Office Management
- The assessment process includes provision and practices for 360-degree holistic assessment.
- The overall progress of the school (planning, organizing, staffing, directing, motivating and controlling)
- Challenges faced and overcoming them.
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SEMESTER-VII

SEMESTER 7**CONTENTS**

Course Code	Curricular Component	Name of the Course	Credits	Total	Page No.
FE06	Foundations of Education	Perspectives of School Leadership & Management	2	4	200-201
FE07		Curriculum Planning and Development (Text book, Material Development, Etc) – Stage Specific	2		202-204
AEV108	Ability Enhancement & Value Added Courses	Art Education – II (Performing & Visual)	2	4	205-214
AEV109		Sports, Nutrition & Fitness	2		215-216
SE224	School Experience	School - based Research Project	2	12	217-218
SE225		Internship in Teaching	10		219-226
Total credits				20	

SEMESTER VII
Perspectives on School Leadership and Management

Credit: 2

Semester: S-7

2.6.1 About the Course

Amidst the changing policy landscape, the new curriculum framework, the challenge of accommodating and adapting to the changing demands and the increasing expectations that come with the culture of performativity. The role of the school leader has never been more complex. School leaders are key change agents and as instructional leaders are responsible for improving practice while navigating an increasingly challenging school environment. Understanding the school system, its nuances, the social, cultural, and political contexts and leading schools requires a strong foundation of knowledge and skills to effectively manage improvement and lead successful schools. The course on ‘Perspectives on School Leadership and Management’ is designed to equip student teachers with the competencies they need to drive school transformation and help diverse stakeholders establish priorities and improve practice.

2.6.2 Learning Outcomes

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

- describe the diversity of schools in India, its structure, its governance, issues, challenges and school leadership needs,
- critically examine the different leadership theories and practices and its relationship with the governance structures, the autonomy and accountability mechanisms and the larger educational policy context,
- critically think in relation to education leadership and its potential application to different contexts,
- reflect critically on school-based data for reflection and improvement,
- develop a culture of cooperation collaboration and teamwork,
- synthesise effectively to develop coherent and compelling arguments in the area of study,
- develop school vision, mission, goals, and School Development Plans.

UNIT - I

Understanding Indian School System

- A. School as a normative organization vis-a-vis school as a socio-emotional-cultural space for learning.
- B. Studying the diversity of schools in India; their structure, governance, socio-political and cultural context, funding, management, autonomy and accountability mechanisms, support systems.
- C. Relationship between school leadership and school diversity issues, challenges, and needs.
- D. Engagement with diversity discourses, educational policies, reforms and practices and role in developing inclusive schools.

UNIT - II

Understanding School Leadership

- A. School Leadership: concept as defined, and concept as practiced.
- B. Being a School Leader: exploring the multiple roles and responsibilities, issues and challenges of school leadership in the Indian context.
- C. What works in schools: sharing National and International best practices on School leadership.

UNIT - III**Schools as Learning Organizations: Role of School Leadership**

- A. Schools as motivating learning spaces: Developing inspiring school ethos.
- B. Schools as learning organization: promoting personal mastery, examining mental models, and developing a shared vision, team learning and a system's thinking perspective.
- C. Development of a shared vision and shaping of the school culture.
- D. Use of data for school improvement focused on students' learning, addressing equity challenges, and building an equitable school culture that promotes excellence for all.
- E. Nurturing school belongingness: engaging students, teachers, staff, parents, SMC, and community in the formulation of a whole school development plan.
- F. Designing professional and collaborative learning opportunities for self and others (teachers, parents, and SMC members) and improving teaching and learning.

2.6.3 Suggestive Mode of Transaction

Perspectives on school leadership and management is a practitioner-centric course and aims to enable future teachers to be efficient school leaders. The approach to curriculum transaction therefore would include a blend of lectures, tutorials, group-work, case-based approaches, and enquiry-based learning.

- Student teachers would engage in case-based learning on topics like improving student learning, classroom observation and feedback, planning and budgeting for school improvement, leadership in diversified school contexts and such others.
- Exposure of student teachers to virtual case studies featuring leaders from a representative cross-section of Schools in India and analyze their experiences, insights, and best practices.
- Learning activities that help student teachers to understand the entire structure and functioning of school organization through interactive lectures and panel discussion with education officers who hold leadership positions at different levels from schools to cluster, block, and district and state levels and understand their leadership issues, challenges and needs and thus get a perspective of the school ecosystem.
- Learners would reflect on their practice as pre-service interns, knowledge, skills, and understandings—and identify opportunities to apply course learnings to their school context.

2.6.4 Suggestive Mode of Assessment

Being a practitioner centric course, the assessment would largely include application-based tasks. This includes exploring the work and life of a school principal and writing a detailed report on the observations and the learning. The following are some exemplars. The institutes may choose either of these or think of other innovative assignment that would enhance the leadership learning experience:

- Preparing school vision, mission, goals, and school development plan.
- Shadowing school principals: a critical observation of the principal's daily work life.
- A critical examination of the diversity of schools; their governance structure, leadership, autonomy and accountability mechanisms, issues and challenges and work life of the school principal.

2.6.5 Suggestive Reading Materials

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

COURSE TITLE: Curriculum Planning and Development**Credit:2****Semester: S-7****2.7.1 About the Course**

The course on curriculum planning and development will introduce to student teachers to the process of designing and organizing the curriculum i.e., the totality of learning experience provided to learners through a deliberate and organized set of arrangements (the selection of subjects that are to be taught, the pedagogical approaches and practices to be pursued, books and other teaching-learning-material to be used, examinations and other forms of learning assessment, school culture and processes etc.) that contribute to the development of the knowledge, capacities, and values and dispositions that help fulfill the aims of school education derived from the purposes and goals articulated in NEP 2020.

2.7.2 Learning Outcomes

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

- discuss aims of education,
- identify and formulate of desirable values and dispositions,
- explain capacities and knowledge,
- outline curricular areas,
- demonstrate teaching-learning assessment processes and
- practice the relevance in terms of achieving the aims of school education.

UNIT - I**Education and Curriculum**

- A. Meaning, need, relationship and significance.
- B. Types of Curriculums: subject-centered, activity-centered, environmental centered,community-centered
- C. Relationship and difference between curriculum, curriculum framework, syllabus andtextbooks.

UNIT - II**Developing the Curriculum**

- A. Basic principles of Curriculum Development
- B. Concerns for developing the Curriculum - aims to be achieved, structure and nature ofdiscipline, different perspectives on learning and their implications to curriculum development, socio-cultural aspects and aspirations of society, value transitions, social efficiency and needs, environmental concerns, gender concerns, inclusiveness, technological advancement.
- C. Impact of Globalization.

UNIT - III**Approaches, Planning, and Implementation**

- A. Approaches to Curriculum Development: Learner and activity centered, Constructivist, Knowledge Construction
- B. Curriculum planning as a cyclic process.
- C. Curriculum Implementation: Operationalizing curriculum into learning situations, Converting curriculum into syllabus, Curriculum engagement activities, Role of school at Regional, State and National level for implementation.

- D. Role of teachers in operationalizing and evaluating the curriculum with special reference to: textbooks and teachers handbooks, source books, workbooks and manuals, other learning material such as kits, AV and software materials, library, laboratory, playground, neighborhood etc.

2.7.3 Suggestive Practicum

1. Arranging discussion on:
 - Basis of National curriculum frame works (1975, 1988, 2000, and 2005).
 - Document: Learning without burden” by Prof. Yashpal
2. Preparing of Report based on observation of:
 - Facilities and infrastructure to implement the present curriculum.
3. Interviewing teachers to understand their role in:
 - Implementing and assessment of the curriculum.
4. Analysis of the following in the context of principles of developing the Curriculum:
 - Guidelines of NEP, 2020.
 - Curriculum of 4 Years B.Ed. Integrated Programme
 - Learning without Burden, MHRD, and India.
 - Position paper (2006). National Focus Group on ‘Curriculum, Syllabus, Textbooks’, NCERT.
 - NCERT (1988) National Curriculum for Elementary and Secondary Education: A framework.
 - NCERT (2000) National Curriculum Framework for school Education.
 - NCERT (2005) National Curriculum Framework. NCERT publications.

2.7.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.7.5 Suggestive Mode of Assessment

- The assessment will be based on the tests and assignments.

2.7.6 Suggestive Reading Materials

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

COURSE TITLE: Art Education

5.0 Art Education (Performing and Visual) and Creative Expressions

Arts - Approach

1. Every student has to complete two courses in the Arts of 2 credits each across the Visual and Performing Arts.
2. There are many art forms within both the Visual and Performing Arts.
3. All these forms require teacher expertise as well as time and resources for the student to learn.
4. We have described three exemplar arts courses based on different forms of Visual and Performing Arts.
5. Institutions could choose to offer any specific art form based on the availability of faculty and resources. Institutions could then design their courses based on these three exemplars.

Credit: 2**Semester:S-7****5.3.1 About the Course**

The engagement with various forms of art as self-expression and the need to develop a sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective, and psycho-motor dimensions among children, as well as that through one or another art form that children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, an aesthetic judgment. This enables students as they grow into adults to have focused attention on making meaning of what surrounds them and in appreciating cultural productions. Children are naturally tuned to appreciate art, as it activates their senses. Further, their psycho-motor skills get developed through art. It gives them space to think independently, create and reflect, while working with others. It is a unique space where all the three are involved- hand, head and heart.

Therefore, students who aim to be educational practitioners, will need to bring an element of art in educational practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful. To this end in the first semester students will attend one course that aims to help them recognize and appreciate the importance of aesthetic judgment, develop familiarity with an art form and basic skills to be creative in their expressions. Skills develop from practice, therefore hands on training in doing art will be emphasised in this course. This course aims to help students develop a habit of improvising on theatrical performances that include following aesthetic judgement at all stages, which will contribute to other educational practices that they develop in the larger programme. Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and also producing content of other subject areas wherever possible.

Theatre is a collaborative art form, and it is inherently interdisciplinary in its nature. It comprises many facets and skills like acting, directing, writing, designing the sets and costumes, make-up, production, lights, sounds and music. All these elements and skill sets come together and are stitched in the form of a 'play' which is performed live, in front of an audience. In the Indian context, theatre has a deep-rooted history with its classical, folk, and other cultural forms until other contemporary forms of theatre evolved in recent times.

Theatre education for children can play a vital role in their individual, social, and emotional development. It teaches them the values of trust and interdependence, makes them confident to express themselves and helps them learn to work in a collaborative environment. It develops their ability to contextualise, critique and discuss certain questions and thoughts they encounter in everyday life. It further helps them imagine, explore, and create their own narratives.

In this course, we will briefly talk about the aesthetics of theatre and how theatre exists in different forms. The students will learn some basic theatre tools that will help them create and perform a narrative they collaboratively arrive at.

In simple terms one can say theatre has two major aspects i.e., creating the script and then performing it. Body is the primary instrument in any theatrical performance accompanied by text, material, visual and sound. This course will introduce students to these aspects of any theatre performance, in the form of direct experience by doing this themselves.

5.3.2 Learning Outcomes

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

- articulate the importance of aesthetics and art in elementary education,
- demonstrate their familiarity with and appreciation of theatre,
- learn basic theatre tools of improvisation, ideation, and creation of a script,
- create a short performance with educational possibilities.

UNIT - I**Importance of Aesthetics and Art education (2 Sessions)**

In this unit the basic idea of aesthetics and art, and ways in which the aesthetic dimension manifests itself in human life will be discussed. Using various examples of art, students will engage in identifying aesthetic aspects of daily life, develop aesthetic judgment, and gain familiarity with the role of art in education. Students will also be introduced to three aspects of art in education: The value of art itself and its use as an instrument in education; moral dimensions of works of art and the controversial distinction between the value of Popular art and High art.

UNIT - II**Introduction to Theatre, and Beginning with the body (3 Sessions)**

We will discuss some core essentials in the aesthetics of theatre like the performance, the makers, the audience, and the context and how we relate this to the world around us, in everyday lives. In this unit, we will discuss examples of how theatre was used in social movements that have contributed to educating the larger population about important social issues. Additionally, we will also learn from practices and approaches of theatre groups like Budhan Theatre who work with denotified tribes, and Manalmagudi who work closely with physical nonverbal theatre. Exposing students to these approaches will lead to rich discussions on the role of theatre in pedagogy and practice.

