Curriculum Framework
M.Sc.-M.Ed.
Academic Year 2024-25

Based on NEP 2020

॥ न हि ज्ञानेन सदृशं पवित्रमिह विद्यते ॥

भारतीय शिक्षक प्रशिक्षण संस्थान, गांधीनगर

Indian Institute of Teacher Education, Gandhinagar

(A State Public University Established by Government of Gujarat)

Curriculum Framework M.Sc.-M.Ed. 2024-25

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From the Desk of Vice-Chancellor….

Dear All,

It gives me immense pleasure to present the revised curriculum framework for the Post Graduate programmes offered by the Indian Institute of Teacher Education (IITE), Gandhinagar. This curriculum has been meticulously developed in alignment with the National Education Policy 2020 (NEP-2020), which aims to reshape the Indian education system by integrating our rich heritage with global standards.

The revisions are rooted in the guiding principles of the National Curriculum Framework. The revised curriculum incorporates the Integrated Teacher Education Programme (ITEP) framework, ensuring that our future educators are equipped with the necessary tools and knowledge to foster holistic development in students.

As we endeavour to bring Indian educational ethos into the global context, these curricula will serve as a foundation for creating educators who not only excel in their professional capacities but also embody the values of peace, harmony, and global citizenship. Through this curriculum, we aim to empower our teacher candidates to contribute to a more inclusive, dynamic, and sustainable future.

I extend my heartfelt gratitude to the faculty members, the Board of Studies (BoS), and the Academic Council for their commitment and hard work in revising and finalizing this curriculum within a short span of time. Their efforts reflect the dedication of our institution to excellence in teacher education.

I also invite all stakeholders to carefully review the revised curriculum and provide constructive feedback. Your insights will help us make these courses more comprehensive, relevant, and in tune with the evolving needs of education globally.

With Best Regards,

Prof. R.C. Patel
Vice Chancellor
Indian Institute of Teacher Education (IITE),
Gandhinagar

Regulations for PG Courses (2024)

Regulations for PG Courses (2024)

M.A., M.Sc., and M.Ed. as per the guidelines issued by UGC on 14th June 2024 in light of recommendations in NEP-2020 and the integrated courses of M.A.-M.Ed./M.Sc.-M.Ed./ B.Ed.-M.Ed.

1.0 Programme, Duration and its equivalence:

1.1 Programme and Duration: **M.A., M.Sc., and M.Ed.** (2-Year), Integrated Techer Educator Programme **B.Ed.-M.Ed.** and integration of Innovative Integrated Teacher Educator programmes **M.A.-M.Ed./M.Sc.-M.Ed.** (3-Year, Recognised by NCTE, New Delhi.)

1.1.1 M.A. is a post-graduate PG programme in Arts and is entitled 'Master in Arts'. This programme is of two years duration and each year comprises 2 semesters. Each semester consists of 16 weeks of instructions, i.e., 96 days for instruction. There shall be 192 days for instruction in a year.

1.1.2 M.Sc. is a post-graduate PG programme in Science and is entitled 'Master in Science'. This programme is of two years duration and each year comprises 2 semesters. Each semester consists of 16 weeks of instructions, i.e., 96 days for instruction. There shall be 192 days for instruction in a year.

1.1.3 M.Ed. is a post-graduate PG programme in Education and is entitled 'Master in Education'. This programme is of two years duration and each year comprises 2 semesters. Each semester consists of 16 weeks of instructions, i.e., 96 days for instruction. There shall be 192 days for instruction in a year.

1.1.4 M.A.-M.Ed. is a post-graduate Integrated Innovative Teacher Educator PG Programme (3-Year) and is entitled 'Master in Arts and Master's in Education'. This programme is of three years duration and each year comprises 2 semesters. Each semester consists of 16 weeks of instructions, i.e., 96 instructional days. There shall be 192 days for instruction in a year.

1.1.5 M.Sc.-M.Ed. is a post-graduate Integrated Innovative Teacher Educator PG Programme (3-Year) and is entitled 'Master in Science and Master in Education'. This programme is of three years duration and each year comprises 2 semesters. Each semester consists of 16 weeks of instructions, i.e., 96 instructional days. There shall be 192 days for instruction in a year.

1.1.6 B.Ed.-M.Ed. is a post-graduate Integrated Teacher Educator PG Programme (3-Year) and is entitled 'Bachelor in Education and Master in Education'. This programme is of three years duration and each year comprises 2 semesters. Each semester consists of 16 weeks of instructions, i.e., 96 instructional days. There shall be 192 days for instruction in a year.

1.2 Equivalence:

1.2.1 The programme contents related to M.A.-M.Ed. is equivalent to PG Programme in Arts and equivalent to M.A. degree of the Indian Institute of Teacher Education and M.Ed. is Masters in Education equivalent to M.Ed. degree of the Indian Institute of Teacher Education.

1.2.2 The programme contents related to M.Sc.-M.Ed. is equivalent to PG Programme in Science and equivalent to M.Sc. degree of the Indian Institute of Teacher Education and M.Ed. is Master in Education equivalent to M.Ed. degree of the Indian Institute of Teacher Education.

1.2.3 The programme contents related to B.Ed.-M.Ed. is equivalent to UG Programme

in Education and equivalent to B.Ed. degree of the Indian Institute of Teacher Education and M.Ed. is Master in Education equivalent to M.Ed. degree of the Indian Institute of Teacher Education.

Students who pass this programme are considered eligible to pursue Research Studies in Education in the Centre of Education of Indian Institute of Teacher Education and also eligible for Ph.D. in relevant subject at the centres specified by University.

2.0 Eligibility for admission to M.A., M.Sc., and M.Ed. and B.Ed.-M.Ed., M.A.-M.Ed. and M.Sc.-M.Ed.

2.1 All of above programmes have different pre-entry qualifications as stipulated below and marks attained in pre-entry test (i3T).

2.1.1 Eligibility for admission to M.A.

The candidates seeking admission to the M.A. programme should have passed following Examinations from the IITE or any of the universities recognised by UGC.

1. B.A.-B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions)
2. Graduate in any of the subjects of Arts discipline and B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions)

2.1.2 Eligibility for admission to M.Sc.

The candidates seeking admission to the M.Sc. programme should have passed following Examinations from the IITE or any of the universities recognised by UGC.

1. B.Sc.-B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions)
2. Graduate in any of the subjects of Science discipline and B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions)

2.1.3 Eligibility for admission to M.Ed.

The candidates seeking admission to the M.Ed. programme should have passed following Examinations from the IITE or any of the universities recognised by UGC.

1. B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions) or
2. B.Sc.-B.Ed. or B.A.-B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions) or
3. B.El.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions) or
4. D. El. Ed. with an UG degree (Minimum 50% of the Total Marks in each or equivalent CGPA from UGC recognised Universities or Institutions or State Examination Board)

2.1.4 Eligibility for admission to M.A.-M.Ed.

The candidates seeking admission to the M.A.-M.Ed. programme should have passed following Examinations from the IITE or any of the universities recognised by UGC.

1. B.A.-B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions)
2. Graduate in any of the subjects of Arts discipline and B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions)

2.1.5 Eligibility for admission to M.Sc.-M.Ed.

The candidates seeking admission to the M.Sc.-M.Ed. programme should have passed following Examinations from the IITE or any of the universities recognised by UGC.

1. B.Sc.-B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions)
2. Graduate in any of the subjects of Science discipline and B.Ed. (Minimum 50% of the Total Marks or equivalent CGPA from UGC recognised Universities or Institutions)

2.1.6 Eligibility for admission to B.Ed.-M.Ed.

The candidates seeking admission to the B.Ed.-M.Ed. programme should have passed following Examinations from the IITE or any of the universities recognised by UGC.

1. PG Degree in Sciences/ Social Sciences/ Humanities with a minimum of 55% of marks or its equivalent grade (CGPA) from UGC recognised

2.2 Admission to the above Programmes

There shall be pre-entry test for all of above Programmes and merit shall be prepared as per the norms regulated by university time by time.

3.0 Scheme of Instruction:

There will be four/six semesters and students will have to learn following subjects in two broad areas of curriculum in Education.

1. PG Course in respective academic programme, (2-Year M.A., and M.Sc.).
2. PG Course in Teacher Education (2-Year M.Ed.).
3. Innovative Integrated Teacher Educator Programme (3-Year) M.A.-M.Ed./ M.Sc.-M.Ed. integration of PG Programme in academics and Teacher Education.
4. B.Ed.-M.Ed. is an Integrated Programme of UG and PG Teacher Education Programmes as per Annexure 15 of NCTE (Recognition Norms and Procedure) Regulations, 2014.

Details of courses and scheme of study, duration, etc. are annexed herewith in Annexure-1.

3.1 PG Course in respective academic programme

There are two basic PG Academic Programmes and they are M.A. and M.Sc. The following subjects shall be offered in these two categories, they are:

i. English (M.A.),
ii. Botany (M.Sc.),
iii. Chemistry (M.Sc.),
iv. Maths (M.Sc.), and
v. Physics (M.Sc.)

Categories of courses being offered and title of the papers are annexed herewith in Annexure: 2.

3.2 PG Course in Teacher Education

PG Course in Teacher Education is integrated teacher education programme leading to PG Degree of M.Ed.

Categories of courses being offered, and title of the papers are annexed herewith in Annexure: 2.

3.3 UG Programme in Teacher Education

UG Programme (B.Ed.) is the programme as approved in Curriculum Frame of B.Ed.-M.Ed. programme of 2023-26 Batch.

3.4 MOOCs Courses

For the MOOC, University shall follow the University Grants Commission (Credit Framework for Online Learning Courses through Study Webs of Active Learning for Young Aspiring Minds) Regulations 2021, UGC Framework for Universities to conduct Examination for SWAYAM Courses August, 2024 and any other UGC Regulations from time to time. Further, the Regulations of Government of Gujarat for MOOCs shall be applicable.Credits from MOOCs can be transferred to the students' academic record as per relevant UGC and IITE regulations.

These regulations for the MOOC will be applicable initially for a period of one year from the date of publication. After that it will be reviewed and revised, if required, after the approval of competent authority.

4.0 Attendance

Provisions of IITE Regulations, 2023 shall be applicable for attendance and amendment in it thereto.

5.0 Medium of Instruction:

The medium of instruction and examination shall be English.

6.0 Course Structure for PG and Integrated Teacher Education Programme

6.1 General Programme Structure of M.Sc., M.A., and M.Ed.- Indian Institute of Teacher Education *Table 1*

6.2 General Programme Structure for M.A., M.Sc. and M.Ed.

6.2.1 For M.A. in General

6.2.2 For M.Sc. in General

6.2.3 For M.Ed. in General

Calculation of Credit:

1. 1 Credit means 1 instructional hour/week for Theory Course
2. 1 Credit means 2instructional hour/week for Practical or Tutorial Course

Summary of Credit and Marks for each programme is as per table shown below:

Programme	Semester	1	2	3	4	5	6	Total
M.Sc.	Credit	24	24	20	20	---	---	88
	Papers	7	7	5	5	---	---	24
	Marks	600	600	500	500	---	---	2200
M.A.	Credit	24	24	20	20	---	---	88
	Papers	7	7	5	5	---	---	24
	Marks	600	600	500	500	---	---	2200
M.Ed.	Credit	22	22	22	22	---	---	88
	Papers	6	6	6	6	---	---	24
	Marks	550	550	550	550	---	---	2200
B.Ed.-M.Ed.	Credit	24	22	28	28	26	26	154
	Papers	8	8	7	8	7	7	45
	Marks	600	550	800	700	650	650	3950
M.Sc.-M.Ed./ M.A.-M.Ed.	Credit	28	28	30	30	30	30	176
	Papers	8	8	8	8	8	8	48
	Marks	700	700	750	750	750	750	4400

Note: For all PG Programmes, all IKS Courses (Character Building and Holistic Development of Personality -1, -2, -3, and -4) are compulsory to clear (pass) but shall not be the part of SGPA, CGPA or in aggregate marks, but shall be included in total credit of that semester and programme as a whole.

7.0 Assessment and Evaluation: CCE (Continuous and Comprehensive Evaluation):

There will be continuous and comprehensive evaluation for the M.A., M.Sc., and M.Ed. Programmes. The learners will be evaluated internally as well as externally. As the university has adopted CCE module for the evaluation, the pattern scheme for evaluation will be as under:

7.1 Scheme of Evaluation:

There are two categories for evaluation:

7.1.1 Internal Evaluation: (30 % of Marks)

Internal evaluation will include assignment, project/seminar and test. The ratio of marks will be 1:1:1 for each. There will be written submission for assignment and project and seminar will be group activity and participation of learner will be adjudged by the subject teacher concerned. The detailed Marks statement of each shall be submitted to Examination Section on or before the last day of the respective semester.

7.2.2 External Evaluation: (70 % of Marks)

External evaluation will be semester end examination, theoretically and/or practically as case may be, conducted by the university at the end of each semester.

7.3 Assessment

7.3.1 The following table shows how the marks will be calculated for the final evaluation:

Paper/ Code	Credit	Internal Evaluation				External Evaluation			Total (6+9)	GP (Total/ 10)	Letter Grade (See Table)	GPA
		Assignment/ Practical etc.	Project/Viva	CCE/Expt.	Total (3+4+5)	Ext Theory	Ext Practical	Total (7+8)				
1	2	3	4	5	6	7	8	9	10	11	12	13
Only Theory (Th)		10	10	10	30	70		70	100			
Only Practical (Pr)		10	10	10	30		70		100			
Theory & Practical (TP)		10	10	10	30	35	35	70	100			
Submission (STh)		10	10	10	30	70		70	100			
Submission (SPr)		10	10	10	30		70	70	100			
Submission (STP)		10	10	10	30	35	35	70	100			
					>= 40%			>= 40%				
Only Internal		Shall be determined by respective BoS										

Digits shown in above table is in Marks but it is proportion when evaluation is not of 100 Marks.

- The student is eligible for Total, if there are more than 40% of marks in Internal and 40 % marks in External Evaluation.
- Types of Evaluation Pattern shall be marked in respective course.
- When internal marks is not of 30, internal marks distribution will be 40-40-20 % for 100 marks and in proportion.
- In case of internal evaluation only in B.Ed.-M.Ed., distribution of marks, the scheme of evaluation shall be as specified in the curriculum framework of 2023-24 for B.Ed. only be considered as approved and final.

7.3.2 Conversion to GP and letter Grade

Sr. No.	% of Marks	Letter grade	Grade Point	Remarks
1	90 and above	O+	10	Outstanding
2	80 to 89	O	9	Excellent
3	70 to 79	A+	8	Very Good
4	60 to 69	A	7	Good
5	50 to 59	B+	6	Above Average
6	40 to 49	B	5	Average
7	0 to 39	F	0	Fail

7.3.3 CGPA

Cumulative Grade Point Assessment (CGPA) will be average SGPA of the all six semesters and Final Degree will awarded on the basis of CGPA.

7.3.4 Examinations

7.3.4.1 There shall be examinations at the end of each semester, for odd semesters (i.e., I, III and V Semesters) after end of respective semesters; for even semesters (i.e., II, IV and VI Semesters) after end of respective semesters. Any candidate who fails to clear any of the examinations may take subsequent examination to be held as per regulations.

7.3.4.2 The candidate will be allowed to keep semesters on until he/she clears preceding semesters of previous year.

7.3.4.3 The candidate shall be allowed to attempt twice after completion of the two-year of the M.A., M.Sc., M.Ed. programmes and three-year M.A.-M.Ed., M.Sc.-M.Ed. and B.Ed.-M.Ed. Programmes. It means student will be allowed two more years for clearing all semesters which are not cleared in last four semesters of the course if he/she is not detained earlier.

If any of the students is detained earlier may not get opportunity of two attempts; those who are detained once will have one more year to clear and those who are detained twice will have no more attempts to clear them.

The Vice-chancellor of the University on his/her sole discretion may allow any of the students who have been given more two chances as per the regulations, one more year to clear courses on request satisfying him the reasons for not clearing examinations for said course.

8.0 These Regulations shall be guided by the Ordinances and Regulations of the University. In case of any discrepancies or ambiguity, Vice Chancellor shall take decision for the same and his decision will be applicable. Any modifications/amendments prescribed by the UGC or any other authority shall be considered by the University Authorities from time to time.

Annexure: A - Format of question paper1

Indian Institute of Teacher Education, Gandhinagar

Semester-End Examination

May 20-

Semester:

Subject:

Course Name:

Date: **Total Marks: 70**

Time:

Note: All the questions are compulsory and carry equal marks.

Specify your option/s clearly.

Q:1 Answer following questions. (Short Answer Questions) 14

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.

(Equal weightage should be given to all units)

Q: 2 Answer following question in 800 words only: 14

(From Unit I, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words.)

OR

Q: 2 Answer following question in 800 words only:

(From Unit I, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)

Q: 3 Answer following question in 800 words only: 14

(From Unit II, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)

OR

Q: 3 Answer following question in 800 words only:

(From Unit II, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)

Q: 4 Answer following question in 800 words only: 14

(From Unit III, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)

OR

Q: 4 Answer following question in 800 words only:

(From Unit III, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)

Q: 5 Answer following question in 800 words only: 14

(From Unit IV, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)

OR

Q: 5 Answer following question in 800 words only:

(From Unit IV, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)

Format of question paper1

Indian Institute of Teacher Education, Gandhinagar

Semester-End Examination

May 20-

Semester:

Subject:

Course Name:

Date: **Total Marks: 35**

Time:

Note: All the questions are compulsory and carry equal marks.