In this unit, students will learn certain principles and awareness on how to use their body and voice in a given space and time, with respect to other bodies. There will be several games, exercises that will familiarise them with certain basics of movement, voice, acting and thereby create improvisations and images in a given context. The activities and tasks will be both in individuals and groups.

UNIT - III**Arriving at a script
(3 Sessions)**

We will engage in some theatre making processes to arrive at a script by the end of this unit. How to adapt or devise a script with actors? How can we borrow from everyday experiences of memory, sound and visuals, without a written text or spoken word? Plays, stories, poems, newspapers articles, will be shared to read, reflect, analyse, and re-create like “Why, why Girl” by Mahashweta Devi, “Ratna Pakshi” by K Ramaiah, “Beyond the land of Hattamala and Scandal in Fairyland” by Baadal Sircar, and songs of Kabir etc. The texts chosen will have a direct relation with topics from social studies, moral and political education.

Students will use their skills of improvisation they learned in Unit 2 to explore, ideate, create, and finally arrive at a script. What kind of stories, narratives, and characters they choose to perform will lead back to the discussion of aesthetics. Students will mostly work in groups to choose or create a text, concept, or an idea which they want to perform. Students will be encouraged to use their perspectives on the education system, in converting the text into a script.

UNIT - IV Performing the script

This unit will engage in the actual making of the final piece they choose to make. Students will have to visualise the final text on stage and start rehearsing in their groups. Apart from using their bodies to play characters, the students will also have to think about design and other aesthetic elements like sets, props, costumes, lights, music and sounds they want to use in the performance.

Students will have to practice beyond the six classes as the class time will be utilised to discuss and provide feedback as the work progresses. The last two classes in this unit will be utilised for the final rehearsals and assessments. The final performance will take place in front of a small audience followed by a brief post-performance discussion. Students will engage in discussing and reflecting on the views, questions and comments shared by the audience.

5.3.3 Pedagogy

The pedagogy is basically hands-on training. More emphasis is given to experiential learning. They do things and through doing, they learn about art and its connection to education. The process takes you through different forms of art- fine arts, playing with colours, costume designing, facial make -up, script writing, music, and performance.

Suggestive Mode of Assessment

Details to be determined by the faculty member as per applicable UGC norms.

Week wise break up of sessions		
Week	Topics	Session flow
1	UNIT - I: Aesthetics and art, art in everyday life. Importance of art. Appreciation of art	Based on their experience
2	Art for art's sake. Art with social responsibility. Art for social change	Discussion
3	UNIT 2: Aesthetics of Theatre	Discussion
4	Body work - Individual and group	Hands on
5	Body work – Improvisation	Hands on
6	UNIT - III: Adaptation of texts. Aesthetic choices.	Hands on, discussion
7	Story making and devising	Hands on
8	Arriving at a text	Hands on
9.	UNIT - IV: Visualising the final piece. Thinking about design and aesthetic elements.	Hands on, Discussion
10.	Rehearsals and feedback	Hands on

11.	Rehearsals and feedback	Hands on
12.	Final rehearsals and assessment	
13.	Finals rehearsals and assessment	
14.	Performance and audience discussion	

5.3.4 Suggestive Reading Materials

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

COURSE TITLE: Arts (Performing and Visual) and Creative Expressions Exemplar 3 - Collage-Making**Credit: 2****Semester: S-7****About the Course**

Engagement with various forms of art as self-expression and the need to develop sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective and psycho-motor dimensions among children, as well as that through one or another art form, children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, aesthetic judgment. This enables students as they grow into adults to have focused attention on making sense of and appreciating cultural productions.

Children enjoy artwork a lot. They explore and find meaning in artwork. Their psycho-motor skills get developed through art. The huge element of socialization is acquired through different forms of art. They get to know each other and understand each other and make friends through art. They develop their peer group through getting involved in art forms. Learning to work with others is also achieved through art. It gives them space to think independently, create and reflect. It is one space where all the three are involved- hand, head, and heart.

Therefore, educational practitioners that the students aim to be, will need to bring an element of art in practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful. Additionally, they should be familiar with some critical debates in art education, even if their work is in other subject areas.

To this end, students will do one course that aims to help them recognize and appreciate the *importance of aesthetic judgment, develop familiarity with an art form* and basic skills to be *creative and artful in their expressions*. Skills develop from practice, therefore hands-on training in doing art will be emphasized in this course. This course aims to help students develop a habit of performing skillful activities that are essentially aesthetic and artful which is expected to contribute to other educational practices that they develop in other courses in the programme.

Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and content of other subject areas wherever possible.

Collage as visual art medium

A major aspect of college, and one that is sometimes overlooked, is the incredibly diverse array of materials and objects that can be used. Collecting interesting materials is an ongoing activity for artists and for those who teach college. But it is just as important for young people to hunt for and make decisions about materials they would like to incorporate into their work. All materials, and the alterations that artists make to them, are suggestive of ideas and concepts based on their surfaces, forms, textures, degree of transparency and opacity, color, and other visual characteristics. Materials also connect us, through association and reference, to social and cultural worlds and places. What ideas might a scrap of newspaper, as a collage material, **210**

express? How might these meanings differ from those of, say, feathers? Or twigs? Or a thin piece of plastic cut out from a plastic bag?

Working with and creating artwork in Collage involves various aspects: selecting materials, manipulating materials, investigating materiality, closely observing materials, discovering possibilities, composing, designing the artwork, planning, finding solutions, applying solutions, thinking flexibility, decision-making, research, using imagination, expressing, taking creative risks, develop perseverance, and much more. Students will also be introduced to various aspects of art in education: The value of art and artmaking by itself, art's use as an instrument in education, social and moral dimensions of art, and the controversial perceptions around good art and bad art. This course aims for students to understand the importance of aesthetics and art in education, the role art can play in education, and mainly to appreciate, understand and gain skills with the medium of collage and its techniques.

5.3.1 Learning Outcomes

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

- articulate the importance and the role of aesthetics and art in education.
- understand the medium of collage and its versatility.
- design, plan, and create an expressive self-portrait collage by applying a variety of collage techniques.
- design and set up an interactive visual art exhibition to display their artworks.
- understand and appreciate art-based learning experiences.
- develop the ability to reflect and challenge their assumptions and beliefs around art and develop new understandings.

UNIT - I

Understand the importance of Aesthetics and Art in Education (2 Sessions) Students will be introduced to Aesthetics and Arts by engaging in experiences, discussions, and dialogues. Students will experience a session of 'Visual thinking strategy' (VTS) activity in which students will collectively view and engage in a series of artworks closely, share their observations, critically analyze their observations, listen to multiple perspectives from peers, suspend judgements, and draw their own understanding of the artwork. Students will recognize aesthetic and un-aesthetic experiences through compare and contrast. Through this activity and unpacking of the experience, students will start making connections and develop understandings around what aesthetics mean, aesthetic aspects of daily life, develop aesthetic judgment, and how arts evoke emotion and awaken.

UNIT - II

Exploring paper collage and its techniques (4 Sessions)

Students will be introduced to the medium of collage and open their minds to the possibilities within this medium. Students will view and discuss examples of collage artworks, artist process and artist interview videos. Students will get a chance to compare and contrast various ways collage as a medium is used. Students will reflect upon their own past art educational experiences and observations and engage in dialogue and discussions. Students will analyze effective and ineffective ways of using the medium of collage in educational and other settings.

Through inquiry-based participatory demonstrations, students will investigate and discover a variety of ways to manipulate paper and create individual and unique two-dimensional compositions in the medium of paper Collage. They will understand and learn the techniques, artistic terminologies of the collage medium. Students will reflect on their experience and engage in facilitated discussions to deepen their understanding on the role of art medium exploration and how it can foster various learning skills.

Students then use their knowledge and experience from the previous sessions and explore collage as a medium further. Students will investigate, discover, and learn to create visual textures, physical textures, and create their own unique patterns. They will understand the difference between textures and patterns. Students will use a variety of techniques to create unique textures and patterns, analyze their findings, give each other feedback, work in groups to problem solve, etc. They will understand how art medium explorations can be used as a pedagogical tool in learning environments.

Students will bring in various materials found around them like different kinds of paper, paper-based materials, natural materials, fabric, and explore these materials and use them as materials to create collage compositions. Students will explore a wide range of techniques and discover their own ways to manipulate these found materials to create interesting textures and patterns. Students will work in groups, problem solve, investigate, develop solutions on their own, and share their findings with each other. Through discussions, students will reflect upon this exploration experience and understand how art making processes can develop skills and abilities in a learner.

Resource Videos

1. *Works of Deborah Roberts, William Kentridge, Wangechi Mutu, etc*
2. *Marc, Cut paper collage artist - <https://www.youtube.com/watch?v=WgRZlWl-Oh0>*
3. *G. Subramanian: Collage art - <https://www.youtube.com/watch?v=ioRRi9R46a0>*
4. *Amber Fletschock, Collage artist - <https://www.youtube.com/watch?v=aa7p1vYqUc4>*
5. *Arturo Herrera, artist - https://www.youtube.com/watch?v=Oagx3_NZ5HU*

UNIT - III

Ideating for an Expressive Self-Portrait (2 Sessions)

In this session students will further explore and discover possibilities in Collage as a medium. Students will learn a variety of ways to make paper stands and create interesting paper sculpture compositions using 3D techniques. Students will draw from their previous experiences of using paper for 2D explorations and add more interest to their unique 3D explorations. Students will share their findings with peers and widen their understanding about the possibilities. Students will reflect on all the material exploration sessions thus far and participate in a facilitated dialogue around art making and education.

Students will engage in a close observation sketching and drawing activity. Through a guided process, students will create a well observed self-portrait drawing. Students will engage in discussions and dialogue to unpack the self-portrait drawing experience, the learnings, discoveries, challenges and more. Through this activity students will also be able to challenge assumptions around talent and art-making.

Resources: Handouts out on Collage techniques and artist examples

Resources: JR's Face to face project (videos and readings)

https://www.youtube.com/watch?v=4u_G0G6Jog4

UNIT - IV

Creation of an Expressive Self-Portrait Collage (3 Sessions)

Students will engage in a step-by-step process involving sketching, ideating, planning, applying their discoveries of using paper as a collage material, and finally create a large expressive self-portrait using the medium of paper collage. Throughout the process students will problem-solve, critically think, push their imagination, find multiple solutions, make independent decisions, receive and give peer feedback, use resources effectively, draw from their own experiences, apply their learnings into creating this unique and expressive self-portrait piece.

UNIT - V

Designing and setting up an Exhibition (2 Sessions and Exhibition Day) Students will collectively start designing and planning for the exhibition to put up their artworks for a general audience to view and engage with. Students will be planning the various aspects of a visual art exhibition: ways to display artworks, designing the layout of the exhibition space and how the audience will move within the space, design invitations, ways that the audience can engage with the artworks, various ways the artists can talk about their art-making, and more. Students will divide the tasks among themselves, take on the various roles required, and set up the exhibition space.

Resources: Planning templates

5.3.2 Pedagogy

- Students will engage in hands-on art making activities.
- Students will engage in discussions and dialogues with peers.
- Students will engage in giving and receiving peer feedback.
- Students will continually reflect on their learning through journaling.
- Students will work independently and collaboratively throughout the course.
- Students will receive reference materials and resources to broaden and deepen their understanding.

5.3.3 Suggestive Assessment

Details to be determined by the faculty member as per applicable UGC norms.

5.3.4 Suggestive Reading Materials

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

COURSE TITLE: Sports, Nutrition and Fitness**Credit:-2****Semester:S-7****5.8.1 About the Course**

This course aims at enabling student teachers to recognize the importance of good health, fitness, and the right nutrition to live a healthy life. It also provides students with the experience of organizing and participating in sports and games.

5.8.2 Learning Outcomes

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

- explain the importance of sports, and the need and impact of sport for maintaining,
- discuss physical fitness, and the methods of teaching and organization of different types of sports,
- explain the importance of physical fitness, describe different components of physical fitness, and identify activities that help maintain physical fitness,
- Recognize the importance of basic health and nutrition and healthy lifestyles and identify food items that help maintain basic health and nutrition among children of different age groups.

UNIT - I**Sports**

- A. Meaning of sports, importance of sports, types of sports.
- B. Different stages of sports (primary and secondary).
- C. Psychology of sports, methods of teaching different sports (indoor, outdoor, team and individual), different sports activities (individual and team games).
- D. Sports for children with disabilities and inclusion.