Specify your option/s clearly.

Q: 1.	Answer following question in 800 words only: (From Unit I, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words.)	14
	OR	
Q: 1	Answer following question in 800 words only: (From Unit I, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)	
Q: 2	Answer following question in 800 words only: (From Unit II, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)	14
	OR	
Q: 2	Answer following question in 800 words only: (From Unit II, paper setter may frame one question or two questions of 7 marks each. For 7 marks question word limit is 400 words)	
Q:3	Answer following questions. (Short Answer Questions) 1. 2. 3. 4. 5. 6. 7. (Equal weightage should be given to all units)	07

Curriculum Framework
M.Sc.-M.Ed.
Academic Year 2024-25

Sr. No.	Sem	Sub	Course Code	Course Type	Credit	Title Of The Course	Internal Total	Marks External	Total
1	1	Physics	DSC010PHY	Theory	4	Classical Mechanics	30	70	100
2	1	Physics	DSC020PHY	Theory	4	Mathematical Physics	30	70	100
3	1	Physics	DSC030PHY	Practical	4	Laboratory Experiments In Physical Sciences-1	30	70	100
4	1	Physics	VAC010PHY	Theory	2	Intellectual Property Rights In Physical Sciences	50	0	50
5	1	Physics	VAC020PHY	Theory	2	Computational Physics	50	0	50
6	1	Physics	DSM010PHY	Theory	4	MOOC/IPR/Prototype/PoC/Training (1)	30	70	100
7	1	Botany	DSC010BOT	Theory	4	Plant Taxonomy	30	70	100
8	1	Botany	DSC020BOT	Theory	4	Cell Biology	30	70	100
9	1	Botany	DSC030BOT	Practical	4	Laboratory Experiments In Plant Science-1	30	70	100
10	1	Botany	VAC010BOT	Theory	2	Bioinformatics	50	0	50
11	1	Botany	VAC020BOT	Theory	2	Intellectual Property Rights In Life Science	50	0	50
12	1	Botany	DSM010BOT	Theory	4	MOOC/IPR/Prototype/PoC/Training (1)	30	70	100
13	1	Chemistry	DSC010CHE	Theory	4	Organic Chemistry	30	70	100
14	1	Chemistry	DSC020CHE	Theory	4	Physical Chemistry	30	70	100
15	1	Chemistry	DSC030CHE	Practical	4	Laboratory Experiments In Chemistry-1	30	70	100
16	1	Chemistry	VAC010CHE	Theory	2	Intellectual Property Rights(Ipr) In Chemical Sciences	50	0	50
17	1	Chemistry	VAC020CHE	Theory	2	Industrial Chemistry	50	0	50
18	1	Chemistry	DSM010CHE	Theory	4	MOOC/IPR/Prototype/PoC/Training (1)	30	70	100
19	1	Mathematics	DSC010MAT	Theory	4	Advanced Complex Analysis	30	70	100
20	1	Mathematics	DSC020MAT	Theory	4	Advanced Group Theory	30	70	100
21	1	Mathematics	DSC030MAT	Practical	4	Practical: Advanced Complex Analysis & Advanced Group Theory	30	70	100
22	1	Mathematics	VAC010MAT	Theory	2	Proofs In Mathematics	50	0	50
23	1	Mathematics	VAC020MAT	Practical	2	Latex Programming	15	35	50
24	1	Mathematics	DSM010MAT	Theory	4	MOOC/IPR/Prototype/PoC/Training (1)	30	70	100
25	1	Education	DSC010EDU	Theory	4	Educational Psychology	30	70	100
26	1	Education	DSC020EDU	Theory	4	Educational Philosophy	30	70	100
27	2	Physics	DSC040PHY	Theory	4	Quantum Mechanics	30	70	100
28	2	Physics	DSC050PHY	Theory	4	Solid State Physics	30	70	100
29	2	Physics	DSC060PHY	Practical	4	Laboratory Experiments In Physical Sciences-2	30	70	100
30	2	Physics	VAC030PHY	Theory	2	Remote Sensing And Applications	50	0	50
31	2	Physics	DSM020PHY	Theory	4	MOOC/IPR/Prototype/PoC/Training (2)	30	70	100
32	2	Botany	DSC040BOT	Theory	4	Anatomy Of Higher Plants	30	70	100
33	2	Botany	DSC050BOT	Theory	4	Biochemistry & Enzymology	30	70	100
34	2	Botany	DSC060BOT	Practical	4	Laboratory Experiments In Plant Science-2	30	70	100

35	2	Botany	VAC030BOT	Theory	2	Analytical Techniques	50	0	50
36	2	Botany	DSM020BOT	Theory	4	MOOC/IPR/Prototype/PoC/Training (2)	30	70	100
37	2	Chemistry	DSC040CHE	Theory	4	Organic Mechanism and Stereochemistry	30	70	100
38	2	Chemistry	DSC050CHE	Theory	4	Inorganic Chemistry	30	70	100
39	2	Chemistry	DSC060CHE	Practical	4	Laboratory Experiments In Chemistry-2	30	70	100
40	2	Chemistry	VAC030CHE	Theory	2	Nanochemistry	50	0	50
41	2	Chemistry	DSM020CHE	Theory	4	MOOC/IPR/Prototype/PoC/Training (2)	30	70	100
42	2	Mathematics	DSC040MAT	Theory	4	Combinatorics And Graph Theory	30	70	100
43	2	Mathematics	DSC050MAT	Theory	4	Advanced Linear Algebra	30	70	100
44	2	Mathematics	DSC060MAT	Practical	4	Practical: Combinatorics , Graph Theory And Advanced- Linear Algebra	30	70	100
45	2	Mathematics	VAC030MAT	Theory	2	Mathematical Aptitude	50	0	50
46	2	Mathematics	DSM020MAT	Theory	4	MOOC/IPR/Prototype/PoC/Training (2)	30	70	100
47	2	Education	VAC020EDU	Practical	2	Internship: Visiting Institutes Of Education	50	0	50
48	2	Education	DSC040EDU	Theory	4	Fundamentals Of Research In Education	30	70	100
49	2	Education	DSC050EDU	Theory	4	Educational Sociology	30	70	100
50	3	Physics	DSC070PHY	Theory	4	Thermodynamics And Statistical Physics	30	70	100
51	3	Physics	DSE011PHY	Theory	4	Electronics And Instrumentation	30	70	100
52	3	Physics	DSE012PHY	Theory	4	Laser And Nonlinear Optics	30	70	100
53	3	Physics	DSR010PHY	Theory	4	Fundamentals Of Research In Physical Sciences	30	70	100
54	3	Physics	DSR020PHY	Practical	4	Dissertation : Research Proposal	30	70	100
55	3	Physics	VAC040PHY	Theory	2	Experimental Techniques	50	0	50
56	3	Botany	DSC070BOT	Theory	4	Advanced Plant Physiology	30	70	100
57	3	Botany	DSE011BOT	Theory	4	Ecology & Evolution	30	70	100
58	3	Botany	DSE012BOT	Theory	4	Phytoresources - Utilization And Management	30	70	100
59	3	Botany	DSR010BOT	Theory	4	Fundamentals Of Research In Life Sciences	30	70	100
60	3	Botany	DSR020BOT	Practical	4	Dissertation : Research Proposal	30	70	100
61	3	Botany	VAC040BOT	Theory	2	Horticulture Techniques	50	0	50
62	3	Chemistry	DSC070CHE	Theory	4	Molecular Spectroscopy	30	70	100
63	3	Chemistry	DSE011CHE	Theory	4	Analytical Chemistry	30	70	100
64	3	Chemistry	DSE012CHE	Theory	4	Environmental Chemistry	30	70	100
65	3	Chemistry	DSR010CHE	Theory	4	Fundamentals Of Research In Chemical Sciences	30	70	100
66	3	Chemistry	DSR020CHE	Practical	4	Dissertation: Research Proposal	30	70	100
67	3	Chemistry	VAC040CHE	Theory	2	Supramolecular Chemistry	50	0	50
68	3	Mathematics	DSC070MAT	Theory	4	Discrete Mathematics	30	70	100
69	3	Mathematics	DSE011MAT	Theory	4	Differential Geometry	30	70	100
70	3	Mathematics	DSE012MAT	Theory	4	Mathematical Modelling	30	70	100

71	3	Mathematics	DSR010MAT	Theory	4	Fundamentals Of Research In Mathematical Sciences	30	70	100
72	3	Mathematics	DSR020MAT	Practical	4	Dissertaion: Research Proposal	30	70	100
73	3	Mathematics	VAC040MAT	Practical	2	Computer Programming In “C”	15	35	50
74	3	Education	DSE012EDU	Theory	4	School Education: Middle And Secondary Stage	30	70	100
75	3	Education	DSE011EDU	Theory	4	School Education: Foundational And Preparatory Stage	30	70	100
76	3	Education	DSM010EDU	Theory	4	MOOC/IPR/Prototype/PoC/Training (1)	30	70	100
77	3	Education	DSE013EDU	Theory	4	Higher Education In India	30	70	100
78	3	Education	DSC030EDU	Theory	4	Educational Technology	30	70	100
79	4	Physics	DSE021PHY	Theory	4	Atomic And Molecular Physics	30	70	100
80	4	Physics	DSE022PHY	Theory	4	Electrodynamics And Plasma Physics	30	70	100
81	4	Physics	DSR030PHY	Practical	4	Dissertation: Research Work	30	70	100
82	4	Physics	DSR040PHY	Practical	4	Dissertation: Submission	30	70	100
83	4	Physics	DSR050PHY	Practical	4	Disseration: Presentation And/Or Publication	30	70	100
84	4	Botany	DSE021BOT	Theory	4	Fundamentals Of Microbiology	30	70	100
85	4	Botany	DSE022BOT	Theory	4	Ethnobotany & Medicinal Plants	30	70	100
86	4	Botany	DSR030BOT	Practical	4	Dissertation: Research Work	30	70	100
87	4	Botany	DSR040BOT	Practical	4	Dissertation: Submission	30	70	100
88	4	Botany	DSR050BOT	Practical	4	Disseration: Presentation And/Or Publication	30	70	100
89	4	Chemistry	DSE021CHE	Theory	4	Polymer Chemistry	30	70	100
90	4	Chemistry	DSE022CHE	Theory	4	Advanced Physical Chemistry	30	70	100
91	4	Chemistry	DSR030CHE	Practical	4	Dissertation: Research Work	30	70	100
92	4	Chemistry	DSR040CHE	Practical	4	Dissertation: Submission	30	70	100
93	4	Chemistry	DSR050CHE	Practical	4	Disseration: Presentation And/Or Publication	30	70	100
94	4	Mathematics	DSE021MAT	Theory	4	Operations Research	30	70	100
95	4	Mathematics	DSE022MAT	Theory	4	Functional Analysis	30	70	100
96	4	Mathematics	DSR030MAT	Practical	4	Dissertation: Research Work	30	70	100
97	4	Mathematics	DSR040MAT	Practical	4	Dissertation: Submission	30	70	100
98	4	Mathematics	DSR050MAT	Practical	4	Disseration: Presentation And/Or Publication	30	70	100
99	4	Education	DSE021EDU	Theory	4	Value Education	30	70	100
100	4	Education	VAC010EDU	Theory	2	Policy Politics And Economics Of Education	15	35	50
101	4	Education	DSE022EDU	Theory	4	Parametric And Non Parametric Statistics	30	70	100
102	4	Education	DSM020EDU	Theory	4	MOOC/IPR/Prototype/PoC/Training (2)	30	70	100
103	4	Education	DSE023EDU	Theory	4	Guidance And Counselling Services	30	70	100
104	4	Education	DSC060EDU	Practical	4	Academic Writing	30	70	100
105	5	Physics	DSC080PHY	Practical	4	Laboratory Experiments In Physical Sciences-3	30	70	100
106	5	Physics	DSE031PHY	Theory	4	Condensed Matter Physics	30	70	100

107	5	Physics	DSE032PHY	Theory	4	Nanotechnology And Thin Film Physics	30	70	100
108	5	Botany	DSC080BOT	Practical	4	Laboratory Experiments In Plant Science-3	30	70	100
109	5	Botany	DSE031BOT	Theory	4	Environmental Biology & Climate Change	30	70	100
110	5	Botany	DSE032BOT	Theory	4	Principles Of Genetics	30	70	100
111	5	Chemistry	DSC080CHE	Practical	4	Laboratory Experiments In Chemistry-3	30	70	100
112	5	Chemistry	DSE031CHE	Theory	4	Heterocyclic Chemistry	30	70	100
113	5	Chemistry	DSE032CHE	Theory	4	Disconnection Approach	30	70	100
114	5	Mathematics	DSC080MAT	Practical	4	Introduction To Sci Lab	30	70	100
115	5	Mathematics	DSE031MAT	Theory	4	Topology	30	70	100
116	5	Mathematics	DSE032MAT	Theory	4	Measure Theory	30	70	100
117	5	Education	DSC080EDU	Theory	4	Psychological Testing	30	70	100
118	5	Education	VAC030EDU	Practical	2	Internship: Teacher Education Institutes	50	0	50
119	5	Education	DSC070EDU	Theory	4	Inclusion: Concept And Policy Framework	30	70	100
120	5	Education	DSR010EDU	Theory	4	Fundamentals Of Educational Research: Methods And Designs	30	70	100
121	5	Education	DSC090EDU	Theory	4	Educational Management & Administration	30	70	100
122	5	Education	DSR020EDU	Practical	4	Dissertation: Research Proposal	30	70	100
123	6	Physics	DSC090PHY	Theory	4	Nuclear And Particle Physics	30	70	100
124	6	Physics	DSE041PHY	Theory	4	Advanced Electronics	30	70	100
125	6	Physics	DSE042PHY	Theory	4	Astrophysics And Cosmology	30	70	100
126	6	Botany	DSC090BOT	Theory	4	Molecular Biology & Genetic Engineering	30	70	100
127	6	Botany	DSE041BOT	Theory	4	Embryology Of Higher Plants	30	70	100
128	6	Botany	DSE042BOT	Theory	4	Plant Biotechnology: Scope And Principles	30	70	100
129	6	Chemistry	DSC090CHE	Theory	4	Natural Products	30	70	100
130	6	Chemistry	DSE041CHE	Theory	4	Medicinal Chemistry	30	70	100
131	6	Chemistry	DSE042CHE	Theory	4	Dyes	30	70	100
132	6	Mathematics	DSC090MAT	Theory	4	Number Theory	30	70	100
133	6	Mathematics	DSE041MAT	Theory	4	Mathematical Methods	30	70	100
134	6	Mathematics	DSE042MAT	Theory	4	Ordinary Differential Equations	30	70	100
135	6	Education	DSC110EDU	Theory	4	Teacher Education	30	70	100
136	6	Education	VAC040EDU	Theory	2	Environment Education	15	35	50
137	6	Education	DSR040EDU	Practical	4	Dissertation: Submission	30	70	100
138	6	Education	DSR030EDU	Practical	4	Dissertation: Research Work	30	70	100
139	6	Education	DSR050EDU	Practical	4	Disseration: Presentation And/Or Publication	30	70	100
140	6	Education	DSC100EDU	Theory	4	Curriculum Development	30	70	100

Sem	Code	Nature Paper		Title	Credit	Hours	Marks (Internal)	Marks (External)
1	IKS010CHP	Theory	Compulsory	Character Building and Holistic Development of Personality - I	2	2	15	35
2	IKS020CHP	Theory	Compulsory	Character Building and Holistic Development of Personality - II	2	2	15	35
3	IKS030CHP	Theory	Compulsory	Character Building and Holistic Development of Personality - III	2	2	15	35
4	IKS040CHP	Theory	Compulsory	Character Building and Holistic Development of Personality - IV	2	2	15	35

Note: For all PG Programmes, all IKS Courses (Character Building and Holistic Development of Personality -1, -2, -3, and -4) are compulsory to clear (pass) but shall not be the part of SGPA, CGPA or in aggregate marks, but shall be included in total credit of that semester and programme as a whole.

SEMESTER- 1

Physics

DSC010PHY Theory	Semester-1 **Classical Mechanics**	Compulsory Credit: 04 Marks:100

Course Outcomes:

- Students gain a comprehensive understanding of classical mechanics principles and their applications, preparing them for advanced studies and practical problem-solving in physics.

Course Content:

Unit 1: Mechanics of a particles and Lagrangian Formulation

1.1 (Review: mechanics of a system of particles, system subjected to different constraints and various examples, generalized coordinates)
1.2 D' Alembert's principle, Lagrange's equations, problems, deduction of Lagrange's equation from D' Alembert's principle,
1.3 Applications of Lagrange's equation, generalized momenta and energy,(Review: Cyclic or Ignorable coordinates).
1.4 Calculus of variations: The Euler-Lagrange equation, first integral geodesics, The brachisto-chrone, Minimum surface of revolution, Several dependent variable.

Unit 2: Hamiltonian Formulation

2.1 Hamilton's principle, Lagrange's equation from Hamilton's principle, Rayleigh's dissipation function, integral of motion, symmetry properties of space and time and conservation theorems.
2.2 Principle of least action, Hamilton's principle, derivation of Hamilton's equation of motion for holonomic system from Hamilton's principle and characteristic functions.