UNIT - II**Physical Fitness**

- A. Meaning and importance of Physical fitness, components of physical fitness, Muscular Strength, Endurance, Flexibility, Body Composition, Cardiovascular Endurance, importance of healthy lifestyle.
- B. Coordination of Health and Fitness.

UNIT - III**Nutrition**

- A. Meaning of nutrition, types of nutrition, importance of nutrition, need of nutrition, methods for teaching nutrition,
- B. Nutrition for different age group, nutritious food for sports personalities and common individuals, nutrition and health, nutrition and fitness, nutritious food in schools (midday meals), hostels.

5.8.3 Suggestive Practicum

Reflective Reading of different Sports Personalities. Collections of different types of games (Indoor, Outdoor, Individual, Team); Organizing different games (Play) for different age-groups, Organizing Group Games for cooperation, Organizing fitness programmes, Exercises at various levels. Collection of different nutritious items food. (Charts, Things, Objects, Models).

Programmes organized to promote the use of nutritious food.

5.8.4 Suggestive Mode of Transaction

The mode of transaction should be designed to ensure that should provide a balance between theoretical knowledge and practical skills. The approaches to curriculum transaction may include the following:

- Active learning encourages student teachers to participate in discussions, brainstorming sessions, and problem-solving activities that help them develop critical thinking and problem-solving skills.
- Collaborative learning involves group projects and tasks that encourage student teachers to work collaboratively and learn from each other.

5.8.5 Suggestive Mode of Assessment

Assessment of theoretical aspects and Practicum.

5.8.6 Suggestive Reading Materials

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

COURSE TITLE: School-Based Research Projects**Credit:2****Semester:S-7****6.3.1 About the Course**

Action research enables teachers to reflect on their wisdom to bring the desired changeover and explore the system when necessary. They may experiment with practices in a controlled environment to improve the transactional processes. Learning about classroom research in action research and case studies practices promotes opportunities to improve the student-teacher learning environment in teacher education institutions. Their involvement in the learning processes during their stay in teacher education institutions becomes more fruitful. It could be individual or collaborative research among the student teachers. Action research and case studies are school-based research, which is acted upon as collective, self-reflective inquiry undertaken in social situations to improve the rationality and justice of their own contextual and educational practices. These two processes explore the answers to the problem and contribute towards theory development. These two methodologies foster critical thinking, problem-solving, collaboration and ethical decision-making skills. The student teachers are placed in schools for internships. School Internship provides the student teachers with a platform to apply theoretical knowledge understanding, techniques, methods, and approaches in an actual classroom situation. It enables them to gain intensive experience in teaching, planning, preparing support materials, and performing other school activities that a regular teacher is expected to do. The student teachers will systematically undertake school-based research to find solutions to contextual problems/challenges. During the school internship, the student teachers will identify school practices and challenges through involvement in different activities, design relevant interventions, analyze data and prepare reports.

6.3.2 Learning Objectives

The student teachers will:

- Identify contextual problems and formulate appropriate research design,
- Prepare the plan of action for undertaking school-based research,
- Develop and use tools and techniques for the collection of relevant data,
- Collect and analyze the data to identify the causes,
- Develop and implement need-based interventions for addressing the problems,
- Study the effectiveness of the intervention(s),
- Reflect and share school-based research experiences through reports and presentations.

6.3.3 Suggestive Mode of Transaction

The following strategies will be used during the school-based research project:

- Discussions with teacher educator, school head, mentors, and peers for identification of problem and development of intervention(s).
- Finalize the school-based research project proposal outline through discussion with mentor teachers/teacher educators.
- Document analysis, interaction with all stakeholders, and field visits.
- Sharing and presentation of the outcomes of school-based research.

6.3.4 Content:

The student teachers during previous semesters have studied different courses in Foundations of Education, Disciplinary Courses, Stage-specific pedagogy courses, Ability Enhancement and Value-Added Courses. The required knowledge of action research and case study includes- the concept and importance of action research/case study, the steps of conducting action research/case study (objectives, methods, research design, design tools, data collection, and data analysis) and report writing.

The research problem will be taken from the day-to-day teaching-learning process of the school. Some of the significant areas may cover:

- Learning progress and outcomes in different subjects
- School-based assessment
- Learners' diversity and inclusion
- Participation in arts, games, sports

6.3.5 Suggestive Mode of Assessment

The assessment of the school-based research project will be continuous. The teacher educators, as well as mentors, will be involved in the assessment of the activities. The following rating scale may be used to assess the student teachers:

Competence/Artifact	Method of assessment	Assessed By	Credits
Observation during the execution of action research	Observation	Teacher-Educator	0.5
Research Report	Presentation of Report	Teacher-Educators (panel of three experts)	1.5

6.3.6 Learning Outcomes

The student teachers will:

- present contextual problems, an appropriate research design and the plan of action for undertaking school-based research,
- demonstrate the tools and techniques used for the collection of relevant data,
- summarize the analyzed data used to identify the causes,
- demonstrate the interventions used for addressing the problems,
- present the effectiveness of the intervention(s),
- share the school-based research experiences through reports and presentation.

COURSE TITLE: Internship in Teaching**Credit:10****Semester:S-7****6.4.1 About the Course**

Teacher preparation is a reflective and experiential process, and internship is vital to connecting student teachers with school, teachers, students and other stakeholders in various ways. It provides a platform and actual field experience for the student teachers to apply theoretical knowledge and teaching methods. During the internship, student teachers are placed in schools in groups as an integral part of all school activities. This provides them with the opportunity to observe classes taken by school teachers, take independent classes, develop a relationship with students, contribute to everyday school activities (e.g., conducting the assembly, assisting in the mid-day meal scheme, organizing school events) and get exposure to all school administrative practices (e.g., maintaining administration records, creating an annual calendar). This enables them to get intensive experience in all aspects of teaching- preparation, planning, developing/collecting/localizing Teaching Learning Materials, classroom transactions, assessment, reflection, and review of their experience. The student teachers are exposed to situations where they can observe different roles played by the teacher in the field, which they will also have to undergo. After completing the internship, student teachers will be ready to take up a teacher's responsibility independently.

6.4.2 Suggestive Structure

ITEP 7th semester has an internship programme where student teachers are expected to go to the participating schools and visit the Institute for completion of other courses. ITEP institute can choose suitable option based on their context.

- Four days in schools and two days at ITEP Institute
- Six weeks in one school, three weeks in the institute and six weeks in another school (preferably in two different types of schools)
- Three weeks in the institute and 12 weeks in two types of schools
- Any other option can be adopted by the institute depending on their local conditions keeping 12 weeks of school internship.

6.4.3 Learning Objectives:

On completion of the school internship, student teachers will be able to:

1. explain the overall functioning of the school.
2. describe and appreciate the different roles played by a teacher in the school.
3. experience the importance of teacher-student relationships for effective teaching.
4. develop age-appropriate pedagogic skills.
5. use different pedagogies learnt in real-life classrooms.
6. create appropriate teaching-learning materials.
7. develop necessary planning and execution skills to conduct school activities (assembly, celebrations, cultural programmes).
8. express the school, teacher, parents, and community relationships.
9. create rapport with the stakeholders and understand their roles in the school system.
10. create student portfolios and comprehensive 360-degree (holistic) progress reports.
11. discuss the importance of maintaining different types of records in the school system.

12. develop research aptitude and ability to conduct action research for the situations/problems faced during their school internship experience.

6.4.4 Suggestive Mode of Transaction

- Observation
- Interaction
- Discussion
- Teaching in the classroom
- Analysis and reporting
- Collection of relevant documents and data

6.4.5 Content

1. Pedagogies' different methods and strategies
2. Scheme of lessons
3. Peer lesson observation
4. Management of substitute classes
5. Various TLMs (including ICT tools) and their uses in teaching-learning.
6. Achievement test
7. Diagnostic tests
8. Analysis of the result of the achievement test
9. Assembly activities
10. Action research and case studies.

6.4.6 Activities:

Student teachers are required to undertake the following stage specific activities:

6.4.6.1 Foundational stage

1. Meet the subject-based mentors, collect timetables of preschool, Balvatika, and classes I and II and develop a scheme of lessons from the syllabus to be covered during the internship.
2. Get acquainted with the school within 2-3 days. Observe classroom teaching of school teachers.
3. Plan and transact minimum 80 lessons (40+40), including 4 stray lessons (2+2). Stray lessons are class appropriate lessons on any topic(s) to be transacted by student teachers as per their convenience to build up confidence gradually. The last 5 lessons in each pedagogy course may be transacted using lesson notes.
 - Lesson plans should derive their inspiration from NCF-FS documents.
 - Lesson plans should include a theme/ web chart/concept map for integrating early learning activities related to FLN.
 - Lesson plans must promote education for sustainability, including equity, environment, global citizenship, pride and rootedness in Indian culture and character building.
4. Participate in post-lesson discussions with peers, mentor(s) and teacher educators.
5. Observe peer lessons and discuss with the group.
6. Conduct sports activities and arts and crafts activities.

7. Participate in student support services- guidance and counselling, bunny, health and wellness programmes.
8. Create age and developmentally appropriate TLM that caters to different domains of development, for example, picture reading posters, letter-sound dominoes, number-object dominoes, stories, rhymes, toys, and number puzzles.
9. Identify the toys and TLM available for 3 to 8-year-olds. and map them with different concepts and skills.
10. Develop differential assessment plans based on interest and expected goals/competencies.
11. Identify children with special needs and address their learning needs.
12. Experience classes as a substitute teacher.
13. Participate in the reading corners, fun zones, gallery walks and other activities.
14. Participate in teacher development and training activities.
15. Participate and Organize school assemblies and other events (cultural, sports, yoga, and other development activities).
16. Attend Parents-Teachers Association (PTA) meetings if held during the internship.
17. Attend School Management Committee (SMC) meeting if held during the internship.
18. Study the process of parent and community engagement for the school development programme.
19. Conduct action research /case study.
20. Prepare a sample student portfolio,
21. Write a reflective diary daily and prepare a report of each activity.

6.4.6.2 Preparatory Stage

1. Meet the subject-based mentors, collect timetables of classes III to V and develop a scheme of lessons from the syllabus to be covered during the internship.
2. Get acquainted with the school within 2-3 days. Observe classroom teaching of school teachers.
3. Plan and transact minimum 80 lessons (40+40), including 4 stray lessons (2+2). Stray lessons are class appropriate lessons on any topic(s) to be transacted by student teachers as per their convenience to build up confidence gradually. The last 5 lessons in each pedagogy course may be transacted using lesson notes.
 - Lesson plans should include activities to promote creativity, inquiry, inquisitiveness, experimentation, exploration, analytical thinking.
 - Lesson plans must promote education for sustainability, including equity, environment, global citizenship, pride and rootedness in Indian culture and character building.
4. Participate in post-lesson discussions with peers, mentor(s) and teacher educators.
5. Observe peer lessons and discuss with the group.
6. Conduct sports, arts and crafts activities.
7. Participate in student support services- guidance and counselling, clubs and bulbs, health, and wellness programmes.
8. Create teaching-learning materials, including ICT tools for opted pedagogic courses.
9. Plan assessment, prepare material and formative and summative assessment tools, and analyze the results.
10. Prepare and conduct diagnostic tests to identify learning difficulties, analyze data and prepare learning enhancement plan.

11. Experience classes as a substitute teacher.
12. Participate in library functioning and literary activities.
13. Participate in teacher development and training activities.
14. Participate and Organize school assemblies and other events (cultural, sports, yoga, and other development activities).
15. Attend Parents-Teachers Association (PTA) meetings if held during the internship.
16. Attend School Management Committee (SMC) meeting if held during the internship.
17. Study the process of parent and community engagement for the school development programme.
18. Conduct action research /case study.
19. Prepare a sample student portfolio,
20. Write a reflective diary daily and prepare a report of each activity.