Unit 3: Rigid Body

3.1 Number of degree of freedom, Euler's angles and Euler's theorem, infinitesimal rotation, rate of change of vector, Coriolis force, angular momentum and kinetic energy of a rigid body.
3.2 The inertia tensor and moment of inertia, principle axes transformation, Euler's equation of motion.
3.3 Precession of a charged body in a magnetic field. Small oscillations, normal modes and coordinates, transition from a discrete to a continuous system.
3.4 The Lagrangian formulation for continuous system, constant of motion and symmetry properties.

Unit 4: Canonical Transformation and Hamiltonian - Jacobi Theory

4.1 Canonical transformation and its examples, generating functions, Poisson brackets,
4.2 Equation of motion, invariance of Poisson brackets under canonical transformations, angular momentum.
4.3 Poisson brackets relations, infinitesimal canonical transformation, problems.
4.4 Hamilton's principle and characteristic function, separation of variables in H – J method, action angle variables interpretation.

Mode of Transaction:

To create a comprehensive and effective learning experience for students pursuing this course, combination of methods mentioned below will be used

- Direct Teaching through Chalk-Walk and Talk
- ICT enabled teaching/Question-Answer
- Class discussion led by teacher/students
- Case Studies/Literature review
- Problem solving activities/Debate
- Collaborative and Co-operative Learning
- Think Pair Share/Jigsaw
- Inquiry Based Learning/Panel Discussion
- Project Based Learning/Flipped Classroom
- Blended Learning designs/Concept Mapping

DSC020PHY Theory	Semester-1 **Mathematical Physics**	Compulsory Credit: 04 Marks:100

Course Outcomes:

- The students will be able to learn the relevance of different tools of pure mathematics in the context of the laws of physics and hence will be able to apply the same to deal with the different concrete problems of natural phenomena.

Course Content

Unit 1: Linear Vector Spaces

1.1 N-dimensional linear vector space, orthonormal basis, Inner product, Hilbert space, Gram-Schmidt orthonormalisation, Outer product.

1.2 Linear operators and their algebra, Matrix representation of operators, Similarity transformation.

1.3 Diagonalisation of Hermitian, Symmetric, Complex and Complex symmetric matrices, Cayley-Hamilton theorem.

Unit 2: Special Function and Partial Differential Equations

2.1 Legendre and Associated Legendre polynomials and spherical harmonics - physical applications, Hermite's Polynomials and applications.

2.2 Bessel function and Spherical Bessel function, Laguerre Polynomial.

2.3 Gamma, Beta functions, Dirac- function. One-dimensional wave equation, one- dimensional heat flow equation (finite and infinite rod). Laplace's equation and its solution.

Unit 3: Fourier and Laplace transform

3.1 Fourier transform and its properties as well as applications such as Gaussian function,finite wave train, etc., transform and its properties.

3.2 Laplace transform and inverse Laplace transform.

3.3 Non homogeneous boundary value problems and Green's functions, Green's functions for one - dimensional problems, Eigen function expansion of Green's function.

3.4 Fourier transform method of constructing the Green's function, Green's functions in higher dimensions.

Unit 4: Complex Variable

4.1 Introduction, Analytical Function, Cauchy Riemann Equations.

4.2 Contour Integral Theorem, Cauchy's Integral Formula, Laurent Series Theorem, Method of finding residues.

4.3 The Residue Theorem, Evaluation of Definite, Integrals by use of the residue theorem.

4.4 Mapping Examples, Conformal mapping, Some Application of conformal Mapping.

Mode of Transaction:

To create a comprehensive and effective learning experience for students pursuing this course, combination of methods mentioned below will be used

- Direct Teaching through Chalk-Walk and Talk
- ICT enabled teaching/Question-Answer
- Class discussion led by teacher/students
- Case Studies/Literature review
- Problem solving activities/Debate
- Collaborative and Co-operative Learning
- Think Pair Share/Jigsaw
- Inquiry Based Learning/Panel Discussion
- Project Based Learning/Flipped Classroom
- Blended Learning designs/Concept Mapping

DSC030PHY Practical	Semester-1 **Laboratory Experiments in Physical Sciences-1**	Compulsory Credit: 04 Marks:100

Course Outcomes:

Students will learn

- Understands the basic principles of Physics related to their courses in a practical way.
- Applies knowledge of mathematics, science, and engineering to the physical problems
- Applies the mathematical concepts/equations to obtain quantitative results.
- Develops basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

Course Content: Suggested Experiments

Practical 1 Class A Push Pull Power Amplifier

Practical 2 Class B Push Pull Power Amplifier

Practical 3 Study OP-Amp IC 741 Characteristics

Practical 4 Operational Amplifier as Schmitt Trigger

Practical 5 To study Operational Amplifier applications (i) Voltage regulator and (ii) Function generator.

Practical 6 Astable multivibrator using 555 timer IC

Practical 7 Bistable multivibrator using 555 timer IC

Practical 8 Mono-stable multivibrator using 555 timer IC

Practical 9 Characteristics of Field Effect Transistor (FET)

Practical 10 Characteristics of Metal–Oxide–Semiconductor Field-Effect Transistor (MOSFET)

Practical 11 To determine of Planck's constant by optical method Practical 11 Study the operation of all logic gates.

Practical 12 Study of LVDT.

Practical 13 Study of R-S, J-K and D-flip flops

Practical 14 To determine the value of e/m by Thomson's method

Practical 15 Numerical Study of Oscillatory Motion. (theoretical)

Practical 16 Study of CMOS Characteristics

Practical 17 Study analogue to digital / digital to analogue conversion

Practical 18 Design and Study clipping and clamping circuits.

Practical 19 Measure RC time constant with square wave using CRO

Practical 20 Design and Verify truth table of RS flip-flop

Practical 21 Design and Verify truth table of clocked RS flip-flop

Practical 22 Design and verify truth table of JK flip-flop

Practical 23 Lloyd's mirror experiment with an He-Ne laser

Practical 24 Determining the wavelength of the light of an He-Ne laser using a Michelson interferometer

Practical 25 Interference at Fresnel's biprism with an He-Ne laser

Mode of Transaction: Laboratory Experiments, e-resources, ICT and Virtual Lab

Suggested Activities:

- Performing the experiments and discussing the physical significance and applications, Group discussion, Presentation, Assignment work and Quiz

VAC010PHY	Semester-1	Compulsory
Theory	**Intellectual Property Rights in Physical Sciences**	Credit: 02 Marks:50

Course Outcomes:

- The students will be able to know the basics of Intellectual Property Rights.
- The students will be able to know about the patents and the procedure to file a patent.

Course Content:

Unit 1: Introduction to IPR

1.1 Introduction to IPRs, Basic concepts and need for Intellectual Property – Meaning and practical aspects of Patents

1.2 Copyrights, Geographical Indications

1.3 IPR in India and Abroad. Nature of Intellectual Property

1.4 Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

Unit 2: Patents

2.1 The IPR tool kit, Patents, the patenting process

2.2 Patent cooperation treaties: International Treaties and conventions on IPRs, Trade Related Aspects of Intellectual Property Rights Agreement

2.3 Patent Act of India

2.4 Rights of an IPR owner, licensing agreements

Mode of Transaction: Classroom teaching using audio visual tools

Suggested Activities: Presentation, Case study

VAC020PHY Theory	Semester-1 **Computational Physics**	Compulsory Credit: 02 Marks:50

Course Outcomes:

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

- Programming Skills: Students will develop proficiency in fundamental programming concepts, including control structures, arrays, and string handling.
- Numerical Methods: Students will apply numerical techniques for differentiation, integration, root-finding, and solving linear equations by programming, with practical applications to physics problems.
- Differential Equations: Students will solve ordinary differential equations using various methods by programming and understand their applications in physical systems.

Course Content

Unit 1: Keywords, Identifiers, Constants, Variables, Data Types, Operators, Expressions, Precedence and Associativity of operators, Type conversions, I/O operations

- **Branching:** if, simple if, if-else, nesting of if-else, else if ladder, switch, conditional operator
- **Looping:** while, do while, for, continue and break, goto.
- **One dimensional arrays**, declaration and initialization of arrays, two dimensional and multidimensional arrays
- **Character strings:** Declaration and initialization of string variables, reading and writing of strings, arithmetic operations on characters, concatenation, comparing, copying and finding length of strings, string handling functions, table of strings.

Unit 2:

- **Numerical Differentiation and Integration:** Forward, backward and central difference methods, Richardson extrapolation, Trapezoidal rule, Simpson rule, Gaussian quadrature. Extremes of a function Examples of related physics problems
- **Root-Finding:** Bisection method, Newton-Raphson method, Secant method.
- **Numerical Methods for Matrices:** Matrices in physics, Basic Matrix operations, Solution for the system of linear equations (Gaussian elimination, LU method), Eigen value problems: Eigen values of Hermitian matrix, General matrix, Eigenvectors of matrix, The Faddeev-Leverrier method.
- **Ordinary Differential Equations:** The initial-value problems, The Euler and Picard Method, Predictor-Corrector Method, The Runge- Kutta method, Application to system of equations, Examples related to physics problems, Order and chaos in two-dimensional motion.

Teaching-Learning Methodology

- Direct Teaching through Chalk-Walk and Talk
- ICT enabled teaching
- Question-Answer
- Class discussion led by teacher/students
- Case Studies
- Literature review
- Problem solving activities

- Debate
- Collaborative and Co-operative Learning
- Think Pair Share
- Jigsaw
- Inquiry Based Learning
- Panel Discussion
- Project Based Learning
- Flipped Classroom
- Blended Learning designs
- Concept Mapping

DSM010PHY Theory	Semester-1 **MOOC/IPR/Prototype/PoC/Training(1)**	Compulsory Credit: 04 Marks:100

Students will opt any one course option out of MOOC/ Proof of Concept (POC)/ Intellectual Property Rights (IPR)/Prototype/Training

Course Outcomes: Promotion of innovation, research, and skill development among postgraduate (PG) students by participating in MOOCs, developing Proofs of Concept (PoC), managing Intellectual Property Rights (IPR), Training and translation of innovative ideas into tangible/intangible solutions of the societal needs after the completion of the course.

MOOCs (Massive Open Online Courses)

- Course must align with the program objectives from various national and international platforms offering MOOCs.
- Credits from MOOCs can be transferred to the students' academic record as per relevant UGC and IITE regulations.
- Students must submit completion certificates and attendance record, assignment submission record and Quiz conducted by the course coordinator for evaluation.

Proof of Concept (PoC)

- A PoC is a demonstration (in the form of presentation) to validate the feasibility of an idea or concept. Students must submit a proposal outlining objectives, methodology, timeline, financial breakups and expected outcomes.
- Proposed PoCs must be presented to the examiners, followed by submission of a report and presentation for assessment.

Intellectual Property Rights (IPR)

- Any idea, design or any novel IP can be created by the student.
- IP generated by students as part of academic work is co-owned by the student and IITE unless otherwise agreed upon.
- Students must ensure their work does not violate existing IP laws.
- Prepared IP document must be presented to the examiners, followed by submission of a report and presentation for assessment.

Prototype

- Students will have access to institutional labs or they can utilize external laboratory and incubation center as guided by the mentor.
- Students may apply for prototype development grants through the institution or external agencies.
- A demonstration and/or presentation with detailed report will be evaluated.

Training

- The students will select the training programs of their choice as guided by the mentors.
- It should include active participation in real-world tasks and projects of domain-specific skills

- The training should help students to work with professionals and peers in the field and building connections for professional growth etc.

- All activities under MOOCs, POC, IPR, Prototype and Training must adhere to ethical guidelines, including proper attribution, plagiarism avoidance, and compliance with IITE, UGC, Govt. of Gujarat and/or any other relevant guidelines.

Botany

DSC010BOT Theory	Semester-1 **Plant Taxonomy**	Compulsory Credit: 04 Marks:100

Course Outcomes:

Prospective teacher educator...

- Differentiate between various groups of Bryophytes, Pteridophytes, and Phanerogams
- Able to practically identify the various groups of plant kingdom
- Able to understand the lifecycle of Gymnosperms
- Able to identify the angiosperm plants with floral diagrams and identification keys of plant families.

Course Content:

UNIT 1: SYSTEMIC BOTANY

1.1 Classification systems - Major systems of Plant Classification (Bryophyta, Pteridophyte, Gymnosperm, Angiosperm)

1.2 Major characteristics used in taxonomy (Anatomy and Embryology)

1.3 International Code of Botanical Nomenclature, Binomial Nomenclature

1.4 Numerical Taxonomy and Chemo Taxonomy

UNIT 2: BRYOPHYTES AND PTERIDOPHYTES

2.1 Study of class Hepaticopsida: Distribution, Habitat, External morphology and reproduction of Pellia

2.2 Study of class Bryopsida: Distribution, Habitat, External morphology and reproduction of Sphagnum

2.3 Life history: Distribution, Occurrence, External morphology and Reproduction (Excluding anatomy) of Equisetum

2.4 Life history: Distribution, Occurrence, External morphology and Reproduction (Excluding anatomy) of Dryopteris

UNIT 3: GYMNOSPERM

3.1 Life history: Distribution, Occurrence, External morphology and Reproduction (Excluding anatomy: Internal structure) of Cycas

3.2 Life history: Distribution, Occurrence, External morphology and Reproduction (Excluding anatomy: Internal structure) of Gnetum

UNIT 4: ANGIOSPERM

4.1 Plant families – Polypetalae

Characteristics with representative examples ofFamily: Rosaceae

Family: Rutaceae

4.2 Plant families – Gamopetalae

Characteristics with representative examples ofFamily: Compositae

Family: Lamiaceae

4.3 Plant families – Monochlamidae

Characteristics with representative examples ofFamily: Polygonaceae

Family: Euphorbiacae

4.4 Plant families – Monocotyledonae Characteristics with representative examples ofFamily: Commelinaceae

Family: Graminae

Mode of Transaction: Lectures; Demonstration and Microscopic Analysis in Life Science Laboratory; Educational Videos

Suggested Activities: Collection of Plant Samples Belonging to Different Families for Identification Experiments

DSC020BOT Theory	Semester-1 **Cell Biology**	Compulsory Credit: 04 Marks:100

Course Outcomes:

On completion of this paper, students will be able to

- Gain the basic knowledge of prokaryotic and eukaryotic cells
- Understand the significance of cell-cell interactions and different types of cell junctions
- Understand the molecular mechanisms of cell signalling
- Acquire the knowledge of molecular structure and functions of cell organelles

Course Content:

UNIT 1: CELL THEORY, CELL STRUCUTRE AND CELL DIVISION

1.1 Cell Theory, Diversity of Cell Size and Shapes, S/V Ratio

1.2 Ultrastructure of Prokaryotic & Eukaryotic Cells

1.3 Cell Cycle and Equational Cell Division : Mitosis

1.4 Reductional Cell Division : Meiosis and its Significance

UNIT 2: CELL JUNCTIONS & CELL SIGNALLING

2.1 Cell-Cell Interactions: Tight Junction, Adherence Junction, Gap Junction

2.2 Types of Cell Signalling : Autocrine, Paracrine and Endocrine Regulation

2.3 Signalling Molecules: Cell Surface Receptors, Peptide and Steroid Hormones, Secondary Messengers

2.4 Molecular Mechanism of Cell Signalling Process

UNIT 3: CELL ORGANELLES-I

3.1 Molecular Organization of Mitochondria, Mechanism of Oxidative Phosphorylation, Electron Transport Chain

3.2 Molecular Organization and Functions of Chloroplast, Photosynthetic Pigments, Photosystem I & II

3.3 Ultrastructure and Functions of Nucleus

3.4 Structure and Functions of Ribosomes

UNIT 4: CELL ORGANELLES-II

4.1 Structure, Types and Functions of Endoplasmic Reticulum

4.2 Molecular Organization and Functions of Golgi Complex

4.3 Structure and Functions of Lysosomes

4.4 Microbodies: Peroxisomes and Glyoxisomes

Mode of Transaction: Lectures; Demonstration of Experiments in Life Science Laboratory; Educational Videos, Charts

Suggested Activities: Analysis of Electron Micrographs

DSC030BOT Practical	Semester-1 **Laboratory Experiments in Plant Science-1**	Compulsory Credit: 04 Marks:100

Course Outcomes:

On completion of this paper, students will be able to

- Understand the Morphology of Brypophytesv, Pteridopophytes,
- Understand the Morphology of Gymnosperms and Angiosperms.
- Understand experimental methodology of cytology.
- Explore plant biodiversity in local area
- Evaluate the importance of phytoresources

Suggested Experiments :

PLANT TAXONOMY AND MORPHOLOGY

1. Study of vegetative and reproductive structure of Pelia.
2. Study of vegetative and reproductive structure of Sphagnum.
3. Study of vegetative and reproductive structure of Equisetum.
4. Study of vegetative and reproductive structure of Dryopteris.
5. Study of vegetative and reproductive structure of Cycas.
6. Study of vegetative and reproductive structure of Gnetum.
7. Study of Family Rosaceae.
8. Study of Family Rutaceae
9. Study of Family Compositae/Asteraceae.
10. Study of Family Lamiaceae.
11. Study of Family Polygonaceae.
12. Study of Family Euphorbiaceae.
13. Study of Family Commelinaceae.
14. Study of Family Graminae.

CELL BIOLOGY

1. Principle, working and use of Microscope
2. Preparation of Stain, Staining reagents and Standard solutions
3. Observation of motility of prokaryotes and eukaryotes by hanging drop method
4. To identify the Barr body from buccal smear
5. Study of different stages of mitosis in onion root tip cells
6. Study of the effect of colchicine on mitosis in onion Root tip cells
7. Study of divisional stages in Mitosis (different floral buds)
8. Staining of mitochondria in human cheek epithelial cells
9. Differential staining for DNA and RNA in human cheek Epithelial cells

VAC010BOT Theory	Semester-1 **Bioinformatics**	Compulsory Credit: 02 Marks:50

Course Outcomes:

On completion of this paper, students will be able to..