6.4.6.3 Middle Stage

1. Meet the subject-based mentors, collect timetables of classes VI to VIII and develop a scheme of lessons from the syllabus to be covered during the internship.
2. Get acquainted with the school within 2-3 days. Observe classroom teaching of school teachers.
3. Plan and transact minimum 80 lessons (40+40), including 4 stray lessons (2+2). Stray lessons are class appropriate lessons on any topic(s) to be transacted by student teachers as per their convenience to build up confidence gradually. The last 5 lessons in each pedagogy course may be transacted using lesson notes.
 - Lesson plans should include activities to promote creativity, inquiry, inquisitiveness, experimentation, exploration, analytical thinking, synthesis to understand the coherent whole, problem-solving, and application of knowledge in real-life situations.
 - Lesson plans must promote education for sustainability, including equity, environment, global citizenship, pride and rootedness in Indian culture and character building.
4. Participate in post-lesson discussions with peers, mentor(s) and teacher educators.
5. Observe peer lessons and discuss with the group.
6. Conduct laboratory activities (Atal Tinkering Lab, Science, Mathematics, Languages, Social Science, Computer), sports, and arts and crafts activities.
7. Participate in student support services- guidance and counselling, NCC, health and wellness programme.
8. Create teaching-learning materials, including ICT tools for opted pedagogic courses.
9. Plan assessment, prepare material and formative and summative assessment tools, and analyze the results.
10. Prepare and conduct diagnostic tests to identify learning difficulties, analyze data and prepare learning enhancement plan.
11. Experience classes as a substitute teacher.
12. Participate in library functioning and literary activities.
13. Participate in teacher development and training activities.
14. Organize school assemblies and other events (cultural, sports, yoga, and other development activities).
15. Attend Parents-Teachers Association (PTA) meetings if held during the internship.

16. Attend School Management Committee (SMC) meeting if held during the internship.
17. Study the process of parent and community engagement for the school development programme.
18. Conduct action research /case study.
19. Prepare a sample student portfolio,
20. Write a reflective diary daily and prepare a report of each activity.

6.4.6.4 Secondary Stage

1. Meet the subject-based mentors, collect timetables of classes IX to XII and develop a scheme of lessons from the syllabus to be covered during the internship.
2. Get acquainted with the school within 2-3 days. Observe classroom teaching of school teachers.
3. Plan and transact minimum 80 lessons (40+40), including 4 stray lessons (2+2). Stray lessons are class appropriate lessons on any topic(s) to be transacted by student teachers as per their convenience to build up confidence gradually. The last 5 lessons in each pedagogy course may be transacted using lesson notes.
 - Lesson plans should include the components to develop critical and reflective thinking, problem-solving, differential learning, synthesis, and application of knowledge in real-life situations.
 - Lesson plans must promote education for sustainability, including equity, environment, global citizenship, pride and rootedness in Indian knowledge systems and character building.
4. Participate in post-lesson discussions with peers, mentor(s) and teacher educators.
5. Observe peer lessons and discuss with the group.
6. Conduct laboratory activities (Atal Tinkering Lab, Physics, Chemistry, Biology, Mathematics, Languages, Social Science, Computer), sports, and arts and crafts activities.
7. Participate in student support services- guidance and counselling, NCC, NSS, health and wellness programme.
8. Create teaching-learning materials, including ICT tools for opted pedagogic courses.
9. Plan assessment, prepare material and formative and summative assessment tools, and analyze the results.
10. Prepare and conduct diagnostic tests to identify learning difficulties, analyze data and prepare learning enhancement plan.
11. Experience classes as a substitute teacher.
12. Participate in library functioning and literary activities.
13. Participate in teacher development and training activities.
14. Organize school assemblies and other events (cultural, sports, yoga, and other development activities).
15. Attend Parents-Teachers Association (PTA) meetings if held during the internship.
16. Attend School Management Committee (SMC) meeting if held during the internship.
17. Study the process of parent and community engagement for the school development programme.
18. Conduct action research /case study.
19. Prepare a sample student portfolio,
20. Write a reflective diary daily and prepare a report of each activity.

6.4.7 Suggestive Mode of Assessment:

The activities conducted / skills acquired during the internship by the student teachers will be assessed as per the following scheme:

Competence/Artifact	Method of assessment	Assessed By	Credits
Observation of classroom practices	<ul style="list-style-type: none"> • Observation of a Minimum of 6 lessons of School Teachers (3+3) • Observation of a Minimum of 10 lessons of Peers (5+5) 	Teacher-Educator	Non-evaluative
Unit planning, Lesson Planning & Transaction	40 lessons transaction for each pedagogical subject * Unit plans and lesson plans * Minimum 2 Innovative lesson plans in each pedagogy subject (Eg: Storytelling, Drama based, Arts and crafts, Use of Technology)	Teacher-Educator, School Mentor	6.0
Assessment Planning and execution	Preparation of report on assessment plan in each lesson transacted i.e., within lesson transaction and lessonend activities. Preparation of a Blue Print (For one/two Pedagogical course/s) and preparation of Assessment tools Conduct of Unit Test & analysis of results (for both Pedagogical course/s) Development of plan for learning enhancement of students related to subjects (for both Pedagogical course/s)	Teacher-Educator, School-Mentor	1.5
Participation/Organization of assembly and other school-level activities, PTM & SMC Meetings	Observation & Interaction	School Mentor	0.5
Preparation of Logbook /Teachers diary Min 5 lessons for each pedagogical method	Review	Teacher-Educator, School Mentor	0.5
Overall feedback on student-teacher performance by School	Observation and Interaction	School Head	0.5

Head			
Test lesson (one in each pedagogical method)	Presentation	Teacher-Educator	1.0

6.4.8 Stakeholders Responsibilities

Role of Head of ITEP Institution

- Identification of the adequate number of internship schools
- Signing the MoU with the schools
- Sharing of mutual expectations of ITEP institutions and the participating schools
- Identification of the internship programme coordinator
- Monitor the progress of the entire School Experience Programme

Role of Teacher-Educators of the ITEP Institution

- Guide the student teachers in preparing lessons and activities, assessment, observation of lessons on peer teaching, action research, and case studies conducting school activities preparation and report writing on Teaching Learning Materials.
- Conduct pre- and post-lesson discussions regularly.
- Assess the transaction of lessons for the complete duration of the lesson in the rating proforma developed by the teacher education institute and give feedback/remarks to the student teachers for lesson improvement.
- Submission of monitoring and supervision reports to the institute in time.
- Discuss with the student teachers frequently and organize a phase-end meeting of the student teachers and mentors to assess the progress and performance of the student teachers.

Role of School Head

- To introduce the student teachers to the students and staff of the school in the assembly on the first day.
- To facilitate student teachers to take classes as per stage requirements- Foundational, Preparatory, Middle, and Secondary.
- Ensure the alignment of the timetable, scheme of lessons and plan of activities/ assignments of the student teachers to be carried out during the programme in the school.
- Countersign on the attendance register maintained by the group leader/ mentor of the school.
- Ensure that all facilities and provisions are available to the student teachers to teach their lessons and carry out their assignments smoothly.
- grant of leave applications of the student teachers in exceptional circumstances.
- Involve student teachers in different activities of the school.
- Facilitate phase-end meetings of the student teachers and the mentors to assess the progress and removal of difficulties.
- Countersign/ certify the report/ documents of the activities/ assignments conducted by the student teachers towards the end of the internship programme.
- Provide input about student-teacher performance.
- Provide suggestions for improvement of the programme to the ITEP institution.

Role of Mentors

- Guide student teachers to prepare detailed lesson plans, brief lesson notes and plans of activities/ assignments to be conducted by them in school.
- Review the lesson plan before a student-teacher transacts the lesson in the class.
- Observe the classes of student teachers.
- Assess each lesson on the prescribed proforma and write remarks in the lesson plan book provided by the student teachers.
- Give feedback continuously to the student teachers for their improvement in their teaching and other curricular activities.
- Conduct post-lesson discussions regularly.
- Countersign in the peer-teaching observation schedules after their observations in the classroom.
- Organize frequent meetings with the student teachers and supervisors to discuss the progress, difficulties faced, and experience gained by student teachers.

Role of Student-Teacher

- Report to the school head of the participating school at least one day before the start of the internship placement.
- Seek information about the classes, timetable, and topics to teach in stage-specific pedagogic courses from the mentors on the first day of the internship programme.
- Mark your attendance as per the school practice.
- Plan all the assignments/ activities with the help of the mentor/ supervisors.
- Seek cooperation from mentors and supervisors in case of difficulty.
- Prepare the lesson plan and get approval from the mentor/ supervisor before transacting every lesson.
- Take classes according to the timetable of the participating school.
- Take substitute classes and participate in other school duties assigned by the school.
- Follow the conduct and dress code of the participating school.
- Get prior leave approval from the head of the participating school in case of emergency.
- Maintain a diary and regularly list all the innovations, challenges faced and reflections for improvement.
- Check with your mentor before attempting learning activities that depart from routine classroom procedures.
- Carry out the activities you plan for school students according to your approved plans.
- Maintain cordial relationships with the students and staff of the school.
- Refrain from making negative comments about the school or the school's personnel, especially when talking with fellow student teachers.
- Submit student teaching profiles, one each, to the supervisor and mentor who supervises your teaching.
- Before the completion of the internship programme, make sure to return all textbooks and materials to the school.

SEMESTER-VIII

SEMESTER-8**CONTENT**

Course Code	Curricular Component	Name of the Course	Credits	Total	Page No.
FE08	Foundations of Education	Philosophical & Sociological Perspective of Education - II	4	10	229-230
FE09		Education Policy Analysis	2		231-232
FE10		Adolescence Education / Education for mental health / Education for Sustainable Development / Emerging Technologies in Education / Gender Education / Guidance and Counselling / Human Rights Education / Peace Education / Sports & Fitness Education / Tribal Education / Economics of Education	4		233-251
AEV110	Ability Enhancement & Value Added Courses	Yoga & Understanding Self	2	4	252-254
AEV111		Citizenship Education, Sustainability & Environment Education	2		255-256
SE226	School Experience	Post Internship (review & Analysis)	2	4	257-258
SE227		Creating Teaching learning material / Work Experience (Educational Toy making, Local/Traditional/Vocations.)	2		259-260
CES228	Community Engagement & Service	Community Engagement & Service (Participation in NSS – related activities New India Literacy programme Etc)	2	2	261-263
Total Credits				20	

SEMESTER VIII**COURSE TITLE: Philosophical and Sociological Perspectives of Education – II****Credit: 4****Semester: S-8****2.8.1 About the Course**

Sociological Perspectives of Education seek to encourage students to explore the relationship between social structures and educational provision. The course focuses on the study of the social behavior of individuals, groups, and societies. It provides opportunities for student teachers to examine relationships among individuals, as well as relationships between people and their societies.

2.8.2 Learning Outcomes

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

- recognize the social context of education,
- outline the meaning, nature, and scope of educational sociology,
- establish the link between education and socialization,
- analyze the main agents of socialization, such as family, school, community and peer groups,
- analyze the impact of culture on education through a study of dimensions of culture and their importance to education practices,
- recognize the different aspects of social stratification,
- identify the close relationship between education and modernization, the role of education in Modernization, and factors and constraints to social change.

UNIT - I**Education and Society**

- A. Conceptual clarity, relationship, significance and aims of studying relationship between these two.
- B. Educational sociology and social perspective of education: meaning and functions.
- C. Education as a Social System.
- D. Conceptual clarity of the following terms: society, social behavior, status, institution, ideology, system, sub-system, socialization, social system, social values and norms, conflict, modernization.
- E. Understanding the relation between individual and group behavior with special reference to purpose of education.

UNIT - II**Education and Social Change**

- A. Meaning, relation, and dimensions of Social Change.
- B. Factors affecting Education and Social Change: technology, social and educational movements, curricular innovations, value conflict, legal provisions.
- C. Constitution of India and Education.
- D. Education and Modernity.
- E. Role of education with reference to social change.

UNIT - III**Education, Culture and Socialization**

- A. Relationship between Education and Culture.
- B. Education as a process of Socialization.
- C. Impact of following on Culture and Educational Process: Social Welfare, Social Reform Movements, Legal interventions on Child Marriage and child labor Act, Educational Policies and Acts, Adult Literacy, New Technology of communication, Equality.

- D. Constitutional Provisions and Education with special reference to Social Equality and Equity.

UNIT - IV
Education and Values

- A. Conceptual Clarity, Relationship and Significance.
B. Types of Values.
C. Constitutional Values and its impact on our Education.
D. Human Rights and Values.
E. Environment and Education.
F. Pedagogical issues.