- Will gain an understanding of the computational challenges (and their solutions) in the analysis of large biological data sets.
- They will understand how some of the commonly used bioinformatics tools work,
- They will understand how to use these tools effectively, and
- Understand how to read and evaluate research articles in the field.
- To understand the basics of bioinformatics and importance of database maintenance
- To demonstrate the various software developed for database management, retrieval and analysis
- To appreciate the various applications of Bioinformatics especially in drug designing, speciation, study of phylogenetic trees and evolution etc.
- Thus, the knowledge from this course can help in the following: a) Develop skills to use software related to bioinformatics b) To be able to work in companies especially involved in drug development

UNIT 1: BIOINFORMATICS & DATABASES

1.1 Introduction to bioinformatics, Applications of bioinformatics

1.2 Biological databases and their growth, Introduction to NCBI

1.3 File formats, Primary and Secondary Biological databases

1.4 Structure databases, Miscellaneous databases

UNIT 2: SEQUENCE ALIGNMENT, BLAST & EMBOSS

2.1 Sequence Alignment : Dynamic programming, global (Needleman-Wunsch) and local (Smith-Waterman) alignments

2.2 BLAST and its types

2.3 EMBOSS Needle and EMBOSS Water

2.4 Phylogenetic Analysis and UPGMA

Mode of Transaction: Apart from the conventional black board teaching, other modes of teaching that will be adopted are power points, problem solving, and group projects. Assignments will be designed such that students inculcate the habit of reading reference books and science journals. The use of smart boards for teaching will also be promoted to enable more interaction-based teaching. Emphasis will be given to systematic designing of experiments in the laboratory sessions.

Suggested Activities: Understanding use of NCBI portal and Bioinformatics Databases

VAC020BOT Theory	Semester-1 **Intellectual Property Rights in Life Science**	Compulsory Credit: 02 Marks:50

Course Outcomes:

Prospective teacher educator...

- Distinguish and Explain various forms of IPRs.
- Identify criteria's to fit one's own intellectual work in particular form of IPRs.
- Apply statutory provisions to protect particular form of IPRs.

Course Content:

UNIT 1: INTRODUCTION TO IPR, PATENT & COPY RIGHT :

1.1 Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights

1.2 Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge, TRIPS

1.3 PATENT - Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.

1.4 COPY RIGHT—Origin, Definition & Types of Copy Right, Registration procedure, Assignment & licence, Terms of Copy Right, Piracy, Infringement, Remedies

UNIT 2: TRADE MARK, GI TAG AND TRADITIONAL KNOWLEDGE

2.1 TRADE MARKS - Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks

2.2 Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties

2.3 GI - Geographical Indication of Goods: Types, why and how GI need protection and GI laws. Indian Gl act

2.4 Traditional Knowledge: Indigenous, medicinal, bioprospecting knowledge Examples, Need for protection, positive protection, defensive protection, legal aspects.

DSM010BOT Theory	Semester-1 **MOOC/IPR/Prototype/PoC/Training(1)**	Compulsory Credit: 04 Marks:100

Students will opt any one course option out of MOOC/ Proof of Concept (POC)/ Intellectual Property Rights (IPR)/Prototype/Training

Course Outcomes: Promotion of innovation, research, and skill development among postgraduate (PG) students by participating in MOOCs, developing Proofs of Concept (PoC), managing Intellectual Property Rights (IPR), Training and translation of innovative ideas into tangible/intangible solutions of the societal needs after the completion of the course.

MOOCs (Massive Open Online Courses)

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Prototype

- Students will have access to institutional labs or they can utilize external laboratory and incubation center as guided by the mentor.
- Students may apply for prototype development grants through the institution or external agencies.
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Training

- The students will select the training programs of their choice as guided by the mentors.
- It should include active participation in real-world tasks and projects of domain-specific skills

- The training should help students to work with professionals and peers in the field and building connections for professional growth etc.

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Chemistry

DSC010CHE Theory	Semester-1 **Organic Chemistry**	Compulsory Credit: 04 Marks:100

Course outcomes:

- Students will get basic knowledge of organic reaction mechanism as well as important reactive Intermediates
- Students will be able to understand the basic and vital concepts of organic chemistry
- Students will be able to know the oxidation and reduction processes
- Students will get knowledge of Pericyclic reactions

Course Content:

Unit 1: Reaction intermediates

1.1 Introduction
1.2 Fundamental Reactions
1.3 Homolytic and Heterolytic fission
1.4 Electrophiles and Nucleophiles
1.5 Carbocations
1.6 Carbanions
1.7 Free radicals
1.8 Carbenes & Nitrenes
1.9 Benzynes
1.10 Ylides & Enamines

Unit 2: Oxidation

2.1 Introduction of oxidation reactions
2.2 Oxidation of hydrocarbons
2.3 Oxidation of Alcohols
2.4 Oxidation of 1,2-diols
2.5 Oxidation of aldehydes
2.6 Oxidation of ketones
2.7 Oxidation of amines
2.8 Oxidation of hydrazine
2.9 Some microbial oxidations of Progesterone, Oestrone, Diazepam, Oleic acid (only reactions)

Unit 3: Reduction

3.1 Introduction of reduction reactions
3.2 Reduction of hydrocarbons
3.3 Reduction of aldehydes
3.4 Reduction of carboxylic acids
3.5 Reduction of esters
3.6 Reduction of anhydrides
3.7 Reduction of nitriles
3.8 Reduction of epoxides
3.9 Reduction of nitro group and Nitroso group
3.10 Some microbial reduction with Baker's yeast

Unit 4: Pericyclic reactions

4.1 Introduction to pericyclic reactions
4.2 Types of Pericyclic reactions
4.3 Stereochemistry molecular orbital symmetry
4.4 Frontier Orbitals of Ethelene, 1,3- butadiene, 1,3,5-hexatriene and allyl system
4.5 F.M.O. and P.M.O. approach to cycloaddition and electrocyclic reactions
4.6 Generalization of wood-word Hoffmann rule
4.7 Sigmatropic rearrangement- suprafacial & antrafacial shift of Hydrogen
4.8 Stereoselectivity in sigmatropic rearrangement
4.9 Enantioselectivity in pericyclic reactions

Mode of Transaction: PPTs. Video Lectures, Chalk and Talk Method

Suggested Activities: Group Discussion, Unit Tests

DSC020CHE Theory	Semester-1 **Physical Chemistry**	Compulsory Credit: 04 Marks:100

Course Outcomes:

- Students will have detailed study of Entropy, Gibbs free energy and Partial molar quantities.
- Students will get basic knowledge of Maxwell Boltzmann distribution law and partition function.
- Students will understand Study of Chemical kinetics of molecular reactions.
- Students will get knowledge of Nernst equation and applications of emf.

Course Content:

Unit 1: Thermodynamics

1.1 Introduction
1.2 Importance of thermodynamics
1.3 Enthalpy
1.4 Entropy
1.5 Gibbs free energy
1.6 Gibbs-Helmholtz equation
1.7 Gibbs Duhem equation
1.8 Third law of thermodynamics
1.9 Determination of absolute entropy using Third law of thermodynamics
1.10 Nernst Heat theorem
1.11 Partial molar volume
1.12 Partial molar quantities- Partial molar free energy

Unit 2: Statistical Thermodynamics

2.1 Introduction
2.2 Permutation
2.3 Combination
2.4 Maxwell-Boltzmann Distribution Law
2.5 Partition Function
2.6 Translational Partition Function
2.7 Rotational Partition Function
2.8 Vibrational Partition Function
2.9 Electronic Partition Function
2.10 Nuclear Partition Function
2.11 Numericals

Unit 3: Chemical Kinetics

3.1 Rate expression
3.2 Rate of chemical reactions
3.3 Order of reaction and molecularity of Reaction
3.4 Half lifetime of reaction
3.5 Arrhenius equation
3.6 Activation energy
3.7 Collision theory
3.8 The transition state theory
3.9 Salt effects-Primary salt effect and secondary salt effect
3.10 Chain reaction
3.11 Chain length
3.12 Reaction Mechanism

Unit 4: Electrochemistry

4.1 Conductance
4.2 Conductivity
4.3 Specific Conductance
4.4 Molar conductance
4.5 Electrolytes
4.6 Oxidation- Reduction reaction
4.7 Electrochemical cell
4.8 Electrode potential and electrode Reaction
4.9 Nernst equation
4.10 Applications of emf
4.11 Faraday's laws of electrolysis
4.12. Fuel cells and batteries

Mode of Transaction: PPT, Video Lecture, Chalk and Talk Method

Suggested Activities: Experiments and Hands on training on conductometer instrument.
Motivate students to perform experiments on chemical kinetics to learn order of reaction

DSC030CHE Practical	Semester-1 **Laboratory Experiments in Chemistry-1**	Compulsory Credit: 04 Marks:100

Course Outcomes:

- Students will be able to determine type of given ternary organic mixture
- Students will be able to carry out separation and identification of organic compounds
- Students will get training of instruments like pH metry and Conductometry
- Students will be able to perform experiments on Chemical kinetics with accuracy and required Skills

Course Content:

Paper: Organic Chemistry (minimum Four)

To carry out systematic qualitative analysis of ternary organic mixtures (Type: Acid, Phenol, Base ,Neutral) of following states :

1. Solid + Solid + Solid (All are water insoluble)
2. Solid + Solid + Solid (At least one compound should be water soluble)
3. Solid + Liquid + Liquid
4. Liquid + Liquid + Liquid

Paper: Physical Chemistry (minimum Four)

pH Metry:

1. To determine Normality, Gram/Litre and Molarity of unknown acid by using 0.1N NaOH.
2. To determine Normality, Gram/Litre and Molarity of each acid present in a mixture of Strong acid and weak acid by using 0.1N NaOH.

Conductometry:

1. To determine Normality, Gram/Litre and Molarity of unknown acid by using 0.1N NaOH.
2. To determine Molarity of each acid present in a Mixture of strong acid and weak acid by titrating against 0.1 M NaOH solution conductometrically.

Chemical Kinetics:

1. Chemical kinetics of a reaction between $K_2S_2O_8$ and KI in an aqueous system. (a=b)
2. Chemical kinetics of a reaction between $K_2S_2O_8$ and KI in an aqueous system. ($a \neq b$)

Mode of Transaction: Demonstration ,Chalk and Talk Method, Videos

Suggested Activities: Viva, Internal Test

VAC010CHE Theory	Semester-1 **Intellectual Property Rights(IPR) in Chemical Sciences**	Compulsory Credit: 02 Marks:50

Course Outcomes:

- Learners will be able to describe the meaning and importance of IPR
- Learners will be able to explain terms associated with patents
- Learners will get familiarized with different types of copyright and trademarks
- Learners will be able to discuss various GI items in India

Course Content:

Unit 1: IPR and Patents

1.1 Introduction to IPR
1.2 Protection of IPR
1.3 Nature of IPR
1.4 Types of IPR for e.g. Patent, Copyright, Trademark, GI, Industrial design and trade secret
1.5 What is a Patent
1.6 Types of patent
1.7 Patentable and nonpatentable items
1.8 Patent procedure and patent offices
1.9 Commercialization of Patent
1.10 Patent Infringement
1.11 Herbal drug patent and others

Unit 2: Copyrights, Trademarks and Geographical Indications

2.1 Definition and meaning of copyrights
2.2 Economic rights and moral rights
2.3 Duration of copyrights
2.4 Author and ownership of copyrights
2.5 Infringement of copyrights
2.6 Introduction to trademarks
2.7 Terms such as mark, brand, brand name, device, letter, brand mark, label and ticket
2.8 Infringement of trademark
2.9 Refusal grounds for registration of trademark
2.10 Introduction to Geographical Indications(GIs)
2.11 Importance of GI
2.12 How to register GI application
2.13 How to file a GI
2.14 Application infringement of GI
2.15 List of GI items in India

Suggested Activities: Case Studies, Group discussions, Unit tests

VAC020CHE Theory	Semester-1 **Industrial Chemistry**	Compulsory Credit: 02 Marks:50

Course outcomes:

- Student will get idea about unit operations and unit processes
- Student will get knowledge about distillation, filtration, nitration and hydrolysis
- Student will understand kinetics and mechanism of nitration and hydrolysis
- Student will get importance of applications of distillation and filtration

Unit: 1 Unit operations

Introduction to unit operations:Distillation, Absorption, Evaporation, Filtration and drying

1.1 Distillation:

1.1.1 Definition, terms used in distillation

1.1.2 Applications

1.1.3 Raoult's law

1.1.4 Distillation Assembly and general equipment

1.1.5 Classification of Distillation methods

1.2 Filtration:

1.2.1 Definition, terms used in filtration

1.2.2 Applications

1.2.3 Factors affecting the process and mechanism of filtration

1.2.4 Type of filtration: Surface/ Screen filtration , Depth filtration

1.2.5 Theories of filtration: Poiseullie's equation, Darcy's equation, Kozeny-Carman (K-C) equation

1.2.6 Classification of filtration equipments

1.2.7 Laboratory scale filtration

Unit: 2 Unit Processes

Introduction to unit operations : Nitration, Halogenation, Sulfonation and Sulfation, Amination by reduction, Amination by ammonolysis, Oxidation, Hydrogenation, Esterification, Hydrolysis, Alkylation, Hydrocarbon synthesis and Hydroformylation

2.1 Nitration

2.1.1 Nitrating agents

2.1.2 Aromatic nitration

2.1.3 Kinetics and mechanism of aromatic nitration

2.1.4 Thermodynamics of nitration

2.1.5 Process equipment for technical nitration

2.2 Hydrolysis

2.2.1 Hydrolysing agent

2.2.2 Materials susceptible to hydrolysis

2.2.3 Thermodynamics of Hydrolytic reaction

2.2.4 Kinetics and mechanism of hydrolysis

2.2.5 Effect of temperature, concentration of reactants and pressure on rate of hydrolysis

Suggested Activities: Industrial visit, Scenario of chemical industries in Gujarat and India, Case Studies,Group discussions, Unit tests

DSM010CHE Theory	Semester-1 **MOOC/IPR/Prototype/PoC/Training(1)**	Compulsory Credit: 04 Marks:100

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Course Outcomes: Promotion of innovation, research, and skill development among postgraduate (PG) students by participating in MOOCs, developing Proofs of Concept (PoC), managing Intellectual Property Rights (IPR), Training and translation of innovative ideas into tangible/intangible solutions of the societal needs after the completion of the course.

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- Students will have access to institutional labs or they can utilize external laboratory and incubation center as guided by the mentor.
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Training

- The students will select the training programs of their choice as guided by the mentors.
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Mathematics

DSC010MAT Theory	Semester-1 **Advanced Complex Analysis**	Compulsory Credit: 04 Marks:100

Course Outcomes:

On completion of this paper students will be able to

- Increased their capacity to develop logics of analysis.
- Understand basic concepts of complex analysis with new ideas.
- Develop problem solving ability in the subject of complex analysis.
- Develop confidence level to teach the same subject.

Unit- 1

- Basic - complex number, De'moiver's Theorem and its applications
- Complex Function and it's Geometrical Interpretation
- Limit and continuity of a complex function
- Derivative of a complex function.

Unit- 2

- Analytic functions, Cauchy-Riemann equations
- Harmonic functions
- Power series, Power series as an analytic function
- Elementary functions

Unit- 3

- Complex Integration – Line Integral
- Cauchy's Theorem, Cauchy's Integral Formula, Cauchy Inequality
- Liouville's Theorem, Morera's Theorem, Cauchy- Goursat's Theorem
- Gauss mean value Theorem

Unit- 4

- Taylor's Theorem, Laurent series
- Convergence of power series
- Classification of singularities, Residues, Residue Theorem, Residues at poles,
- Mobius Transformation – Properties and it's Canonical Form

DSC020MAT Theory	Semester-1 **Advanced Group Theory**	Compulsory Credit: 04 Marks:100

Course Outcomes

On completion of this paper students will be able to:

- Increased their capacity to develop logics.
- Understand basic concepts of Abstract algebra with new ideas.
- Develop problem solving ability in the subject of Abstract algebra.
- Develop confidence level to teach the same subject.

Unit 1 :

- Introduction to Groups, Symmetries of a Square
- The Dihedral Groups, Elementary Properties of Groups, Finite Groups
- SubGroups, SubGroup Tests, Cyclic Groups
- Classification of SubGroups of Cyclic Groups

Unit 2:

- Permutation Groups, Cycle Notation, Properties of Permutations
- Isomorphisms, Cayley's Theorem, Properties of Isomorphisms, Automorphism
- Properties of Cosets, Lagrange's Theorem and consequences and further applications
- External Direct Products and their properties. The Group of Units Modulo n as an External Direct product and further applications

Unit 3:

- Normal subGroups, Factor Groups, Applications of Factor Groups
- Internal Direct products, Group homomorphisms and their properties
- The First Isomorphism Theorem, Fundamental Theorem of finite Abelian Groups
- Isomorphism classes of Abelian Groups

Unit 4:

- The Conjugacy classes, The Class Equation
- Sylow Theorems and their applications
- Finite Simple Groups, Non-Simplicity Tests
- The simplicity of the Group A5

DSC030MAT Practical	Semester-1 **Practical: Advanced Complex Analysis & Advanced Group Theory**	Compulsory Credit: 04 Marks:100

Course Outcomes:

On completion of this paper students will be able to

- Increased their problem-solving skills.
- Understand applications of complex analysis.
- Develop problem solving ability in the subject of complex analysis.
- Develop confidence level to teach the same subject.

Unit 1:

1. Testing Various Properties of Complex Number, Modulus, Argument and Complex Conjugate,
2. Logarithm of Complex Number
3. Conformal mapping.
4. Classify the various types of singularities by definition as well as using expansion of series.
5. Testing Analyticity of Complex function & Verifying the Theorems on analytic function.
6. Explain various theorems on complex integration. 7. Examples on Mobius Transformation.

Unit 2:

1. Problem solving on groups, subgroups and cyclic groups.
2. Verifying the different algebraic groups, Isomorphism of groups, Homomorphism of groups & Abelian groups.
3. Examples on isomorphism and homomorphisms of groups.
4. Examples on permutation groups and its application.
5. Examples based on application of Lagrange's theorem
6. Problem solving on conjugacy classes, class equations, Sylow theorems and its applications.
7. Examples on Simple groups.

VAC010MAT Theory	Semester-1 **Proofs in Mathematics**	Compulsory Credit: 02 Marks:50

Course Outcomes:

- To get knowledge about mathematics terminology used in various literature survey in Mathematical sciences.
- To learn Mathematical proofs in research paper/article in Mathematical Sciences.
- To carry out the research work in Mathematical sciences.
- To study of Results and Discussion coming out from Dissertation work in Mathematical Sciences.

Unit 1:

- Mathematical Grammar & Vocabulary: Theorem, Corollary, Lemma, Proposition, Axioms, Postulates, Hypothesis, Conjecture, Existence, Uniqueness, Boundedness, Characteristic & Property - Meaning & Differences. Algorithm – Basic concepts, Sorting & its Complexity.

Unit 2:

- Various Proof Methods: Direct proof, Indirect proof, Contrapositive Method, Contradiction Method, Proofs by cases, Mathematical Induction Method, Biconditional Proof, Vacuous Proof, Trivial Proofs, Disproof Method by Counter Example, Characterization. Gneralisation & Simplification Techniques.

VAC020MAT Practical	Semester-1 **LaTex Programming**	Compulsory Credit: 02 Marks:50

Course Outcomes

- To create well-structured LaTeX documents, including articles, reports, and theses, using advanced formatting techniques.
- To demonstrate the ability to accurately typeset complex mathematical equations and expressions using LaTeX mathematical environments.
- To capable of customizing document layouts.
- To adept at using LaTeX in collaborative environments

Unit 1

- **Foundations of LaTeX Programming:** Introduction to LaTeX, Basic Document Creation, Document Structure, Compiling and Debugging.

Unit 2

- **Advanced Document Formatting:** Creating and Managing Lists and Tables, Mathematical Typesetting, Graphics and Figures, Document Layout Customization

DSM010MAT Theory	Semester-1 MOOC/IPR/Prototype/POC/Training (1)	Compulsory Credit: 04 Marks:100

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Education

DSC010EDU Theory	Semester-1 **Educational Psychology**	Compulsory Credit: 04 Marks:100

Course Outcomes:

Prospective teacher educator...

- Understands the nature of human growth and development.
- Understands learning as a process and the factors affecting it.
- Understands the concept and process of learning acceleration.
- Develops their abilities to apply different learning theories according to the demand of the situation.
- Develops the ways of enhancing some mental abilities of the learners.
- Develops a proper perception regarding theories of personality.
- Develops skill of guidance and counselling

Unit 1: Schools of Psychology and Theories of Learning

1.1 Introduction to various Schools of Psychology: Structuralism, Functionalism, Behaviourism, Gestalt School, Psychoanalytic School, Humanistic School, and Cognitive School

1.2 Learning Curve, Gagne's Theory of Hierarchy of Learning, Bandura's Theory of Social Learning

1.3 Hull's Theory of Learning, Bruner's Learning Theory

1.4 Insightful Learning, Tolman's Learning Theory

Unit 2: Intelligence and Personality

2.1 Intelligence: Stenberg's Theory of Intelligence, Social Intelligence
Multiple Intelligence: Concept, Gardener Theory of Multiple Intelligence

2.2 Emotional Intelligence: Concept And Daniel Goleman's Theory

2.3 Personality: Freud's Structure of The Human Mind, Freudian Psychoanalytic Theory of Personality, Carl Rogers's Humanistic Theory of Personality, Indian Theories of Personality

2.4 Erikson's Theory of Personality, Jung's Theory of Personality and Gordon's Allport's Trait Theory of Personality

Unit 3: Aptitude, Interest, Thinking, Reasoning

3.1 Aptitude: Concept, Nature, Types, Uses, Advantages, Limitations, Measurement
Difference: Aptitude and Intelligence, Aptitude and Achievement , Aptitude and Interest

3.2 Interest : Concept, Development and Identification of Interest

3.3 Attention: Concept, Characteristics, Factors affecting Attention, Types

3.4 Reasoning: Concept, Characteristics, Steps, Types

Unit 4: Guidance and Counselling

4.1 Guidance: Concept, Nature, Principles and Need of guidance
Types: Individual guidance, Educational guidance, and Vocational guidance

4.2 Counselling: Concept, Nature, Principles and Need of counselling
Types: Directive Counselling: Steps, Limitations

Non-Directive Counselling: Steps, Limitations

Eclectic Counselling: Steps, Limitations

4.3 Approaches: CBT, REBT

4.4 Carl Roger's Client centred Theory

Mode of Transaction: Group discussion, Lecture-cum –discussion, Panel discussion, Symposium, Reports, Research Journals, School visits and sharing of experiences

Suggested Activities:

- To organize a seminar on the current topic of educational psychology.
- Visit of Psychological lab and get acquainted with psychological equipment.
- Preparation of any tool on intelligence and its administration on five students
- Conduct a case study on one student who has difficulties in learning in primary years.
- Preparation of learners' profiles based on cognitive and non-cognitive characteristics in order to depict individual differences at the primary or secondary stage.

DSC020EDU Theory	Semester-1 **Educational Philosophy**	Compulsory Credit: 04 Marks:100

Course Outcomes:

Prospective teacher educator...

- introduce to Philosophy and Philosophy of Education.
- identify Indian schools of philosophy and educational thinkers.
- know Schools of Philosophy and Educational Thinkers around the World.
- develop competence in analyzing philosophical texts and review the researches in the areas of pure philosophy and educational philosophy and to draw implications thereof.

Unit 1 : Introduction to Philosophy and Philosophy of Education

1.1 Definitions, Concept and Nature of Philosophy from Bhartiya and Western Perspectives

1.2 Relation between Philosophy and Education

1.3 Branches of Philosophy; Metaphysics, Epistemology and Axiology; their Educational Implications

1.4 Philosophical attitude and its implications in educational practices.

Unit 2 : Indian Schools of Philosophy and Educational Thinkers

2.1 Samkhya Darshan, Yog Darshan and Uttar Mimamsa Darshan

2.2 Buddhism, Jainism

2.3 Gandhiji, Tagore, Swami Vivekananda

2.4 Sri Aurobindo, J. Krishnamurty, Pandit Deendayal Upadhyay

Unit 3 : Schools of Philosophy and Educational Thinkers around the World

3.1 Idealism, Realism, Naturalism, Pragmatism and Existentialism, Post-modernism

3.2 Islamic and Christian philosophies of education

3.3 Herbert Spencer, Rousseau, John Dewey

3.4 Michel Foucault, Paulo Freire, Martin Buber

Unit 4 : Philosophical analysis and implications of Educational Text and Researches in Educational

4.1 Analysis of Selected Philosophical Texts from Educational Perspectives

4.2 Analysis of Selected Educational and Literary Texts from Educational Perspectives

4.3 Analysis of Selected Movies / Documentaries from Educational Perspectives

4.4 Nature of Research in Educational Philosophy with illustrations of at least 3 research studies.

Mode of Transaction: Lecture Method, Discussion, Group Project

Suggested Activities: Field Visits, Projects & Research, Case Studies and comparative studies

SEMESTER- 2

Physics

DSC040PHY Theory	Semester-2 **Quantum Mechanics**	Compulsory Credit: 04 Marks:100

Course Outcomes:

- Students will apply perturbation theory, the variation method, and the WKB approximation to solve complex quantum mechanical problems.
- Students will analyze and compute scattering processes using methods like the Born approximation and partial wave analysis, understanding their applications in physics.
- Students will solve and interpret the Klein-Gordon and Dirac equations, understanding their implications for relativistic particles and their interactions with electromagnetic fields.

Course Content:

Unit 1: Time Independent Perturbation theory, the variation method and the WKB approximation

1.1 Time Independent Perturbation theory: Perturbation theory for discrete levels, Equation in various orders of perturbation theory, The non-degenerate case for first and second order corrections, The degenerate case-removal of degeneracy. Stark effect.

1.2 The variation method: Upper bound on ground state energy. Application to excited states, The ground state of a two-electron atom. The Hydrogen molecule-exchange interaction.

1.3 The WKB approximation: The one-dimensional Schrödinger equation, the asymptotic solution, Solution near turning point, matching at turning points and connection formulae, The Bohr-Sommerfeld quantum condition. WKB solution of the radial wave equation.

Unit 2: Scattering

2.1 Scattering theory–Kinematics of the scattering process, Differential and total cross sections. Wave mechanical picture of scattering, Scattering amplitude and its formal expression by Green's function.

2.2 The Born approximation and its validity through examples, Partial wave analysis, Asymptotic behavior of partial waves, phase shifts and scattering amplitudes.

2.3 Optical theorem. Phase shifts- relation with the potential. Potential of finite range. The Eikonal approximation. Applications to selected problems.

Unit 3: Time dependent Perturbation theory

3.1 Evolution with time: The Schrödinger equation and general solution, Propagators, Sudden approximation.

3.2 Perturbative theory for time evolution problems: Perturbative solution for transition amplitude, Constant perturbation and Fermi's golden rule, Scattering of a particle by a potential-elastic scattering.

3.3 Harmonic perturbations, Interaction of an atom with electromagnetic radiation.

3.4 The dipole approximation, Einstein coefficients-spontaneous emission. Alternative pictures of time evolution: The Schrödinger picture, Heisenberg picture, interaction picture.

Unit 4: Relativistic wave equations

4.1 Relativistic wave equations, generalization of the Schrödinger equation, the Klein-Gordon equation and its plane wave solutions.

4.2 Dirac's relativistic Hamiltonian and the Dirac equation, position probability density and expectation values, Dirac matrices.

4.3 Plane wave solution of the Dirac equation, the spin of the Dirac particles, significance of the negative energy states.

4.4 Relativistic electron in a central potential, electron in magnetic field and spin magnetic moment.

Mode of Transaction:

To create a comprehensive and effective learning experience for students pursuing this course, combination of methods mentioned below will be used

- Direct Teaching through Chalk-Walk and Talk
- ICT enabled teaching/Question-Answer
- Class discussion led by teacher/students
- Case Studies/Literature review
- Problem solving activities/Debate
- Collaborative and Co-operative Learning
- Think Pair Share/Jigsaw
- Inquiry Based Learning/Panel Discussion
- Project Based Learning/Flipped Classroom
- Blended Learning designs/Concept Mapping

DSC050PHY Theory	Semester-2 **Solid State Physics**	Compulsory Credit: 04 Marks:100

Course Outcomes:

- This paper intends to provide knowledge of conceptual solid-state physics.In addition, this course aims to provide depth in condensed matter with theoretical and experimental topics in solid state physics.
- Understand the phenomena of new state of materials i.e. superconductivity and its properties in details.
- To learn theoretical as well as experimental knowledge in solid state physics.

Course Content:

Unit 1: Crystal Structure and Defects in Solids

1.1 Crystalline State, Basic Definitions, Bravais and Non-Bravais Lattices,
1.2 Elements of Symmetry, Crystal Planes and Miller Indices, Examples of Simple Crystal Structures
1.3 Principals of X-Ray, Neutron and Electron Diffraction in Crystalline Solids, Braggs Law,Concept of Reciprocal Lattice, Experimental Techniques of X-Ray Diffraction
1.4 Types of Defects - Point Defects, Line Defects, Plane Defects, Grain Boundaries, Stacking Faults, Diffusion in Solids.

Unit 2: Band Theory of Solids

2.1 Electron in Periodic Potential, Bloch Theorem, Kronig-Penney Model
2.2 Effective Mass, Tight Binding Approximation, Brillouin Zones
2.3 Cellular and Pseudo Potential Methods, Fermi Surfaces, De Hass Van Alfon Effect
2.4 Cyclotron Resonance, Classification of Solids, Limit of Band Theory – Metal Insulator Transition

Unit 3: Superconductivity

3.1 Definition, Types of Superconductors, Properties
3.2 Meissner Effect, Isotope Effect, BCS Theory – Qualitative Approach
3.3 Outcomes of BCS Theory, Josephson Effects
3.4 SQUID, Applications of Superconductivity

Unit 4: Magnetism

4.1 Quantum Theory of Diamagnetism and Paramagnetism, Diamagnetic and Paramagnetic Susceptibilities of free electrons,
4.2 Weiss Theory, Temperature Dependence of Saturation Magnetization (MS),
4.3 Heisenberg`s Exchange Model, Slater's Criterion, Concept of Magnons,Ferromagnetic Domains,
4.4 Origin of Domains, Antiferromagnetism and Ferrimagnetism, Ferrites

Mode of Transaction: To Create a comprehensive and effective learning experience for students pursuing Solid State Physics paper. ICT based learning, Using Laboratory work, Presentation, Assignment and Access to online resources.

Suggested Activities: Topic related live demonstration in the classroom, ICT based Teaching – learning, Experiment work in Physics Lab, Outreach program

DSC060PHY Practical	Semester-2 **Laboratory Experiments in Physical Sciences-2**	Compulsory Credit: 04 Marks:100

Course Outcomes:

Student will learn

- Uses different measuring devices and meters to record the data with precision.
- Applies the mathematical concepts/equations to obtain quantitative results.
- Develops basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.
- Applies knowledge of mathematics, science, and engineering to the physical problems.

Course Content: Suggested Experiments

Practical 1 Resistivity of Ge at various temperatures by Four Probe method and determination of band gap.

Practical 2 To determine the Hall coefficient and the carrier concentration of semiconductor material using Hall effect.

Practical 4 To determine the Curie temperature of ferromagnetic materials

Practical 5 To determine dielectric constant of Ferroelectric materials

Practical 6 To determine the magnetic susceptibility of liquid materials using quink's method

Practical 7 Method for Determining Crystal Grain Size by X-Ray Diffraction (Theoretical Concept)

Practical 8 Indexing of a Cubic Crystal X-Ray Diffraction Patterns by Mathematical and Analytical Method.

Practical 9 Study of magnetic hysteresis loop (B–H)

Practical 10 To determine the value of e/m by helical method

Practical 11 Determine energy band gap of semiconductor material by Thermistor

Practical 12 Solving First & Second Order differential Equations including Simultaneous Equations (Euler & Runge-kutta) (theoretical)

Practical 13 Numerical Integration (Trapezoidal, Simpson and Quadrature methods) (theoretical)

Practical 14 Matrices- Arrays of variable Size, Matrix Operations, Eigenvalues & Eigenvectors, Matrix Inversion, Solving Systems of Linear Equations (theoretical)

Practical 15 Phonon dispersion relation of monoatomic lattice. (theoretical)

Practical 16 Study of magnetic hysteresis by magnetostriction method/ anchoring method.

Practical 17 Characteristics of Hydrogen Spectra

Practical 18 Study of Absorption Spectra of KMnO4

Practical 19 I2 Molecule absorption Spectra to find dissociation energy.

Practical 20 To determine Vibrational Constant and anharmonicity constant of a vibrational rotational spectra (theoretical)

Practical 21 To determine of wavelength of LASER beam with diffraction grating

Mode of Transaction: Laboratory Experiments, e-resources, ICT and Virtual Lab

Suggested Activities: Performing the experiments and discussing the physical significance and applications, Group discussion, Presentation, Assignment work and Quiz

VAC030PHY	Semester-2	Compulsory
Theory	**Remote Sensing and Applications**	Credit: 02
		Marks:50

Course Outcomes:

- After learning the course the student will be able to understand the remote sensing system and activity in the space, its effect on the earth's environment, observational instruments and techniques related to space and astrophysics.
- The main objective of this course is to teach the fundamentals of remote sensing application used in space measurements.
- A student of this course is expected to be able to understand the design for possible potential application.

Course Content:

Unit 1: Concepts and Foundations of Remote Sensing

1.1 Energy sources and Radiation principles, Energy interactions in the atmosphere, energy interactions with earth surface features

1.2 Data acquisition and Interpretations, Reference data, Characteristics of real remote sensing system

1.3 Practical applications of remote sensing, Land and Geographic Information System

Unit 2: GPS

2.1 GPS: Coordinate and time systems, Definition of global and local coordinate systems,

2.2 Relationship between satellite and conventional geodetic systems,

2.3 Satellite orbital motions: Description of motion, Forces acting on the satellites, Satellite NAV messages.

2.4 Applications, Orbital Period and Velocity, Effects of Orbital inclination, Azimuth and Elevation

Mode of Transaction: To Create a comprehensive and effective learning experience for students pursuing remote sensing application paper. ICT based learning, Using Laboratory work, Presentation, Assignment and Access to online resources.