2.8.3 Suggestive Practicum

1. Critical/Reflective study of contemporary aims of education and their social determinants.
2. Observation and critical study on how textbooks determine every activity of teacher and learner in the school.
3. A critique of textbook culture in school.
4. Observing the process of knowledge construction by children in structured and unstructured environments to appreciate their learning processes and nature.
5. A critical analysis of Constitution of India in the context of process of Education in India / Educational Policies / Educational Commissions)
6. Critically observing nearby society/ locality in groups of 4-5 students and sharing observations related to cultural/ social influences on educational practice.
7. Analyzing social purpose of NEP, 2020.

2.8.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.8.5 Suggestive Mode of Assessment

- The assessment will be based on the tests and assignments.

2.8.6 Suggestive Reading Materials

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

COURSE TITLE: Education Policy Analysis**Credit:2****Semester:S-8****2.9.1 About the Course**

This course on Education Policy Analysis aims at orienting student teachers to the theoretical frameworks and methodology that will help assess and evaluate the effectiveness of policies at the national, state and programme levels.

2.9.2 Learning Outcomes

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

- discuss knowledge and capacity to engage in education policy analysis and evaluate their effectiveness,
- explain processes involved in policy analysis including undertaking situation analysis and research.
 - To identify possible policy options,
 - Describing these possible options,
 - Comparing the potential policy options,
 - Ranking the possible policy options and
 - Choosing the most effective option that could address issues and problems confronting school education.

UNIT - I**Planning an Educational Policy**

- A. Meaning and significance of 'Policy on Education'.
- B. Purpose and Dimensions of an Educational Policy at local and Global level.
- C. Philosophical and Sociological Perspective of planning an Educational Policy.
- D. Historical development of Educational Policies in India.
- E. Basic steps involved in planning.
- F. Constitutional provision for Policy on Education.
- G. Fundamental principles for analyzing an Educational Policy.

UNIT - II**Educational Policies in India**

- Critical analysis of Policies on Education since Independence: 1968, 1986 (Modified in 1992), 2020 in the context of: need and significance, goals and frameworks of educational policies, content of policies, issues raised in policies, constitutional provisions, special stress, modification of policies, implementation strategies.
- Issue of modifying an Educational Policy.

UNIT - III**Implementation of an Educational Policy**

- A. Meaning, need and significance.
- B. Mechanism of Policy Implementation.
- C. Strategies to Implement an Educational Policy.
- D. Programme of action and implementation: conceptual clarification and significance.
- E. Role of different Organization / Groups: Legislature/ Judiciary/ Political Will and Parties/ Voluntary Organizations/ Non-governmental organizations (NGOs)/ Pressure Groups/ Public.

F. Challenges for Implementation.**2.9.3 Suggestive Practicum**

1. Reviewing and presenting report on NEP, 2020 in reference to Policy Implementation.
2. To present a critical review of the Programme of Action (1987).
3. Preparing a list of challenges to implement the present new National Education Policy, 2020 in our States.
4. Preparing a list of Measures to be taken or taken to implement National Education Policy, 2020 in our State.

2.9.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children and schools.

2.9.5 Suggestive Mode of Assessment

- The assessment will be based on the tests and assignments.

2.9.6 Suggestive Reading Materials

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

COURSE TITLE: Education for Mental Health**Credit:4****Semester:S -8****2.10.1 About the Course**

This course on Education for Mental Health will give a comprehensive understanding on the concept of meaning and determinants of Mental Health. The course will further enhance the student teacher's ability to know different stress management and adjustment techniques. The course aims to introduce historical and contemporary developments of Mental Health Education programs in Indian and Global perspectives.

2.10.2 Learning Outcome

After studying this course, student teachers will be able to:

- express the meaning and significance of mental health,
- describe social and psychological determinants of mental health,
- analyze the causes of stress and process of stress management,
- analyze the significance of adjustment in life,
- analyze the needs and importance of global mental health education programme,
- explain the special role of teachers and parents to maintain the good mental health of children,
- suggest prevention and promotional measures to maintain good mental health of society,
- express the need for health policies globally.

UNIT - I
Mental Health

- A. Meaning and determinants of Mental Health.
- B. Mental Health Vs Mental Hygiene.
- C. Mental disorders: Characteristics and Types.
- D. Causes of poor Mental Health.
- E. Myths Vs Facts about Mental Health.
- F. Legal perspectives of Mental Health in India.
- G. Concept of Healthy Personality

Unit-II

Stress, Stress Management and Adjustment

- A. Stress: meaning, nature and symptoms, types of stress, social and psychological perspectives, remedial measures.
- B. Stress management and adjustment: meaning and significance of stress management and adjustment, prevention and promotion, role of parents, peer group and teachers.

UNIT - III

Mental Health Education Programme

- A. Meaning and significance of Mental Health Education Programme.
- B. Dimensions of Mental Health Education Programme in India.
- C. Historical development of Mental Health Education Programmes in India.
- D. Local and Global Perspective of Mental Health Education Programme.
- E. Organizations at local and international level.
- F. Characteristics of a good Mental Health Education Programme.
- G. Role of Educational Institutions.

UNIT - IV
Challenges to Pedagogical Issues

- A. Home Vs. school
- Diverse school and home contexts
 - Lifestyles of teachers and parents
 - Stereo-type roles
 - Mental health concerns of teachers and parents
 - Material availability/ production
- B. Guidance and Counselling Programme:
- Concept, need and techniques.
 - Teacher as a counselor
- C. Designing and evaluating Mental Health Programmes

2.10.3 Suggestive Practicum

1. Visiting of Mental hospital and preparing list of four cases admitted in Hospital.
2. Preparation of two case histories on causes of abnormal behavior.
3. Critical analysis of laws and Public Health Policies.
4. Critical analysis of National Educational Policy, 2020 in the context of Health of children at school.
5. Critical analysis of Legal perspectives Mental Health Education in India.
6. Preparing comprehensive report on Mental Health Education Programme in India.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

COURSE TITLE: Education for Sustainable Development**Credit:4****Semester:S-8****2.10.1 About the Course**

This course is designed to highlight the meaning, nature and significance of Education and Sustainable Development in the light of 17 sustainable development goals envisaged in United nations agenda. The course is designed to make student teachers aware and understand SDG 4 goal of Inclusive and Quality Education in the light of NEP 2020. The course also highlights the politics and policies involved in Sustainable Development.

2.10.2 Learning Outcome

After studying this course, student teachers will be able to:

- clarify the meaning and significance of sustainable development,
- explore the relationship among education, development and environment,
- appreciate the relation between education and sustainable development,
- describe the characteristics of ESD,
- explain the role of education in sustainable development,
- critically analyze the meaning and importance of education in the context of sustainable development.,
- explain the role of education to achieve sustainable development,
- analyze the pedagogical issues related to ESD.

UNIT - I**Education and Sustainable Development**

- A. Meaning, relationship, goals, and significance.
- B. Characteristics of ESD
- C. Education for Sustainable Development: Historical Perspective
- D. Philosophical, Sociological and Psychological Perspective.
- E. Role of Education for Sustainable Development.
- F. Decolonizing Knowledge for Sustainable Development.
- G. Challenges of Education for Sustainable Development.

UNIT - II**Sustainable Development Goals (SDGs)**

- A. Meaning, nature and significance of SDGs.
- B. 17 Sustainable Development Goals (SDGs): UNESCO agenda.
- C. SDGs and Social Transformation as Universal Commitment.
- D. Education as a Human Right to achieve Sustainable Development.
- E. Sustainable Development and Peace.
- F. Role of Educational Institutions and Challenges to achieve SDGs.

UNIT - III**SD Goal-4: Quality Education for All**

- A. Meaning, Nature, and Significance.
 - NEP, 2020 on SDG-4: Sustainable lifestyle, Gender equality, Promotion of peace & non-violence, Global citizenship, Good mental health & wellbeing, Justice in society.
- B. Pedagogical issues for SDG-4.

UNIT - IV**Sustainable Development: Politics and Policies**

- A. Understanding the Policy-Making Process.
- B. Policy Analysis.
- C. Democratizing Science and Technology.
- D. Globalization and the Environment: Capitalism, Ecology and Power.
- E. Perspectives, Methods, and Skills.
- F. Innovation for Sustainability.
- G. Key Issues from an International perspective.
- H. Critical issues involved in sustainability.

2.10.3 Suggestive Practicum

1. To present critical review on NEP, 2020 in the context of SDGs.
2. Critical study of Delors Commission Report, 1996: Learning: The Treasure within with reference to SDGs.
3. To review and present a critical report on legal perspective on SDGs.
4. To prepare Toolkit for Educations for Sustainable Development.
5. To organize discussions/ seminars of Teachers of all streams to present their views on SDGs and to present Action Plan for this.
6. To prepare and present a short Video/film to promote SDGs.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

- The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

COURSE TITLE: Emerging Technologies in Education**Credit:4****Semester:S-8****2.10.1 About the Course**

The course is designed to use Information and Communication Technology in a classroom as an important 21st century skill and an important step for ICT enabled education of the country. The course explores various ICT approaches and its integration in Pedagogy, Assessment and Management. The course will help student teachers to know and apply online and offline software applications and it will enhance their understanding related to social, economic, and ethical issues associated with the use of ICT.

2.10.2 Learning Outcome

After studying this course, student teachers will be able to:

- describe the need and uses of technology in the field of education,
- use various digital technologies for creating the resources,
- provide learning experiences for all types of learners including differently abled.
- create learning environment in the class room,
- understand the role of ICT to enhance the creativity of students,
- view the use of massive open online courses (MOOCs),
- explain the role of ICT in authentic and alternative assessment,
- discuss the social, economic, and ethical issues associated with the use of ICT.

UNIT - I**Education and Technology**

- A. Relationship between Education and Technology.
- B. Conceptual clarity of Technology of Education and Technology in Education.
- C. Meaning, Nature, and significance of Technology in Education.
- D. Historical Development of use of Technology in Education.
- E. Principles of using Technology in Education.
- F. Emerging trends in Technology in Education.

UNIT - II**Information and Communication Technology**

- A. Meaning, nature, and types.
- B. Fundamentals of Information and Communication Technology.
- C. ICT Tools and application.
- D. Hardware and Software: meaning, difference and types.
- E. System software and Application software.
- F. ICT application and multiple intelligence.
- G. Social, Economic, and Ethical issues associated with the use of ICT.

UNIT - III**Technology in Education and Pedagogy**

- A. Approaches of integration of Technology in teaching and learning.
- B. Subject specific ICT tools for creating and facilitating learning.
- C. Subject specific online resources and their uses in lesson Planning.
- D. Technology integrated learning experiences and creating learning Environment.

- E. Use of Technology for children with special needs: Tools and processes; Universal Design for Learning.
- F. Massive Open Online Courses (MOOC)-Concept and use.
- G. ICT for Assessment and Management.

UNIT - IV

Online and Offline Software Applications

- A. Application software- meaning and types.
- B. Word processing, spreadsheet, presentation: Features and educational applications.
- C. Drawing tools – diagrams, concept maps, timelines, flow charts. Educational applications of these tools.
- D. Web 2.0 technology and tools: meaning characteristics and types.
- E. Social networking and social book marking: Educational Applications.
- F. Blog and micro blog – reflective journaling and other educational applications.
- G. Wiki, YouTube, TED, Skype – collaborative authoring and projects.
- H. Instant messaging and its educational applications.
- I. Online forums/discussion groups and chats: educational applications.
- J. Social media sharing – video, presentations, audio (podcasts), graphics, and text.
- K. Web 2.0 tools for creating, sharing, collaborating, and networking.

UNIT - V

Instructional Design and E-content

- A. Instructional Design: concept, principles, models, and stages.
- B. E-learning courseware (e-content) design.
- C. Identifying and organizing course content: need analysis (learner, content, and task), learning objectives and course sequence.
- D. Designing instructional media, evaluation, and delivery strategies.
- E. Creating interactive content: story board, courseware outline, interactivity, and interface
- F. Courseware delivery and evaluation.
- G. Multimedia tools: Audio editing, video editing, screen casting, graphic editing, and basics of animation, and creating interactive media.
- H. Reusable learning objects (RLO) – meaning, types and characteristics, RLO repositories, metadata and standards.
- I. E-content authoring tools- open source and proprietary alternatives.
- J. Open Educational Resources – Meaning and importance, various OER initiatives, creative common licensing.