Suggested Activities: Topic related live demonstration in the classroom, ICT based Teaching – learning, Experiment work in Physics Lab, Outreach program

DSM020PHY Theory	Semester-2 **MOOC/IPR/Prototype/PoC/Training(2)**	Compulsory Credit: 04 Marks:100

Students will opt any one course option out of MOOC/ Proof of Concept (POC)/ Intellectual Property Rights (IPR)/Prototype/Training

Course Outcomes: Promotion of innovation, research, and skill development among postgraduate (PG) students by participating in MOOCs, developing Proofs of Concept (PoC), managing Intellectual Property Rights (IPR), Training and translation of innovative ideas into tangible/intangible solutions of the societal needs after the completion of the course.

MOOCs (Massive Open Online Courses)

- Course must align with the program objectives from various national and international platforms offering MOOCs.
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- Students must submit completion certificates and attendance record, assignment submission record and Quiz conducted by the course coordinator for evaluation.

Proof of Concept (PoC)

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Intellectual Property Rights (IPR)

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Prototype

- Students will have access to institutional labs or they can utilize external laboratory and incubation center as guided by the mentor.
- Students may apply for prototype development grants through the institution or external agencies.
- A demonstration and/or presentation with detailed report will be evaluated.

Training

- The students will select the training programs of their choice as guided by the mentors.
- It should include active participation in real-world tasks and projects of domain-specific skills

- The training should help students to work with professionals and peers in the field and building connections for professional growth etc.

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Botany

DSC040BOT Theory	Semester-2 **Anatomy of Higher Plants**	Compulsory Credit: 04 Marks:100

Course Outcomes:

On completion of this paper, students will be able to

- Understand the primary and secondary anatomical structures of different plant parts
- Understand different types of plant tissue systems in angiosperms
- Gain the fundamental knowledge of secondary plant growth and wood types
- Experience the benefits of team work which will foster their flexibility and responsiveness, especially their abilityto change

Course Content:

UNIT 1: INTRODUCTION TO PLANT TISSUES

1.1 Types of Plant Tissues

1.2 Meristematic Tissue: Characteristics, Classification, Theories and Functions

1.3 Simple Permanent Tissues: Parenchyma, Collenchyma, Sclerenchyma

1.4 Complex Permanent Tissues: Xylem and Phloem

UNIT 2: PLANT TISSUE SYSTEMS

2.1 Structure, Orientation and Arrangement of Epidermal Tissue System

2.2 Structure, Types and Classification of Stomata and Epidermal Out Growth

2.3 Ground Tissue System: Definition, Types and Functions

2.4 Vascular Tissue System: Definition, Types and Functions

UNIT 3: SECONDARY GROWTH

3.1 Secondary Growth in Dicots: Vascular Cambium and Cork Cambium

3.2 Secondary Growth in Dicot Stem and Dicot Root

3.3 Dicot Wood Anatomy: Annual Rings, Types of Wood, Tyloses

3.4 Anomalous Secondary Growth with Various Examples

UNIT 4: PLANT ANATOMY IN EVOLUTION

4.1 Phylogeny of Xylem and Phloem Elements

4.2 Nodal Anatomy

4.3 Types of Stele

4.4 Applications and Significance of Plant Anatomy

Mode of Transaction:

Lectures; Demonstration and Microscopic Analysis in Life Science Laboratory; Educational Videos

Suggested Activities:

Collection of Plant Samples Belonging to Different Families for Anatomy Experiments

DSC050BOT Theory	Semester-2 **Biochemistry & Enzymology**	Compulsory Credit: 04 Marks:100

Course Outcomes:

On completion of this paper, students will

1. Learn the structure, function and metabolic pathways of essential biochemical molecules.
2. Learn about the alternative pathways of energy production and lipid metabolism
3. Learn principles of enzyme kinetics and apply these through hands on problem sets. Students will be shownhow enzyme properties contribute to metabolic processes.

Course Content:

UNIT 1: BIOENERGETICS & THERMODYNAMICS

1.1 Basic concepts of Enthalpy, Entropy, Free energy and chemical equilibrium Determination of DG &Energy rich compounds

1.2 Energy Metabolism: Role of ATP in metabolism, Role of Reducing power

1.3 Laws of Thermodynamics

1.4 Fuelling Reactions : Catabolic pathways of carbohydrates – Glycolysis, TCA cycle

UNIT 2: METABOLIC PATHWAYS

2.1 Modes of ATP generation : Substrate Level and Oxidative Phosphorylation

2.2 Carriers and Complexes of Respiratory Chain, Chemiosmotic Theory

2.3 PPP and Glyoxylate Cycle

2.4 Lipid catabolism – Fatty acid Beta oxidation Pathway

UNIT 3: INTRODUCTION TO ENZYMES

3.1 Enzymes – General Characteristics, Active and Allosteric Sites

3.2 Nomenclature and Classification

3.3 Mechanism of Enzyme Action, Concept of Activation Energy

3.4 Overview of : Cofactors, Coenzymes, Isoenzymes, Ribozyme, Abzyme

UNIT 4 : ENZYME KINETICS AND INHIBITION

4.1 Enzyme kinetics : Effect of Temperature, pH, Substrate & Enzyme Concentration

4.2 Steady-state hypothesis, derivation of Michaelis-Menten equation, Double reciprocal plot

4.3 Significance of Km and Vmax and their determination using different plots

4.4 Enzyme inhibition, Enzyme kinetics in the presence of inhibitors

Mode of Transaction: Lectures; Demonstration of Experiments in Life Science Laboratory; Educational Videos, Charts

Suggested Activities: Study of biomolecules using models, understanding enzyme kinetics using videos

DSC060BOT Practical	Semester-2 **Laboratory Experiments in Plant Science-2**	Compulsory Credit: 04 Marks:100

Course Outcomes:

On completion of the paper, students are able to:

- Identify the angiosperm plant families on the basis of the morphological characters
- Understand the meaning of taxonomical terminology
- Learn various forms of plant parts
- Understand diversity of plant parts in the plant kingdom

Suggested Practicals :

ANATOMY OF HIGHER PLANTS

1. Study of shoot apex and root apex
2. Study of simple tissues in Dicot stem T.S
3. Study of complex tissues in Dicot stem L.S
4. To study the types of vascular bundle from the available plants in campus
5. To study primary and secondary growth in dicot stem
6. To study anomalous secondary growth due to abnormal behaviour of cambium
7. To study Periderm and Lenticel
8. To study types of nodal anatomy
9. Preparation of permanent slides
10. To study Types of Wood anatomy

BIOCHEMISTRY & ENZYMOLOGY

1. To perform qualitative tests for carbohydrates
2. Titrimetric estimation of reducing sugar by Cole's Method
2. Preparation of standard curve for carbohydrates
3. Estimation of Glucose by DNSA method
4. To perform qualitative tests for Protein
5. Preparation of standard curve for Protein
6. Estimation of protein by Biuret Method
7. Estimation of protein by Folin-Lowry's Method
8. Determination of unit activity of alpha Amylase by iodometric method
9. Determination of Vmax and Km for amylase / alkaline protease enzyme by performing substrate concentration curve with M-M & Line Weaver Burk plot

VAC030BOT Theory	Semester-2 **Analytical Techniques**	Compulsory Credit: 02 Marks:50

Course Outcomes:

- Understand the working of different instruments utilized in the research of plant sciences
- Apply their theory-based knowledge about plants practically
- It will open new paths for scientific research
- Operate various instruments for analysis of various biomolecules

Course Content:

UNIT 1: SPECTROSCOPIC METHODS AND CHROMATOGRAPHY

1.1 Principal of Spectroscopy, UV- Visible Spectroscopy
1.2 IR Spectroscopy
1.3 NMR Spectroscopy
1.4 Principles of Chromatographic Separation
1.5 Theory, principle and applications of Paper Chromatography and Thin Layer Chromatography and Gas Chromatography

UNIT 2: CENTRIFUGATION AND ELECTROPHORESIS

2.1 Centrifugation: Principle
2.2 Types of Centrifugation: Analytical and Preparative
2.3 Basic Principles of Electrophoresis
2.4 Theory and Applications of Paper, Agarose and Polyacrylamide Gel Electrophoresis
2.5 Blotting Techniques

Mode of Transaction: Lectures; Demonstration of Experiments in Life Science Laboratory; Educational Videos

Suggested Activities: Determination of absorption maxima of various natural samples, Educational videos

DSM020BOT Theory	Semester-2 **MOOC/IPR/Prototype/PoC/Training(2)**	Compulsory Credit: 04 Marks:100

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Course Outcomes: Promotion of innovation, research, and skill development among postgraduate (PG) students by participating in MOOCs, developing Proofs of Concept (PoC), managing Intellectual Property Rights (IPR), Training and translation of innovative ideas into tangible/intangible solutions of the societal needs after the completion of the course.

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Chemistry

DSC040CHE Theory	Semester-2 **Organic Mechanism and Stereochemistry**	Compulsory Credit: 04 Marks:100

Course outcomes:

- Students will able to know various concepts Stereochemistry
- Students can understand the role of reagents in the organic synthesis
- Students can get knowledge of synthesis and mechanism of organic compounds
- Students will be able to know different aspects of Photochemistry

Course Content:

Unit 1: Name Reactions

1.1 Pechmann reaction
1.2 Stork enamine reaction
1.3 Robinson ring annulation
1.4 Wittig reaction and its modifications
1.5 Peterson olefination
1.6 Shapiro reaction
1.7 Michael addition
1.8 Suzuki reaction
1.9 Vilsmeier-Haak reaction
1.10 Fisher Indole synthesis
1.11 Ulmann Reaction

Unit 2: Reagents in organic synthesis

2.1 Pyridinium dichromate(PDC) & PCC
2.2 NBS, HIO_4, $Pb(OAC)_4$, $NaBH_4$, $LIAlH_4$
2.3 1,3-Dicyclohexylcarbodiimide (DCC), Lithium diisopropylamide (LDA)
2.4 Baker's yeast
2.5 umpolung reagent

Unit 3: Stereochemistry

3.1 Concept of Chirality
3.2 Chirality and Symmetry
3.3 Elements of Chirality including Chiral centre, Chiral axis, Chiral plane and Helicity
3.4 CIP Nomenclature
3.5 Molecules with more than one Chiral centre
3.6 Total number of Stereoisomer in such molecules
3.7 Enantiomeric and Diastereomeric Relationship
3.8 Chirogenicity and Stereogenecity
3.9 Pseudochirality, Topicity and Prostereoisomerism
3.10 Determination of Topic relationship between Homomorphic ligands in Intact
3.11 Sawhorse, Newman and Fischer Projections

3.12 Interconversion of Projections

3.13 Optical Purity

Unit 4: Photochemistry

4.1 Introduction

4.2 Basic law of photochemistry : Grothus-Draper Law

4.3 Beer Lambert Law

4.4 Basis of Photochemistry : electronic excitation, excited states

4.5 Jablonskii diagram

4.6 Fluorescence

4.7 Phosphorescence

4.8 Di-π methane rearrangement

4.9 Difference between photochemical and thermal reactions

4.10 Photochemical Reactions of some carbonyl compounds and olefins

4.11 Photochemical cycloaddition reactions

Mode of Transaction: PPTs. Video Lectures, Chalk and Talk Method

Suggested Activities: Group Discussion, Unit Tests

DSC050CHE Theory	Semester-2 **Inorganic Chemistry**	Compulsory Credit: 04 Marks:100

Course Outcomes:

- The students will be able to understand the periodic elements thoroughly.
- The students will be able to understand s-block elements and their applications efficiently.
- The students will be able to understand p-block elements and their applications efficiently.
- The students will be able to get idea about molecular symmetry and structural properties with potential applications.

Course Content:

Unit 1: Periodic properties and bonding in chemistry

1.1 Electronegativity and electron affinity
1.2 Ionization potential and ionic radii
1.3 Effective nuclear charge
1.4 Chemical bond
1.5 Ionic bond
1.6 Covalent bond
1.7 Hydrogen bond
1.8 Shape and hybridization of molecules
1.9 Bond order
1.10 MO theory of diatomic molecule
1.11 Huckel theory for conjugated π-electron systems

Unit 2: Chemistry of s-block elements

2.1 Alkali & alkaline earth metals
2.2 Solutions in non-aqueous Media
2.3 Application of crown ethers in extraction of alkali & alkaline earth metals
2.4 Organometallic compounds of Li, Mg, Be, Ca & Na

Unit 3: Chemistry of p-block elements

3.1 Synthesis, Properties, uses & structures
3.2 Boron Hydrides
3.3 Preparation, structure & bonding and interconversion of lower & higher boranes
3.4 Metalloboranes
3.5 Carboranes
3.6 Allotropes of Carbon, C_{60} and compounds (fullerenes)
3.7 Intercalation compounds of Graphite, Carbon nanotubes, silicates, silicones, sulphur and nitrogen

Unit 4: Molecular symmetry

4.1 Introduction

4.2 Symmetry operations and symmetry elements: C_n, σ, S_n, i and E

4.3 Point groups for the molecules (excluding S_{2n} and Ih)

4.4 Multiplication tables of C_{2v}, C_{2h} and C_{3v} point groups

4.5 Application of symmetry to molecular vibrations

4.6 Interpretation of IR and Raman spectra

Mode of Transaction:PPT, Video Lecture, Chalk and Talk Method

Suggested Activities: Group Discussion, Unit Test

DSC060CHE Practical	Semester-2 **Laboratory Experiments in Chemistry-2**	Compulsory Credit: 04 Marks:100

Course Outcomes:

- Students will be able to synthesize of organic compounds and Inorganic complexes
- Students will be able to find out percentage yield of synthesized materials
- Students will be able to identify the structural reaction mechanism of organic compounds.
- Students will learn chemical preparation of inorganic compound.
- Students will be able to separate different organic mixtures through chromatographic techniques
- Students will be able to synthesize of polymers

Course Content:

Paper: Organic mechanism and stereochemistry (minimum Four)

To carry out organic preparation of followings:

1. 1,2,3,4-Tetrahydrocarbazole from Cyclohexanone (Fisher indole synthesis)
2. 9,10-dihydroanthracene-a,b-succinic anhydride from anthracene (Diels-Alder reaction)
3. Aniline to chlorobenzene/ p-nitroaniline to p-nitrochlorobenzene/ Anthranilic acid to ochlorobenzoic acid/ o-toluidine to o-chlorotoluene/ p-iodonitrobenzene from pnitroaniline / m-nitrophenol from m-nitroaniline (Sandmeyer reaction)
4. 2,4-dihydroxybenzoic acid from resorcinol (Kolbe-Smith reaction)
5. Benzanilide from Benzophenone/Acetanilide from acetophenone(Backmann rearrangement)
6. Benzyl alcohol and Benzoic acid from Benzaldehyde (Cannizarro reaction)
7. Preparation of 1-nitro naphthalene from naphthalene
8. Preparation of m-nitroaniline from m-dinitrobenzene
9. Preparation of benzil from benzoin
10. Preparation of m-dinitrobenzene from nitrobenzene

Paper: Inorganic Chemistry

Inorganic Mixture Sepration: (minimum Four)

The systematic qualitative analysis of inorganic mixtures containing six radicals as of following:

1. $CuSO_4$, KBr, KI, Na_2CrO_4, $CaCO_3$, $Zr(NO_3)_3$, $NaNO_3$, ZnS, Na_2SO_4, SeO_2, NaCl, K_2SO_4, $(NH_4)_2SO_4$, $(NH_4)_2MoO_4$, $BaCl_2$, $ZnCO_3$, $Al_2(SO_4)_3$, ZnS, $Ni(NO_3)_2$, KNO_2,KCl, $CdCO_3$, $CuCl_2$, K_2SO_4, $AlPO_4$, H_3BO_3, $(NH_4)_2SO_4$, $CdCl_2$, $NaNO_3$, $ZnCO_3$, $AlPO_4$, $Pb(NO_3)_2$, $NaNO_2$, $MnSO_4$, $NaHSO_3$, K_2CrO_4, $FeSO_4$, $(NH_4)_2SO_4$, Na_3AsO_3, Na_3AsO_4, $(NH_4)_2SO_4$, K_2SO_4, $CeSO_4$, As_2O_3, NH_4Cl, $NiSO_4$, $LiCO_3$, $MgCO_3$, $NaNO_2$, $Mg_3(PO_4)_2$, V_2O_5, H_3BO_3, $SrCO_3$, $Th(NO_3)_3$, Na_3AsO_3, Na_3AsO_4, $BaCO_3$ and $LiCO_3$

VAC030CHE Theory	Semester-2 **Nanochemistry**	Compulsory Credit: 02 Marks:50

Course Outcomes:

- Learners will be able to Demonstrate a working knowledge of nanoscience/nanotechnology principles and applications
- Learners will be able to Explain the nanoscale paradigm in terms of properties at the nanoscale dimension
- Learners will Explain the history of nanotechnology, identify current nanotechnology solutions in design, engineering, and manufacturing, and where the field may evolve over the next 10 to 15 years
- Learners can Identify societal and technology issues that may impede the adoption of nanotechnology

Course Content:

Unit 1: Nanochemistry , Nanomaterials and preparation of Nanomaterials

1.1 Introduction to Nanochemistry
1.2 Nanomaterials and Bulk Materials
1.3 Difference between nanomaterials and bulk materials
1.4 Classification of nanomaterials
1.5 Nano tubes, Nano wires, Nano rods, Nano sheets , Fullerenes and Quantum dots
1.6 Importance of nanomaterials
1.7 Preparation of Nanomaterials: Top-down Methods and Bottom-up Methods
1.8 Various methods for Nanomaterials preparation:Mechanical grinding, sol-gel process, gas phase synthesis of nanomaterials, wet chemical synthesis of nanomaterials, gas condensation processing (gcp), sputtered plasma processing, microwave plasma processing
1.9 Properties of nanomaterials e.g. optical, electric and magnetic properties

Unit 2: Nanoparticle Behavior and applications of Nanomaterials

2.1 Nanoparticle Behavior in Colloid Solutions
2.2 Types of Colloid Solutions
2.3 Stability of Colloidal Solutions
2.4 Electrostatic Stabilization
2.5 Steric Stabilization
2.6 Depletion Stabilization
2.7 Applications of nanomaterials in different fields
2.8 Disadvantages of Nanomaterials

Suggested Activities: Group discussions, Model preparation, Unit tests

DSM020CHE Theory	Semester-2 **MOOC/IPR/Prototype/PoC/Training(2)**	Compulsory Credit: 04 Marks:100

Students will opt any one course option out of MOOC/ Proof of Concept (POC)/ Intellectual Property Rights (IPR)/Prototype/Training

Course Outcomes: Promotion of innovation, research, and skill development among postgraduate (PG) students by participating in MOOCs, developing Proofs of Concept (PoC), managing Intellectual Property Rights (IPR), Training and translation of innovative ideas into tangible/intangible solutions of the societal needs after the completion of the course.

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Mathematics

DSC040MAT Theory	Semester-2 **Combinatorics and Graph Theory**	Compulsory Credit: 04 Marks:100

Course Outcomes

- Understand various techniques of combinatorics
- Acquire skill of various counting Methods and calculating various graph parameters
- Solve various problems on Combinatorics and Graph Theory.
- Apply knowledge of Combinatorics and Graph Theory to solve various problems.

Content:

Unit

1. Revision: Permutations and Combinations, Basic Counting techniques, The pigeonhole principle,The Inclusion-Exclusion Principle and Applications.
2. Generating Functions, Recurrence Relations, Binomial & Multinomial Coefficients, Linear Recurrence Relations and it's Solutions
3. Graphs: Definitions and examples, Subgraphs, walks, paths and cycles, Connectedness, Matrix representation of graphs, Operations on graphs, connectedness Trees and connectivity: Definition and simple properties, Bridge, spanning trees, Caley's theorem. Graph Coloring- Chromatic Number, Various Graph Parameters.
4. Directed Graph- Definition, Examples, Elementary theorems on Directed graph. Orientation, tournament, Eulerian digraph, Network Flow- Definition, Maximal flow, Problems on Network Flow

DSC050MAT Theory	Semester-2 **Advanced Linear Algebra**	Compulsory Credit: 04 Marks:100

Course Outcomes

- Understand concepts of advanced Linear algebra
- Acquire knowledge of solving various problems of advanced Linear algebra
- Develop skills of solving various problems of advanced Linear algebra
- Apply knowledge in various problems.

Content

Unit

1. **Revision**: Vector spaces-subspaces, bases and dimensions. Matrix Theory - Rank & Inverse of a Matrix. Basic Concepts-Eigen Value & Eigen Vector of a Square Matrix, Characteristic equation of square matrix, Cayley-Hamilton Theorem, Relation between matrix and Eigen Values.
2. **Linear transformations:** Introduction to linear transformation, Matrix associated with a Linear Map, Linear Map associated with a Matrix., Geometric idea of linear transformation, some special linear transformations
3. **Introduction** of L(U, V) and Isomorphism between L(U,V) and M_{mxn}, Dimension Theorems for M_{mxn} and L(U,V). Rank – Nullity of linear transformation and matrices, the Rank-Nullity Theorem.
4. **Canonical and Quadratic Forms of a Matrix:** Basic Concepts- Minimum Polynomial of a Matrix, Block Matrix& Properties. Nilpotent Canonical Form (NCF), Jordan Canonical Form (JCF) & Rational Canonical Form (RCF) of a Matrix. Bilinear Form, Quadratic Form and its Properties. Conic Section - Reduction of conic equation into standard forms.

DSC060MAT Practical	Semester-2 **Practical: Combinatorics, Graph Theory and Advanced Linear Algebra**	Compulsory Credit: 04 Marks:100

Course Outcomes

- Understand various techniques of Combinatorics Graph Theory& Advanced Linear Algebra
- Acquire skill of various counting Methods and calculating various graph parameters
- Solve various problems on Combinatorics Graph Theory& Advanced Linear Algebra
- Apply knowledge of Combinatorics Graph Theory& Advanced Linear Algebra to solve various problems.

Content

Unit 1:

1. Applications of Permutations, combinations & pigeonhole principle.
2. Problems on Generating Functions.
3. Testing Various Properties of different graph structure.
4. Verifying the various theorems on graphs and diagraphs.
5. Find various graph parameters and graph operations.
6. Algorithms: Fusion, Flurry ,Prim, Krusal, Breadth First Search, back Tracking. Dijikstra's shortest path algorithm for Weighted graph

Unit 2:

1. Examples on vector space, subspace and span of a set.
2. Examples based on the application of eigen values and eigen vectors
3. Applications of Cayley-Hamilton theorem
4. Examples on Matrix canonical forms.
5. Examples based on application of rank-nullity theorem
6. Problem solving on matrices and linear transformations.
7. Examples on quadratic forms

VAC030MAT Theory	Semester-2 **Mathematical Aptitude**	Compulsory Credit: 02 Marks:50

Course Outcomes

- Understand various techniques of combinatorics
- Acquire skill of various counting Methods and calculating various graph parameters
- Solve various problems on Combinatorics and Graph Theory.
- Apply knowledge of Combinatorics and Graph Theory to solve various problems.

Content

Unit 1: Mental ability skills

- Analogy, classification, coding-decoding, distance & direction problems, blood relations, puzzles
- alphabet problems, age problems.
- Number, ranking, time sequence, mathematical operations, inserting or missing character, arithmetical reasoning.
- Data interpretation, decision making , situation reaction problems, assentation and reason problems , cause and effect problems.

Unit 2: Reasoning Skills

- Logical reasoning: statement- arguments, statement- assumption, statement-conclusion
- theme detection, Question- statement.
- Nonverbal reasoning: Series, analytical reasoning, mirror images, water images, figure matrix, paper folding, paper cutting, Embedded figures , dot situation.
- Verbal reasoning : series completion, logical sequence of words, pattern finding, verification of truth, character puzzle, data sufficiency, seating arrangement.

DSM020MAT Theory	Semester-2 MOOC/IPR/Prototype/POC/Training (2)	Compulsory Credit: 04 Marks:100

Students will opt any one course option out of MOOC/ Proof of Concept (POC)/ Intellectual Property Rights (IPR)/Prototype/Training

Course Outcomes: Promotion of innovation, research, and skill development among postgraduate (PG) students by participating in MOOCs, developing Proofs of Concept (PoC), managing Intellectual Property Rights (IPR), Training and translation of innovative ideas into tangible/intangible solutions of the societal needs after the completion of the course.

MOOCs (Massive Open Online Courses)

- Course must align with the program objectives from various national and international platforms offering MOOCs.
- Credits from MOOCs can be transferred to the students' academic record as per relevant UGC and IITE regulations.
- Students must submit completion certificates and attendance record, assignment submission record and Quiz conducted by the course coordinator for evaluation.

Proof of Concept (PoC)

- A PoC is a demonstration (in the form of presentation) to validate the feasibility of an idea or concept. Students must submit a proposal outlining objectives, methodology, timeline, financial breakups and expected outcomes.
- Proposed PoCs must be presented to the examiners, followed by submission of a report and presentation for assessment.

Intellectual Property Rights (IPR)

- Any idea, design or any novel IP can be created by the student.
- IP generated by students as part of academic work is co-owned by the student and IITE unless otherwise agreed upon.
- Students must ensure their work does not violate existing IP laws.
- Prepared IP document must be presented to the examiners, followed by submission of a report and presentation for assessment.

Prototype

- Students will have access to institutional labs or they can utilize external laboratory and incubation center as guided by the mentor.
- Students may apply for prototype development grants through the institution or external agencies.
- A demonstration and/or presentation with detailed report will be evaluated.

Training

- The students will select the training programs of their choice as guided by the mentors.
- It should include active participation in real-world tasks and projects of domain-specific skills

- The training should help students to work with professionals and peers in the field and building connections for professional growth etc.

- All activities under MOOCs, POC, IPR, Prototype and Training must adhere to ethical guidelines, including proper attribution, plagiarism avoidance, and compliance with IITE, UGC, Govt. of Gujarat and/or any other relevant guidelines.

Education

VAC020EDU | Semester-2 | Compulsory

Practical

Internship: Visiting Institutes of Education

Credit: 02

Marks:50

Course Outcomes:

Prospective teacher educator...

- develops skills of doing research on psychological attribute, social research and status surveys.
- develops skills of guiding and supervising microteaching lessons/ simulation lessons/practice teaching lessons of B.Ed. trainees.
- develops an understanding of role, functions and process various agencies related with teacher education.
- develops and understanding of the role of technology in content development and research.
- develops an understanding of social roles of teachers as volunteers.
- develops skills of effectively presenting the work done.

Activities:

- Implementation of a Psychological Test/Status Survey/Social Research
- Guidance, checking and supervision of Microteaching Lessons/ Simulation lessons/ practice teaching lessons of student teachers
- Visit to an agency of curriculum development/text book bureau/DIET/ GCERT/ Teacher Education Institution
- Visit to Secondary Teacher Training Institute, GCERT /INFLIBNET/ GIET / an institute of special education/NGO and contribute as a teacher/volunteer
- Presentation of submissions

Internal Assessment: (Suggested)

- Report of a Psychological Test/Status Survey/Social Research
- Report of checking and supervision of Microteaching Lessons/ Simulation lessons/ practice teaching lessons of student teachers
- Report of visit to an agency of curriculum development/text book bureau/DIET/ GCERT/ Teacher Education Institution
- Report of visit to Secondary Teacher Training Institute, GCERT /INFLIBNET/ GIET / an institute of special education/NGO and contribute as a teacher/volunteer
- Presentation of submissions

Sr.No.	Evaluation Pattern	Marks
1	Submission	20
2	Observation of Supervisor	20
3	Viva	10
Total Marks		**50**

DSC040EDU | Semester-2 | Compulsory

Theory

Fundamentals of Research in Education

Credit: 04

Marks:100

Course Outcomes:

Prospective teacher educator...

- Understands the basics of educational research.
- Develops the skill of reviewing related literature and previous research.
- Comprehends the meaning of variables, objectives and hypotheses of research.
- Develop understanding of population, sample and sampling technique.

Unit 1: Basics of Educational Research

1.1 Research: Definitions, Meaning and Characteristics

1.2 Types of Research:
-Fundamental Research, Applied Research, Action Research;
- Quantitative Research, Qualitative Research

1.3 Educational Research: Definitions, Meaning and Characteristics

1.4 Areas of Educational Research, Steps of Educational Research Process

Unit 2: Review of Related Literature

2.1 Review of Related Literature: Meaning and Need
Sources: Primary, Secondary and Tertiary

2.2 Types of Review: Traditional or Narrative, Systematic, Meta-analysis, Meta-synthesis

2.3 Conceptual and Theoretical Framework; Operationalisation of terms used

2.4 Criteria for Selecting Research Problem

Unit 3: Objectives , Variables, and Hypotheses of Research

3.1 Research Problem and Research Questions: Characteristics, Points to be kept in mind

3.2 Objectives of Research: Points to be kept in mind and Importance

3.3 Variable: Meaning and Types- Independent, Dependent, Moderator, Controlled and Intervening & Confounding Variable

3.4 Hypothesis: Concept and Characteristics,
Types: Declarative, Directional, Non-directional, Question Form, Null and Research Hypothesis

Unit 4: Population, Sample and Sampling Technique

4.1 Universe and Population: Concept and Characteristics

4.2 Sampling: Meaning, Need and Characteristics

4.3 Types of Sampling
Probability: Random, Stratified, Systematic and Cluster
Non-Probability: Incidental, Purposive, Convenient, Quota and snowball,
Multiphase, Multistage, Double and Match Pair Sampling

4.4 Sample: Concept, Characteristics and Importance
Choice of Sampling Method and determination of sample size

Mode of Transaction: Lecture cum Discussion, Field trip, Assignment, Project

Suggested Activities:

- Classroom discussions on various topics related to research in education
- Panel discussion/debate/seminar presentation on various topics related to research in education

DSC050EDU Theory	Semester-2 **Educational Sociology**	Compulsory Credit: 04 Marks:100

Course Outcomes:

Prospective teacher educator...

- understand concept of sociology and education.
- appreciate the socio-cultural context of education.
- understand the relation between society and education.
- understand the sociological issues and their remedies.

Unit 1 Sociology and Education

1.1 Concept, nature and definition of Sociology;
1.2 Relationship between Education & Sociology
1.3 Branches of Sociology: Sociology of knowledge, Rural Sociology, Sociology of Mass media
1.4 Concept, Nature and Scope of sociology of Education

Unit 2 Socio-cultural Context of Education

2.1 Culture: Meaning, Nature, Cultural change and Cultural Lag - Relation between education and culture
2.2 Nature of Indian Society: social and cultural changes in India
2.3 Social Change: Meaning, Nature, Pattern and Factors; Interrelationship between Education and Social Change
2.4 Modernization and Post-modernization as social movements and their educational implications

Unit 3 Society and Education

3.1 Concept of socialization, Education as a socialization process
3.2 Social Stratification: Concept, meaning & factors affected Social Stratification.
3.3 Social Mobility: Concept, Meaning, types and factors affecting
3.4 Future of Social Institutions in India: Challenges to Education

Unit 4 Sociological Issues and Remedies

4.1 Equality and Equity
4.2 Gender issues, disadvantaged section of Indian society (SC, ST and OBC)
4.3 Unemployment & Poverty
4.4 LPG, Urbanization Vs Ruralization

Mode of Transaction: Lecture cum Discussion, Field trip, Assignment, Project

Suggested Activities:

- Classroom discussions on various topics related to Educational Sociological
- Panel discussion/debate/seminar presentation on various topics related to Educational Sociological

Character Building and Holistic Development of Personality

IKS010CHP Theory	Semester-1 **Character Building and Holistic Development of Personality - I**	Compulsory Credit: 02 Marks:50

Unit-1 Cognitive Development

- Panchakosha - General Introduction, Concept and its Importance (Indian concept of Panchakosha) Basic study of PanchaKosha described in Upanishads. Annamaya Kosha Importance and significance of food in the process of construction, development and enrichment of the Annamaya Kosha.
- External Personality Annamaya Kosha. Importance and significance.
- Development of Annamaya Kosha and the creation of a healthy, strong, vigorous, tolerant, elastic and elegant body.
- Dimensions Physical Education, Sports, Health Education, Healthy food, Sanitation and Cleanliness, Physical Labour and Environmental Protection.

Unit-2 Moral-Spiritual Development

- Contribution of great Indian Personalities in the process of Character-Building and Personality Development (especially in the context of Human, Society and Nation building).
- Mahatma Buddha, Maharishi Valmiki, Sant Ravidass, Guru Jambheshwar and Guru Nanak Dev.

Unit-3 Physical Development

- General Introduction: Exercises and Surya Namaskar.
- Asana - Introduction and types, (Asanas in standing position)-Tadaasana,Vrikshaasana, Chakraasana and Trikonaasana.
- Pranayama-Introduction: Deep-breathing, Anuloma-Viloma and Kapal-Bhati.
- Hasta Mudra-Introduction: Gyana Mudra and Vaayu Mudra.

Unit-4 Intellectual - Emotional Development

- Self-Reliance, Nishkama Karma Yoga, Etiquettes, Responsibility towards Society, Ideal Teacher, Moral Values, Time Management and the Goal of My Life.

Practical (Internal Work: Any three from five)

Sr.No.	Task for the Students (For each Semester)	Marks
1	Tree Plantation (2 Plants – each student)	10
2	To teach needy students (one hour a week)	10
3.a	To make aware five needy families about government schemes for their welfare	05
3.b	Demonstration of Yoga – Abhyasa	05
4	Practical File (Based on the above-listed Social Works done)	10
5	Presentation based on social works done during Semester	10
Total Marks		**Max: 30**

Note: It is mandatory to opt all the components and not to opt any more than 3 times

IKS020CHP Theory	Semester-2 **Character Building and Holistic Development of Personality - II**	Compulsory Credit: 02 Marks:50

Unit-1 Cognitive Development

- Pranamaya Kosha General Introduction, Concept and its Requirement. Prana's four impulses- Aahaar, Nidra, Bhay (Fear) and Maithun. The development of Prana-Shakti and its relation to body and mind, Efforts for the development of Pranas, Imbalance in Pranas and its side effects.
- Manomaya Kosha General Introduction, Concept and its Requirement. Manomaya Kosha as the operator of the body; Peace, concentration, detachment, positivity, and Process of development of Mana, Activities and programmes for development of Mana.

Unit-2 Moral-Spiritual Development

- Contribution of great Indian Personalities in the process of Character-Building and Personality Development (especially in the context of Human, Society and Nation building).
- Veer Shivaji, Guru Gobind Singh, Swami Dayananda Saraswati, Savitri Bai Phule and Ravindra Nath Tagore.

Unit-3 Physical Development

- Asana- (Asanas in sitting position) Singhasana, Padmasana, Vajrasana, Matsyasana, Gomukhasana and Parvatasana.
- Pranayama-Chandra Bhedan, Surya Bhedan and Udgeeth.
- Hasta Mudra - Surya Mudra and Prana Mudra.