2.10.3 Suggestive Practicum

1. Creating an account in wikispace/wikipedia/mediawiki and adding/editing content.
2. Developing an educational blog in www.blogger.com, www.wordpress.com.
3. A critical study of some *e-learning* course.
4. Developing a multimedia e-content for a topic.
5. Field visits to the EDUSAT center and take part in teleconferencing.
6. Planning and creating digital rubrics for any topic
7. Organizing web conferencing using Skype/Yahoo/ Messenger/ Google+.
8. Interview of computer hardware engineer/ICT specialist regarding Hardware planning, evaluation, maintenance, and up gradation
9. Review of NEP, National ICT policy and curriculum in the context of Technology in Education.

10. Enrolling and completing some MOOC courses of interest.
11. Developing technology integrated unit/lesson plans and trying them out in schools.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

- The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

COURSE TITLE: Gender Education**Credit:4****Semester:S-8****2.10.1 About the Course**

The course Gender Education seeks to develop understanding and interlinkages between gender and education. The course is designed to develop a conceptual understanding of the overall gender discourse with special emphasis on issues such as gender bias, gender stereotypes in school, curriculum and in textual materials. The course also addresses gender sexuality, sexual violence, abuse, and legal perspectives.

2.10.2 Learning Outcomes

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

- clarify key concepts like gender, transgender, gender bias, gender stereotype, empowerment, gender parity, equity and equality and patriarchy,
- explain the shifting from women studies to gender studies,
- clarify gender issues in school, curriculum, and textual materials across disciplines, pedagogical processes and its intersection with class, caste, religion, and region,
- examine school environment, curriculum, and pedagogy with reference to gender related issues,
- address issues related to sexuality, sexual violence, and abuse,
- draw framework for gender sensitized classroom and school environment.

UNIT - I**Gender and Education**

- A. Meaning, relationship, and significance of studying.
- B. Conceptual clarity of related terms: Gender, gender perspective, sexuality, patriarchy, masculinity, feminist, gender bias, transgender, gender stereotyping and empowerment.
- C. Gender as the basis in school education.
- D. Constitutional Provisions with special reference to equity and equality, rights of girls.
- E. Education and women's empowerment.
- F. Shifting from women's studies to Gender Studies.

UNIT - II**Learning Gender Roles**

- A. Social and Cultural Perspectives of Gender Identity: role of family and school, media, and other formal and informal organizations/ agencies
- B. Socialization and learning gender roles.
- C. Gender stereotyping/Role models.
- D. Preventing Measures: role of school and home

UNIT - III**Gender, Sexuality, Sexual Violence and Abuse**

- A. Development of sexuality and its impact on children with reference to gender, body image, role-models.
- B. Sexual violence in formal and informal institutions.
- C. Child sexual abuse from pre-primary stage to secondary stage: providing accurate information on child sexual abuse, helping, and identifying signs of sexual abuse in children.

- D. Providing dos and don'ts about sexual abuse.
- E. Legal perspective: Laws for safety and Security of girls and women, Implementation of the POCSO Act.

UNIT - IV

Pedagogical Issues

- A. Analyzing classroom practices.
- B. Creating gender friendly classrooms and school environment.
- C. Analyzing Curriculum from gender perspective: learning outcomes, textual material, teaching-learning processes, language used, teaching aids, assessment strategies.
- D. ICT pedagogy for gender sensitive school curriculum.
- E. Challenges for pedagogical issues.

2.10.3 Suggestive Practicum

1. Preparing a Report on National Educational Policies, (1986/1992 and 2020) in the context of gender issues in Education.
2. Preparation of projects on:
 - Analysis of textual materials from the gender perspective for identifying gender bias and gender stereotype in textual materials.
 - Recommendations of commissions and policies on education to empower girls/women.
 - Mahila Samakhya Programme.
 - Women Role Models in various fields with emphasis on women in unconventional roles.
 - Video clipping on portrayal of women.
 - Folklores reflecting socialization process.
 - How students perceive sexuality and their own body images.
3. Field visits to schools to observe the schooling processes from a gender perspective.
4. Preparing Analytical Report on portrayal of men and women in print and electronic media.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

- The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

COURSE TITLE: Guidance and Counselling**Credit:4****Semester:S-8****2.10.1 About the Course**

This course comprises of four units aiming to develop the understanding about the concept, need and significance of guidance and counselling. It will give a comprehensive understanding of guidance and counselling principles, techniques, and real-world applications. This course also deals with psychological testing and diagnosis in counselling. It examines the factors affecting guidance and counselling along with ethical considerations. The importance of counselling for individuals with disabilities, visual impairment, and hearing impairment is also emphasized in this course along with challenges related to providing counselling services in schools.

2.10.2 Learning Outcomes

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

- explain the basic meaning, need and significance of Guidance and Counseling in the context of education,
- differentiate between Guidance and Counselling with special reference to the purpose and strategies,
- clarify the general social, psychological, and historical perspective of Guidance and Counselling,
- describe the basic features of Guidance and Counseling with reference to students needs at school level,
- explain the basic principles of Guidance and Counselling,
- organize guidance program,
- analyze the reports of educational commission and educational policies with reference to Guidance and Counselling.

UNIT - I**Guidance**

- A. Meaning, need, nature and scope of Guidance.
- B. Brief historical background of Guidance movement in India.
- C. Individual and Group Guidance.
- D. Basic assumptions and principles of Guidance.
- E. Need to understand the needs of the individual and group in the context of Guidance.
- F. Essential information for Effective Guidance.
- G. Vocational Guidance and Role of teachers.

UNIT - II**Counselling**

- A. Meaning, importance, areas, and types of Counselling.
- B. Approaches to Counseling: directive, non-directive and eclectic, behaviorally, and cognitively oriented.
- C. Process of Counseling: initiating counseling, preparation, and intake procedures, establishing rapport, termination of and response to initial interview.
- D. Establishing Structure: attending behaviour, observation, non-verbal behaviour, listening, verbal patterning and communication responses, silence, use of questions, transference and countertransference. regarding and respect in counseling relationships. involuntary clients, client expectation.

- E. Role of family and community.

UNIT - III

Tools and Techniques to Collect Data

- A. Psychological Testing and Diagnosis: Need and Nature.
- B. Test use and interpretation, appraisal techniques.
- C. Counseling Interview: Essential aspects, basis procedures, problems, and their handling.
- D. Personality Assessment: Historical perspective
- E. Material administration, scoring, interpretation, and evaluation of frequently used personality inventories/ questionnaire and projective tests. Personal Orientation Tests and Rating Scales: Type a behaviour, Locus of Control, Attitude scale, ST AI etc., and other clinical rating scales.
- F. Case Study: Need and Importance.

UNIT - IV

Issues Related to Guidance and Counselling

- A. Factors affecting Guidance and Counselling.
- B. Ethical issues in Guidance and Counseling.
- C. Limitation of diagnosis with special reference to Counselling.
- D. Challenges to organize Guidance and Counselling programmes in schools.
- E. Counselling and Guidance of persons with learning disabilities, visual and hearing impairment.
- F. Challenges related to counselling services in schools.

2.10.2 Suggestive Practicum

1. Prepare a case study on students with learning difficulties.
2. Prepare a report on challenges of organizing guidance and counselling programmes in school.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

COURSE TITLE: Peace Education**Credit:4****Semester:S-8****2.10.1 About the Course**

The course is designed to develop a holistic and critical understanding of the theoretical and practical bases of peace education in National and Global perspectives both. The aim is to inculcate values and attitudes required to become a reflective peace practitioner who promotes peace and harmony in society. The course further enhances the contribution of various leaders or educationists in promoting culture of peace.

2.10.2 Learning Outcomes

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

- acquire a holistic and critical understanding of the theoretical and practical bases of peace education,
- trace the historical development and status of the peace education field,
- searching and identifying the best ways to follow peace in life,
- show ability to select and use appropriate method of resolving conflict,
- become critical learners and reflective peace practitioners,
- appreciate the foundations of just and peaceful societies,
- understand and practice the positive action and non-violent conflict resolution in society,
- enhance students' intellectual flexibility, creativity & problem-solving capacities,
- connect course content to current public events and issues worldwide.

UNIT - I**Peace Education: Nature and Significance**

- A. Peace and Peace Education.
- B. Meaning, need, dimensions and goal of Peace Education.
- C. A brief review of Historical Development of Peace Education.
- D. Philosophical, sociological, and psychological perspectives of Peace Education.
- E. Types of Peace: positive, negative, inner, social and with nature.
- F. Conflict-Resolution and Peace Education.
- G. Relationship between Development and Peacebuilding.
- H. Learning from experiences to explore the scope of Peace Education.
- I. Challenges to Peace Education.

UNIT - II**Towards the Global Culture of Peace**

- A. Process of Peacebuilding.
- B. Culture of Peace Vs Culture of War.
- C. Approaches to Peace Education.
- D. Conflict Analysis and Resolution.
- E. Role of Social and Religious Foundations in Peacebuilding.
- F. Role of local and International Agencies in the Peacebuilding process.
- G. Contribution of Mahatma Gandhi, Tagore, Shri Aurbindo and Dalai lama to build the Culture of Peace at Global level.

UNIT - III
Thoughts on Peace and Harmony

- A. Ancient Indian views.
- B. UNO role for Global Peace Education.
- C. Constitutional provisions.
- D. Study of following thinkers in context of global Peace and Harmony: J. Krishnamurti, Sri Aurobindo, Rabindra Nath Thakur, Mahatma Gandhi, Montessori, Russell, Dalai Lama.

UNIT - IV
Pedagogical Issues for Peace Education

- A. Assessing curriculum policy for social and civic reconstruction.
- B. Comparative and historical perspective on school knowledge and peace.
- C. Socio-historical processes on curriculum change.
- D. Teachers' perceptions of the effects of young people's war experiences and pandemic.
- E. Critical analysis of school curriculum at school level in the light of peace building process.
- F. Challenges of Pedagogical issues of Peace Education.

2.10.3 Suggestive Practicum

1. Critical analysis of Educational Policies, Curriculum and Text Material for Peace-building Process.
2. Reflection on Human Rights, with special reference to Constitution of India, as a process of Social-cohesion and Peace.
3. Analyzing the Role of UNESCO in the context of Peace at Global level.
4. Collection of statements, shloka or sukta (Good Sayings) from ancient Indian literature related to inner and Social Peace.
5. Study of Yoga-Darshana as a process of Peace and Harmony.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

COURSE TITLE: Sports and Fitness Education**Credit:4****Semester:S-8****2.10.1 About the Course**

The course seeks to develop a comprehensive and holistic understanding about the concept of health, its various dimensions, and determinants. The course traces the evolution of Health and Physical Education, historical development of the discipline with special reference to Indian Education and its relation to other subjects. It further highlights the importance of physical fitness policies, programs and services addressing health initiatives in school context.

2.10.2 Learning Outcomes

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

- understand the concept of holistic health, its various dimensions, and determinants,
- develop positive attitude towards health physical education and yoga as individual,
- sensitize, motivate, and help them to acquire the skills for physical fitness, learn correct postural habits and activities for its development,
- create interest for the practice of yogasana and meditations,
- understand various policies and programmes related to health, physical education and yoga,
- help them to understand the process of assessment of health and physical fitness.

UNIT - I**Evolution of Health and Physical Education**

- A. Health and Physical Education: Conceptual Clarity (locally as well as globally), importance and aims.
- B. Place in School Curriculum: Historical Development as a subject, Objectives with special reference to Indian Education and its relationship with other subjects.
- C. Status of Health and Physical Education: From primary to secondary education in a global perspective, ayurvedic and yogic concept of Health Education, legal perspective of Health and Health Education in India.

UNIT - II**Health Education**

- A. Concept, dimensions, and determinants of health with special to India.
- B. Psycho-social concerns of children and adolescents including differently able children.
- C. Understanding the body system and its functions
- D. Common health problems and diseases: causes, prevention and cure, immunization and first aid.
- E. Impact of Physical activities, games, sports and yoga on different body systems.
- F. Food and nutrition, nutrients and their functions.

UNIT - III**Games and Fitness**

- A. Physical fitness and its components: athletics (general physical fitness exercises), games (lead-up games, relays, and major games), Rhythmic activities, gymnastics, and their impact on health.

- B. Development of physical fitness: Postures and Importance of relaxation, Fitness tests; Resources and services for games and sports and Health.
- C. Fundamentals skills of sports: Sports for recreation and competition, Sports awards and scholarships, sport person ship, Indigenous and self-defense activities.
- D. School and family, health services, policies and major health and physical education-related programmes, blood banks, role of media.
- E. Safety and security.
- F. First Aid: Need and Principles.

UNIT - IV

Policies, Programmes and Assessment

- A. Policies, programmes, and services for addressing health needs.
- B. School Health Programme: school health services, health promoting schools, global school health initiatives.
- C. Yoga: Meaning, initiation, historicity, classification, streams, and schools of yoga, Need and importance and role of yoga for healthy life and living, Yoga as a Psychotherapy.
- D. POCSO (Protection of Children from Sexual Offences Act, 2012), PWD 2016, the Integrated Child Protection Scheme.
- E. Assessment of health performance testing in games and sports, reporting of health condition and performance of child in the sport fields.

2.10.3 Suggestive Practicum

1. Recognizing important indicators of health and wellbeing of children and mental health.
2. Undertaking a survey, understanding local food related matters, and understanding the importance of the right to food.
3. Analyzing NEP, 2020 with reference to Games Oriented Education.
4. Planning activities for development of physical fitness.
5. Organization of games and sports tournaments
6. Learning and performing basic yogic activities, asanas, and pranayama, Kriyas and Meditation. Celebration of yoga day, yoga week.
7. Arranging reflective Dialogues on Serials and related videos.
8. Preparation of inventories on myths on exercises and different types of food.
9. Preparation of First Aid kit.
10. A critical review of YOGA-SUTRA.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

COURSE TITLE: Adolescence Education**Credit:4****Semester:S-8****2.10.1 About the Course**

The course is designed to develop a comprehensive understanding and knowledge about Adolescence and Adolescence education with special references of Adolescence Education programmes in India at School level. There is an attempt to develop understanding about intellectual, emotional, physiological, socio-cultural, and interpersonal issues related to the processes of growing up and to inculcate healthy attitude towards sex and sexuality, respect for the opposite gender and understanding of responsible social behaviour. The course highlights core life skills and their significance in adolescence life period and try to know about the various Adolescence Education programmes undergoing for Adolescence in India.

2.10.2 Learning Outcomes

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

- develop sensitivity, understanding and knowledge about Adolescence and Adolescence Education,
- know the historical development of Adolescent Educational Programme in India,
- know the role of local as well as international agencies towards Adolescent Educational Programme,
- develop a positive attitude towards the importance of Adolescence Education Programmes at the school level,
- develop knowledge and sensitivity on matters related to reproductive health, sex and sexuality and communicate effectively on these issues,
- develop understanding about intellectual, emotional, physiological, socio-cultural, and interpersonal issues related to the processes of growing-up,
- inculcate a healthy attitude towards sex and sexuality, respect for the opposite gender and an understanding of responsible sexual behavior,
- develop an understanding about the desired life skills,
- acquire pedagogical related skills for Adolescence Education Programmes.

UNIT - I**Adolescence and Adolescence Education**

- A. Understanding Adolescence: intellectual, emotional, social, and physiological aspects of Adolescence, issues and challenges during Adolescence, myths and realities.
- B. Adolescence Education: concept, nature, and significance of Adolescence Education in Indian context, aims and objectives of Adolescence Education.
- C. Role of school, family, media, and community as social agencies in Adolescence Education.
- D. Challenges of Adolescence Education.

UNIT - II**Life Skills and Adolescence Education**

- A. Concept, nature, and significance of Life Skills for Adolescence Education.
- B. Relationship between Life Skills and Adolescence Education.
- C. Core Life Skills and their significance.
- D. Understanding sexual and reproductive health.
- E. STIs and HIV/AIDS: causes, prevention, cure, and skills of coping.

249

UNIT - III**Adolescence Education Programme in India (AEP)**

- A. Historical Development of Adolescence Education Programme in India.
- B. Goals and Significance of Adolescence Education Programme in India.
- C. Role of Teachers in Adolescence Education in India (AEP).
- D. Challenges to Educational Programmes in India.
- E. Myths / Misconceptions

UNIT - IV

Pedagogical Issues

- A. Meaning, goals and significance.
- B. Challenges of teaching adolescence education: understanding student's behavior, dealing with personal self-constraints, socio-cultural issues, class-room issues and challenges, material production, methodology
- C. Preparation of teachers
- D. Approaches to adolescence education: case studies and critical incidents, brainstorming, role-playing, gaming, value clarifications, question box, discussions and debates, puppet shows, role reversal, video shows.

2.10.3 Suggestive Practicum

1. Study of Case studies and Critical Incidents. a) Field visit/s
2. Review and analysis of the work done by Government and Non-Government.
3. Study of Organizations (NGO) at national and international level.
4. A research study or detailed case study: Adolescents' behavior in different socio-economic settings, a study on child abuse victims, adolescents in drug rehabilitation centers, adolescents residing in the precincts of industrial areas and factory establishments, adolescents in the educational regions showing either higher or lower drop-out rate, adolescents belonging to communities in which social evils affecting them are manifested like child marriages, conducting Adolescence Education sessions in School.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

COURSE TITLE: Art in Education**Credit:-4****Semester:S-8****2.10.1 About the Course**

The course seeks to develop an understanding of Art with special reference to its relevance in human life in general and Education in particular. It will further develop imagination and sense of appreciation and aesthetic of art. The theoretical considerations of Art Education are highlighted from Indian and western perspectives of art in Life. The course talks about the fundamental principles of Art Education at school level. The pedagogical issues of art education and approaches to teaching-learning process are also discussed.

2.10.2 Learning Outcomes

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

- develop art appreciation with special reference to relevance and place of Art in human life,
- acquaint with conceptual understanding of the key ideas of Art Education,
- discuss critically the value development in Art Education.,
- understand the implications of Art in Education,
- sensitize towards the problems and issues in Art Education,
- sensitize towards pedagogical issues of Art Education,

UNIT - I**Art and Education**

- A. Conceptual clarity, relationship, and significance of studying art education with special reference to place of art in Human life.
- B. Historical development of art education in school education.
- C. Goals of studying art education in school curriculum at different stages.
- D. Studying art education across the curriculum.
- E. Perspective of NEP, 2020 on Art Education.

UNIT - II**Theoretical Consideration of Art Education**

- A. Philosophical, psychological and sociological perspective of Art Education.
- B. Formal and informal theories of art.
- C. Indian perspective of art in life.
- D. Western perspective of art in life.
- E. Critical analysis of theories of Art Education.

UNIT - III**Fundamentals of Art Education**

- A. Literature of Art Education
- B. Conceptual clarity of the following basic concepts of art at school level: aesthetics, criticism and judgement at school level, beauty, reality, idea, truth, taste, sense.
- C. Basic requirements of teaching-learning art at school across stages.
- D. Question of social ethics.

UNIT - IV

Pedagogical Issues of Art Education

- A. Approaches to teaching-learning process of Art Education.
- B. Curriculum of art education with special to challenges of developing curriculum.
- C. Material production and its challenges.
- D. Assessment and Evaluation strategies with special reference to challenges.
- E. Criterion of analyzing: curriculum of Art Education, teaching-learning material, assessment and evaluation strategies, teaching strategies of art at school level.
- F. Values in Art teaching.

2.10.3 Suggestive Practicum

1. Preparing multimedia material for Art Education in senior secondary schools.
2. Preparation of instructional material for education in the arts for secondary school.
3. Organizing the Art Club.
4. Case studies of the children's work of art and their understanding of the concept of Art.

2.10.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

2.10.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.10.6 Suggestive Reading Materials

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

Yoga and Understanding Self

Credit:-2

Semester:S-8

5.9.1 About the Course

This course focuses on the benefits of Yoga for healthy living and the importance of the practice of yoga for promoting the optimal state of physical, emotional, intellectual, social, and spiritual wellbeing of a person. Yoga as a way of life is characterized by peace and tranquillity, harmony and health, love and happiness, precision, and efficiency. The course seeks to engage student teachers with these ideas. The focus of the course is on being mindful of self (body, mind, emotions, thoughts, and actions). Course components will include brief history of yoga, principles and different types and streams of yoga, practices (Kriyas, Āsana, Prāṇāyāma, Bandha & mudra, Dhāraṇa & Dhyāna, etc), meditation and reflective practices, and the importance of these aspects in becoming an effective teacher. It lays equal weightage to the theory and practicum.

5.9.2 Learning Outcomes

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

- explain the importance of Yoga and how it helps an individual in understanding Self,
- describe the importance of practicing Yoga Asana,
- practice basic Yoga Asanas/ Kriyas.

UNIT - I**Philosophy and Historical Perspective of Yoga**

- A. Concept and Meaning of Yoga, Philosophy of Yoga,
- B. Brief history and development of Yoga (Classical Yoga, Post Classical Yoga and Modern Period)
- C. Importance of Yoga for healthy living, Yoga and its relevance in the modern times, Traditions in Yoga.

UNIT - II**Schools of Yoga**

- A. Different streams \schools of Yoga (Gnana, Bhakthi, Karma).
- B. Construction of Yoga Practice for all round development.
- C. Principals of Yoga: - Ahimsa, Satya, Asteya, Brachmacharya, Aparigraha, Shoucha, Santhosha, Tapas, swadyaya and Isvara Paridhana.

UNIT - III**Modern Principles of Yoga and Meditation**

- A. Modern Principles: Human Body is a holistic entity, Individuals and their need are Dhāraṇa & Dhyāna, etc, meditation and reflective practices, and the importance of these aspects in becoming an effective teacher, unique Self-empowering, the quality and state of an individual mind is crucial to healing.
- B. Meditation: - its Importance, Types, and Process, Pranayama: its importance, types and process, Yoga as a Way of life for Peace, Harmony, Health love and happiness. Yoga in Indian philosophy for understanding Self.

5.9.3 Suggestive Practicum

1. Practice of Basic Yoga Asanas/ Kriyas.

5.9.4 Suggestive Mode of Transaction

Reflective reading of different Yoga practicing Personalities, Learning by doing, Relaxation Techniques for imparting concentration, Understanding Self and personality development.

5.9.5 Suggestive Mode of Assessment

Assessment of practicum; Assessment of practice of basic Yoga Asanas/ Kriyas; Assessment of Reflective level Readings.

5.9.6 Suggested Reading Materials

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

Citizenship Education, Sustainability, and Environmental Education**Credit: 2****Semester:S -8****5.10.1 About the Course**

This course seeks to orient student teachers to the Constitution of India with a particular emphasis on Fundamental Rights and Fundamental Duties, and to prepare them for their roles and responsibilities as responsible, productive, and effective citizens of India. The course also seeks to enable student teachers to understand the interconnected and interdependent world, India's rich heritage and philosophical foundation of "Vasudaiva Kutumbakam" (Whole world is one family), acquire the knowledge, capacities, values, and dispositions needed to understand global issues and become active promoters of more peaceful, harmonious and sustainable societies. The course also seeks to create among student teachers an awareness of responsible global citizenship required for responding to contemporary global challenges.

The sustainability aspect of the course seeks to develop among student teachers an understanding of the idea of 'Sustainability' in all fields of human activities, including achieving sustainable development in its three dimensions – economic, social, and environmental – in a balanced manner. The environmental education component of the course aims at creating an awareness among student teachers of environmental issues, including actions required for mitigating the effects of climate change, environmental degradation and pollution, and initiatives required for effective waste management, conservation of biological diversity, management of biological/natural resources, forest and wildlife conservation, and sustainable development and living. The course will also deepen the knowledge and understanding of India's environment in its totality, their interactive processes, and effects on the future quality of people's lives.

5.10.2 Learning Outcomes

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

- explain the concept of citizenship and citizenship education,
- describe the aims of and approaches to citizenship education,
- explain the concept and aims of Global Citizenship and Global Citizenship Education,
- describe the aims of and approaches to global citizenship education,
- explain the concept of 'Sustainability' in all fields of human activities, and approaches to achieving sustainable development in its three dimensions – economic, social and environmental – in a balanced manner,
- demonstrate an awareness of environmental issues, and actions required for mitigating the effects of climate change, environmental degradation and pollution, and initiatives required for effective waste management, conservation of biological diversity, management of biological/natural resources, forest and wildlife conservation, and sustainable development and living.

UNIT - I**Citizenship Education**

- A. Concept of citizenship and citizenship education.
- B. Aims of and approaches to citizenship education.
- C. Concept of Global Citizenship and Global Citizenship Education.
- D. Aims of and approaches to global citizenship education.

- E. Concept of *Vasudhaiva Kutumbakam*, its importance in development of a holistic perspective towards local and global communities.

UNIT - II
Sustainability

- A. Concept of ‘Sustainability’ in all fields of human activities.
- B. Approaches to achieving sustainable development in its three dimensions – economic, social, and environmental.
- C. Sustainable development goals.
- D. Sustainable management of natural resources.
- E. School- and community-based activities.
- F. Education for sustainable development

UNIT - III
Environmental Education

- A. Environmental issues.
- B. Actions required for mitigating the effects of climate change, reducing environmental degradation, pollution etc.
- C. Initiatives required for effective waste management, conservation of biological diversity, management of biological/natural resources, forest and wildlife conservation, and sustainable development and living.
- D. Approaches to delivering Environmental Education
- E. Role of Mass Media and Technology in delivering environmental education.
- F. Roles Governmental and Non-Governmental Organizations in promoting Environmental Education.
- G. School and community-based environmental education activities.

5.10.3 Suggestive Practicum

- 1. Write a report on the roles of governmental and non-governmental organizations in promoting Environmental Education.

5.10.4 Suggestive Mode of Transaction

Lecture-cum- discussion, Focus Group discussions, in-class seminars, Library Work, Assignments, Project Work, Lesson Plan Development, Interaction with different stakeholders, ICT based educational materials, Group Work, critical reflections, group-work, case-based approaches, and enquiry-based learning.

5.10.5 Suggestive Mode of Assessment

Assessment of practicum and assessment of reflective level readings.

5.10.6 Suggestive Reading Materials

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

COURSE TITLE: Post Internship

Credit: 2
Semester:S-8

6.5.1 About the Course

After successful completion of internship programme in 7th semester, student teachers compile the learnings, discuss with peers about their experiences, reflect on the experiences, refine the artifacts developed during internship and prepare comprehensive internship report during post internship in 8th semester.

6.5.2 Learning Objectives

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

- develop comprehensive understanding of the school ecosystem,
- describe their learning from internship with the peers and teacher educators,
- reflect on school internship sharing learning experiences on each activity undertaken.

6.5.3 Suggestive Mode of Transaction

- Discussion
- Presentation, Gallery walks and Exhibition.
- Report Writing

6.5.4 Activities:**6.5.4.1 Experience Sharing and Reflective Learning**

- Presentation of reflective journal summary
- My Learning Journey: by each student-teacher
- Gallery walks (Exhibition): TLMs, display of participation in school activities (photos/stories) and other artefacts created during the internship by student teachers.
- Sharing of best practices (PPTs, Videos.)
- Survey and collect the local stories and rhymes from the parents and community (in the context of the foundational stage)
- Holding a training workshop for the parents and community and encouraging them to act as volunteers.
- Awareness and advocacy programme in FLN for parents and community: Role play with parents and community on conducting specific FLN activities.
- Organizing a parents /community mela/fair on homemade TLM for FS children

6.5.4.2 Submission of Internship Report

- Reflective Journal
- Lesson Plans and TLMs
- Observation records (Teacher Educator, Mentor, school heads, Teachers, Parents)
- Assessment records and Student Portfolio
- Action research report/case study
- Comprehensive internship report.

6.5.5 Suggestive Mode of Assessment

Competence/Artifact	Method of assessment	Assessed By	Credits
Artefacts created during the internship. My Learning Journey	Exhibition & Presentation	Teacher-Educator	1
Comprehensive Internship Report	Review	Teacher-Educator	1

6.5.6 Learning Outcomes

The student teachers will be able to:

- demonstrate/Exhibit/Manifest comprehensive understanding of the school ecosystem.
- reflect on school internship experiences in a report.
- share their learning from school internship with the peers and teacher educators.

Creating Teaching Learning Material (TLM)/Work Experience**Credit:2****Semester:S-8****6.6.1 About the Course**

Having developed an understanding of education's philosophical, sociological, and psychological perspectives and gained hands-on experiences from pre-internship school observation and internship phases, the student teachers have developed a comprehensive understanding of education. By utilizing these experiences and understanding, the Student teachers will be in a position to develop/create Teaching Learning Materials (in various forms, Programed Learning Materials, Educational videos, teachers' handbooks, flashcards, story books, toys, games, posters, collages, innovative lesson plans using different pedagogies, to mention a few) which in turn may be helpful to both the school students with whom he/she has interacted during school experiences and the student teachers. Schools provide a systematic teaching environment for the learners to acquire the knowledge, skills and attitude required to meet the varied aspirational needs and educational goals. Work experience fosters basic knowledge, skills and disposition among the students that prepare them to think of becoming skilled entrepreneurs. To orient the school students on work education, the student teachers need exposure to visit the local vocational artisans, crafts person and entrepreneurs and prepare learning resources to enhance their professional skills and competencies. Teaching Learning Materials of good quality with (i) innovations, (ii) the use of low-cost materials, (iii) local context and (iv) modern technology (for digital learning materials) will enhance students' engagement, interest, and practical learning.

6.6.2 Learning Objectives

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

- Assess the need for Teaching Learning Materials and prepare innovative TLM,
- Develop an understanding of the importance of work experience and competencies of a local crafts person, artisans and entrepreneurs,

6.6.3 Suggestive Mode of transaction

- Workshop
- Group discussion
- Field visits and interaction
- Analysis of existing local-specific learning resources, toys
- Exhibition of TLM and presentation of reflective reports on the use of learning resources, including toys.

6.6.4 Content

- Understanding how students learn at different stages.
- Knowledge of toys and other TLMs from different parts of the countries
- Knowledge of relevant TLMs for specific groups of children- CWSN, kinesthetic learners, visual learners, auditory learners addressing individual differences.

6.6.5 Activities to be conducted.

The following are a few suggestive activities:

- Orientation workshop on work experience and development of learning resources
- Field visit for interaction with local artisans, craftspeople, and entrepreneurs.
- Observe Traditional work practices and their integration into Local Technologies and Ideas.
- Analysis of available local specific, indigenous learning resources, including toys and their use in the learning-teaching process
- Development of at least two low-cost learning resources as per the local contexts (foundational/preparatory/middle/secondary) and presentation/exhibition
- Prepare the manual of TLM highlighting the objectives that will be achieved by its use, the material used, the process of its development and its use during classroom transaction.

1.6.6 Suggestive Mode of Assessment

Assessment			
Competence/Artifact	Method of assessment	Assessed By	Credits
TLM developed	Presentation /Exhibition	Teacher Educators (panel of three experts including an external expert)	1.5
Manual	Presentation	Teacher Educator	0.5

6.6.7 Outcomes

The student teachers will:

- demonstrate the use of TLM for enhanced learning,
- explain the importance of work experience and competencies of local crafts person.

CURRICULAR COMPONENT: COMMUNITY ENGAGEMENT AND SERVICE
(This component is common to student teachers across Stage
Specialization)

Credit:2

Semester:S-8

7.1 About the Course

The curricular component of ‘community engagement and service’ seeks to expose student teachers to the socio-economic issues in society and community-supported development activities so that classroom learnings can be supplemented by life experiences to generate solutions to real-life problems. This course is designed to develop insights into the functions of the community, enhance the ability of student teachers to enlist community support to and participation in school-related activities, make the community aware of the importance of education, issues associated with schooling, gender inequity, health & wellness of children, initiatives for supporting lifelong education etc. It aims at sensitizing the student teachers to initiate actions with the support of the community members to address the social, cultural and educational problems, and develop social leadership skills through community service. The component seeks to enable student teachers to be acquainted with various community development initiatives and organize activities such as *street plays, advocacy activities, door-to-door campaigns, and prabhat-pheris* etc. to mobilize community participation in development initiatives.

This curricular component envisages participation of student-teacher in activities undertaken under the National Service Scheme (NSS), New India Literacy Programme, Student the mentoring initiatives, etc. Some of the activities include: Survey of community resources for participation in different school activities, Study of the situation with regard to school dropout and the reason thereof (Stage wise); Survey of a specific settlement to study the socioeconomic and educational status; Survey of non-literates in a specific settlement, including identification of 4-5 non-literate adults who will be supported by student teachers to become literate; training of local youth in First-Aid and other relevant activities; assessment of the situation with regard to Health and wellness of children in a locality, creating awareness of the importance of sustainable development, making the community members aware of the importance of environmental protection, creating awareness of rainwater harvesting, mentoring school students with learning deficits, guidance and counselling to school students etc.

7.2 Learning Outcomes

On successful completion of the ‘Community Engagement and Service’ programme, the student-teacher should be able to:

- recognize the socio-economic issues in the community and identify initiatives that could help solve problems faced by the community,
- demonstrate an awareness of the functions of the community, and the measures required for enlisting community participation in school-related activities,
- undertake initiatives that are required to make the community aware of the importance of education, issues associated with schooling, gender inequity, health & wellness of children, illiteracy among youth and adults in the community etc.,

- suggest actions in collaboration with community members to address the social, cultural and educational problems in the community,
- organize activities such as *street plays, advocacy activities, door-to-door campaigns, and prabhat-pheris* etc. to mobilize community participation in development initiatives,
- demonstrate social leadership quality through community services,
- organize interactions between schools and local communities for generating solutions to problems such as dropout and learning deficits,
- facilitate partnerships between local communities to enhance participation of the community in school-related activities such as PTA meetings,
- recognize the fault lines of the society, such as casteism, social taboos and superstitions etc. and work towards bridging them to establish harmony in the society,
- demonstrate positive feelings towards the local community and appreciate traditional knowledge and practices,
- Recognize the values of public service and active citizenship.

7.3 Approach to curriculum transaction

The student teachers will be provided opportunities to have exposure to community life for ten days in total, two days in Preparation for Community Engagement & Service in the institution, seven days working with the community, and the last day in the institution for sharing their experiences and reflections. The activities may be conducted in groups or individually as appropriate.

Days 1-2: Preparation for community services (In the institution)

- Orientation of student teachers on Community Engagement & Services through discussion and group activities.
- Workshop for developing tools for different activities during the programme.

Days 3-9: Engagement with the community (Mandatory onsite stay with the community)

Students will be divided into smaller groups; They would participate in the planned activities with defined roles for seven days on a rotation basis. These activities include:

- participation of student teachers in activities undertaken under the National Service Scheme (NSS), New India Literacy Programme, Student mentoring initiatives, etc.
- Survey of community resources for supporting school activities.
- Study of the situation regarding school dropout and the reason thereof (Stage wise).
- Survey of specific settlement to assess the situation about non-literates in the settlement, including identification of 4-5 non-literate youth and adults who will be supported by student teachers to become literate,
- Training of local youth in First Aid and other relevant interventions,
- Assessment of the situation about Health and wellness of children in a locality,
- Creating awareness of the importance of sustainable development, and making the community members aware of the need to support initiatives to ensure environmental protection, creating awareness of rainwater harvesting, mentoring school students with learning deficits, guidance and counselling to school students etc.)
- Visit and interact with local artisans and craftsperson.

The above activities typically will include working with the community, collecting data, playing local games, community awareness programmes like nukkad natak, rallies, organizing and participating in the cultural programmes with the community members etc.

The student teachers shall conduct different pre-scheduled activities throughout the day. Morning sessions will be used for activities with the community and data collection. The afternoon session will be devoted to data analysis and preparation of the report, and participation in games & sports activities. Evening session will involve cultural activities with community members.

Day 10: Feedback session and Reflection (: In the Institution)

- Sharing experiences and discussion on activities carried out.
- Presentation and submission of report of the activities carried out.
- Evaluation of the activities by collecting feedback on the effectiveness of the campaign from the mentor and the students.
- Reflection of experience (individual/group) of organizing community service

7.4 Assessment components and weightage

- Involvement and active participation in activities relating to Community Engagement and Service: (Assessment method: Observation by teacher educator, teacher and community members); Weightage: 75%; Assessed by the teacher educator, teacher and community members),
- Group Report & Reflections: Method of assessment: Presentation by student teachers); Weightage: 25% (Assessed by Teacher Educator)

7.5 Suggestive Links

- Ministry of Education (2021). Vidyanjali: Guidelines for Promoting Community and Voluntary Participation for Enhancing Quality School Education, Government of India. https://vidyanjali.education.gov.in/assets/pdf/Final_Guidelines_Vidyanjali_%20December.pdf
- RIE Bhubaneswar (2020). Handbook on Field Engagement in Pre-service Teacher Education, Bhubaneswar, Regional Institute of Education.