Unit-4 Intellectual - Emotional Development

- Scientific Approach, Non-violence, Self-Confidence, Student: The future of the nation, love, Ideal Friend, Student Life and Benevolence, and Spirit of Nationality.

Practical (Internal Work: Any three from five)

Sr.No.	Task for the Students (For each Semester)	Marks
1	Tree Plantation (2 Plants – each student)	10
2	To teach needy students (one hour a week)	10
3.a	To make aware five needy families about government schemes for their welfare	05
3.b	Demonstration of Yoga – Abhyasa	05
4	Practical File (Based on the above-listed Social Works done)	10
5	Presentation based on social works done during Semester	10
	Total Marks	**Max: 30**

Note: It is mandatory to opt all the components and not to opt any more than 3 times.

REFERENCES

SEMESTER- 1

Physics

Classical Mechanics

Online Resources

- https://archive.nptel.ac.in/courses/115/106/115106123/ (Introduction to classical Mechanics, Prof Anurag Tripathi, IIT Hyderabad
- https://archive.nptel.ac.in/courses/115/105/115105098/ (Lagrangian Formulation, Prof Devmalya Bannerjee, IIT Kharagpur)

Suggested Reading: (Available in market and Latest)

- Introduction to Classical Mechanics R. G. Takwale and P. S. Puranik, 1979, Tata Mc Graw- Hill Pub. Co. Ltd., New Delhi.
- Introduction to classical mechanics by Golstein, Poole & Safko (Pearson Education, Asia) 1st edition, 2002.
- Classical Mechanics by J. C. Upadhyaya (Himalaya Publishing House)

Mathematical Physics

Online Resources:

- https://archive.nptel.ac.in/courses/111/106/111106135/ (Linear Vector Space, Prof Pranav Haridas, Kerala School of Mathematics)
- https://archive.nptel.ac.in/courses/111/107/111107111/ (Partial Differential Equations, Prof P.N.Agarwal, Dr P,N, Pandet, Indian Institute of Technology, Roorkee)
- https://nptel.ac.in/courses/111106111 (Fourier Transform, Prof Srinivasa Manam, NPTEL course, IIT Madras)
- https://archive.nptel.ac.in/courses/111/106/111106141/ (Complex Analysis, Dr Pranav Haridas, NPTEL course, Kerala School of Mathematics)

Suggested Reading: (Available in market and Latest)

- Mathematical methods for Physicists, Arfken & Weber (Academic Press)
- Mathematical Methods in Physical Sciences, M. L. Boas (John Wiley & Sons)
- Mathematical Physics - B.S. Rajput & B.D. Gupta (Vikas Publication House)

Laboratory Experiments in Physical Sciences-1

- B.Sc. Practical physics, C.L. Arora, (S.Chand)
- A text book of Practical Physics, Indu Prakash & Ramkrishna, (Kitab Mahal)
- Practical Physics, S.L.Gupta and V. Kumar, (Pragati Prakashan)

Intellectual Property Rights(IPR) in Chemical Sciences

- Intellectual Property Rights: Unleashing the Knowledge Economy, P.B. Ganguli (Tata Mc Graw Hill)
- The Quality Revolution, S. Smith, (Jaico Publishing House)
- Fundamentals of IPR for Engineers, K. Bansal & P. Bansal (BS Publications)
- Intellectual Property Rights, P. Ganguli (TMH)
- Intellectual Property Rights, R. Radha Krishnan & S. Balasubramanian, (Excel Books)
- Intellectual Property Rights, M. Ashok Kumar & Mohd. Iqbal Ali (Serial Publications)
- Managing Intellectual Property, V. V. Scople (Prentice Hall of India Pvt Ltd)
- Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets. D. E. Bouchoux (Cengage Learning)

Computational Physics

- Computer Programming in Fortran 90 and 95 – V. Rajaraman Prentice-Hall India, 1997
- Computer programming in C – V. Rajaraman Prentice-Hall of India, 1998
- Object oriented programming with C++- E. Balaguruswamy Tata McGraw-Hill Pub. Co., New Delhi, 1999
- Numerical methods – E-Balaguruswamy Tata McGraw Hill Pub. Co., New Delhi, 1999

On-line resources to be used if available as reference material

- https://onlinecourses.nptel.ac.in/noc22_cs40/preview
- https://archive.nptel.ac.in/courses/106/105/106105171/
- https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/lecture-notes/

Botany

Plant Taxonomy

- Raghavan, V.1999. Developmental Biology of Flowering plants. Springer - Verlag, New York.
- Singh, G. 1999. Plant Systematics - Theory and Practice. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- Stebbins, G.L. 1974. Flowering Plant - Evolution above Species Level. Edward Arnold Ltd. London.
- Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
- Naik, V.N. 1984. Taxonomy of Angiosperms. Tata McGraw - Hill Publishing Co. Ltd. New Delhi.
- Datta, S. C. 1988. Systematic Botany. Wiley Eastern Limited, New Delhi.
- Singh, G. 2012. Plant Systematics – Theory and Practice. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Bhojwani, S. S. & Bhatnagar, S.P. : Embryology of Angiosperms. Vikash Publishing House, New Delhi.
- Lawrence, G. H. M. 1964. Taxonomy of Vascular Plants. Oxford & IBH Publishers, Calcutta.
- Naik, V. N. 1984. Taxonomy of Angiosperms. Tata McGraw-Hill Publishing Company Limited, New Delhi.
- Davis, P. H. & Heywood, V. H. 1963. Principles of Angiosperm Taxonomy. Princeton, NJ: Van Nostrand.
- Radford, A. E. 1986. Fundamentals of Plant Systematics. Harper & Row, London.
- Judd, W. S.,Campbell, C. S., Kellogg, E. A., Stevens, P. F., Donoghue, M. J. 2008. Plant Systematics – A Phylogenetic Approach. Sinauer Associates, Inc., Sunderland, Massachusetts USA.
- Stuessy, T. F. 2008. Plant Taxonomy – The Systematic Evaluation of Comparative Data. Columbia University press, New York.
- Hooker, J.D. 1872 – 1897. The Flora of British India. Vols. 1 – 7. L. Reeve & Co., Ltd. Ashford, Kent.
- Stace, C. A. 1989. Plant Taxonomy and Biosystematics. Arnold Publishers, UNITed Kingdom.
- Johnes, S. B. & Luchsinger, A. E. 1987. Plant Systematics. McGraw-Hill. London. 18. Jain, S.K. & Rao,
- R.R. 1977. A Handbook of Field and Herbarium Methods. Today &Tomorrow's Printers and Publishers, New Delhi.
- Sivarajan, V. V. 1991. Introduction to the Principles of Plant Taxonomy. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Cell Biology

- Cell and Molecular Biology De Robertis, E.D.P. and De Robertis E M F
- Cell and Molecular Biology Garald Karp J. Wiley & Sons, NY 2008
- Cell Biology – Structure and FunctionDavid E. Sadawa, Jones and Barttett Pub.,IND. 1993
- Cell Biology LabFaxG.B.Dealtry& D. Rickwood Bios Scientific Pub. 1992
- Cell Biology, Genetics, Molecular Biology, Evolution and Ecology P.S. Verma, V.K. Agarwal S. Chand Pub., NDelhi 2004
- Cell Growth and Division, A Practical Approach. R. Basega, IRL Press, Oxford Univ. Latest
- Cell in Development and inheritance EB Wilson MacMilan, NY Latest Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th Edition. ASM Press &Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
- Nelson D. L. and Cox M.M. (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company
- Voet, D. and Voet J.G. (2004) Biochemistry 3rd edition, John Wiley and Son
- Sharma, V. K. (1991) Techniques in microscopy and cell biology. Tata McGraw Hill
- Reimer, L. and Kohl, H. (2008) Transmission electron microscopy. Springer.
- Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6thedition, Cold Spring Harbour Laboratory Press, Pearson Publication.

Intellectual Property Rights in Life Science

- P.B. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy. Tata Mc Graw Hill, 2001.
- Steve Smith, The Quality Revolution.1st ed., Jaico Publishing House, 2002.
- Kompal Bansal and Praishit Bansal. Fundamentals of IPR for Engineers, 1st Edition, BS Publications, 2012.
- Prabhuddha Ganguli. Intellectual Property Rights. 1st Edition, TMH, 2012.
- R Radha Krishnan & S Balasubramanian. Intellectual Property Rights. 1st Edition, Excel Books, 2012.
- M Ashok Kumar & Mohd. Iqbal Ali. Intellectual Property Rights. 2nd Edition, Serial Publications, 2011.
- Vinod V. Scople, Managing Intellectual Property. Prentice Hall of India Pvt Ltd, 2012.
- Deborah E. Bouchoux. Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets. Cengage Learning, 3rd ed. Edition, 2012.

Laboratory Experiments in Plant Science-1

- A textbook of Practical Botany, Bendre and Kumar, Rastogi Publications
- Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
- Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
- Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
- Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
- Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
- Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
- Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
- Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
- Konika Sharma, Manual of Microbiology – Tools and Techniques , Ane books, Delhi
- International student edition: Microbiology- A laboratory Manual 4th edition. By James G. Chappuccino & Natalie Sherman
- Bacteriological Techniques By F.J. Baker
- Introduction to Microbial Techniques By Gunasekaran.

Chemistry

Organic Chemistry

- Advanced organic Chemistry: Reactions, Mechanisms and Structure by Jerry March, 4th edition, Wiley publication India Pvt. ltd.
- A Guidebook to Mechanism in Organic Chemistry by Peter Sykes,6th Edition, Pearson Education
- Organic chemistry by Stanley pine, 5th edition, McGraw Hill publication
- Organic chemistry by I L Finar, Vol.I, 6th edition, Pearson Education
- Organic Chemistry 2nd edition by Clayden, Greeves Warren & Wothers–Oxford University Press
- Principles of Organic Synthesis: R.O.C Norman & J.M. Coxon (ELBS)
- Modern Methods of Organic Synthesis: W. Carruthers (Cambridge)
- Organic Reaction Mechanism: V.K.Ahluwalia and R.K.Parashar (Narosa)
- Organic synthesis by Jagdamba singh & L.D.S. Yadav, 6th edition, Pragati Prakashan

Physical Chemistry

- Peter, A. Julio D. P. (2009). Physical Chemistry (9th Ed.). England: Oxford Press.
- Silbey, R. J. Alberty, R. A. Bawendi, M. G. (2004). Physical Chemistry (4th Ed.). New York: Wiley
- Rajaram, J. Kuriacose, J. C. (2013). Thermodynamics (3rd Ed.). New Delhi: Shoban Lal and Co.
- Engel, T. Reid, P. (2007). Thermodynamics, Statistical Thermodynamics and Kinetics. New Delhi: Pearson Education.
- McQuarrie, D. A. Simon J. D. (2004). Molecular Thermodynamics. New Delhi: Viva Books Pvt. Ltd.
- Glasstone, S. (2008). Thermodynamics for Chemist. Madras: EWP.
- Laidler, K. J. (1987). Chemical Kinetics (3rd Ed.). New Delhi: Pearson Education.
- Gurdeep, R. (2017). Advanced Physical Chemistry (41st Ed.). Goel Publishing House Krishna's Educational Publishers, Meerut.
- Soni, P. L. Dharmarha, O. P. Dash, U.N. (2010). Textbook of Physical Chemistry (23rd Ed.). New Delhi: Sultan Chand and Sons.
- Bockris, J. O. M. Reddy, A. K. N. Maria G. A. (2006). Modern Electrochemistry, (2nd Ed.). New Delhi: Springer.
- Moore, W. J. (2010). Physical Chemistry (5th Ed.). New Delhi: Orient Longmann Private Ltd.
- Gurtu, J. N. Gurtu, A. (2010). Advanced Physical Chemistry (11th Ed.). New Delhi: Pragati Prakashan.
- Glasstone, S. Van, D. (1946). Textbook of Physical Chemistry. New Delhi: Nostrand Company.
- Gupta, M. C. (1991). Statistical Thermodynamics (2nd Ed.). New Delhi: New Age International Publishers.
- Barrow, G. M. (2019). Physical Chemistry (6th Ed.). New Delhi: Tata McGraw Hill Publishing Co. Ltd.
- Rakshit, P. C. (2001). Physical Chemistry (6th Ed.). Kolkota: Sarat Book Distributors.
- Castellan, G. (1995). Physical Chemistry (3th Ed.). New Delhi: Narosa Publishing House.
- Puri, B. R. Sharma, L. R. Pathania, M. S. (2008). Principles of Physical Chemistry. New Delhi: Vishal Publishing Company.
- Levine, I. (2002). Physical Chemistry (5th Ed.). New Delhi: Tata McGraw Hill Publishing Co. Ltd.

Laboratory Experiments in Chemistry-1

- Comprehensive Practical Organic Chemistry: Qualitative Analysis by V K Ahluwalia & S. Dhingra.
- An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.
- Vogel's Textbook of practical organic chemistry by Fumiss Brain S.
- Elementary practical organic chemistry Part-1 (small scale preparation) by A.I. Vogel.
- Elementary practical organic chemistryPart-2 (Qualitative organic chemistry) by A.I. Vogel.
- Advanced Practical Physical Chemistry by J. B. Yadav, 30th Edition, Goel Publishing House, Krishna's Educational Publishers, Meerut.
- Experimental Physical Chemistry by V. D. Athawale and Parul Mathur, New Age
- International Publishers, New Delhi.
- Experiments in Physical Chemistry by P.H. Parsania, F. Karia
- Experimental Physical Chemistry by R.C. Das & B. Behera, Tata McGraw hill Publishing Company Ltd., New Delhi.
- Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition

Intellectual Property Rights(IPR) in chemical sciences

- P.B. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw Hill, 2001.
- Steve Smith, The Quality Revolution.1st ed., Jaico Publishing House, 2002.
- Kompal Bansal and Praishit Bansal. Fundamentals of IPR for Engineers, 1st Edition, BS Publications, 2012.
- Prabhuddha Ganguli. Intellectual Property Rights. 1st Edition, TMH, 2012.
- R Radha Krishnan & S Balasubramanian. Intellectual Property Rights. 1st Edition, Excel Books, 2012.
- M Ashok Kumar & Mohd. Iqbal Ali. Intellectual Property Rights. 2nd Edition, Serial Publications, 2011.
- Vinod V. Scople, Managing Intellectual Property. Prentice Hall of India Pvt. Ltd, 2012. Deborah E. Bouchoux. Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets. Cengage Learning, 3rd ed. Edition, 2012.
- Intellectual Property, A Primer for Academia by Prof. Rupinder Tewari & Ms. Mamta Bhardwaj Publication Bureau, Panjab University, Chandigarh.

Industrial Chemistry

- Unit operations of chemical engineering, W. McCabe Smith, Mc Graw Hill Co., 7th edition
- Chemical process principal Vol. I & II, Horghen Watson, Asian Pub. House, 2nd edition
- Unit process in organic systems, Groggins, Tate, McGraw Hill Co. 5 edition
- Encyclopaedia of industrial chemical analysis, Foster Dee Snell, Leslie Interscience publication, Wiley & Sons N.Y., 1973, Vol-1 to 20
- Ullmann's Encyclopedia of industrial chemistry, Vol: 1 to 39, Wiley-VCH, Weinhein 2003
- Basics of Industrial Chemistry, by Rajarshi Patel, Lambert Publications ,2016-11

Mathematics

Advanced Complex Analysis

- Churchill, R.V., Brown, J. and Verle R., Complex Variables and Applications, McGraw-Hill Publ. Co., Eighth edition, 2009.
- L. V. Ahlfors , Complex Analysis, International Student Edition, Mc Graw–Hill Book Company,1979.
- Karunakaran, Complex Analysis-Second Edition, Narosa Publishing House, 2006.
- S. Lang, Complex Analysis, Addison-Wesley, 1977.
- S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1977.

Advanced Group Theory

- J. A. Gallian, Contemporary Abstract Algebra-Fourth Edition, Narosa Publishing House, New Delhi, 1999.
- P. B. Bhattacharya, S. K. Jain and S. R. Nagpal, Basic Abstract Algebra-Second Edition, Cambridge University Press, 1995.
- M. Artin, Algebra, Prentice-Hall of India Private Ltd., New Delhi, 1994.
- P.M. Cohn, Algebra Volume 1, John Wiley Pub., New York, 1974.
- I. H. Sheth, Abstract Algebra, PHI pvt. Ltd.
- I. N. Herstein, Topics in Algebra-Second Edition, Wiley Pub., New York, 1975.
- T. W. Hungerford, Algebra, Springer-Verlag, First Indian Reprint, 2004.
- S. Mac Lane and G. Birkhoff, Algebra-2nd Edition, AMS Chelsea Pub., AMS.
- N. Jacbson, Basic Algebra, Hind, Pub. Corp, 1984

Practical: Advanced Complex Analysis & Advanced Group Theory

- Churchill, R.V., Brown, J. and Verle R., Complex Variables and Applications, McGraw- Hill Publ. Co., Eighth edition, 2009.
- L. V. Ahlfors , Complex Analysis, International Student Edition, Mc Graw–Hill Book Company,1979.
- Karunakaran, Complex Analysis-Second Edition, Narosa Publishing House, 2006.
- S. Lang, Complex Analysis, Addison-Wesley, 1977.
- S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1977.
- J. A. Gallian, Contemporary Abstract Algebra-Fourth Edition, Narosa Publishing House, New Delhi, 1999.
- P. B. Bhattacharya, S. K. Jain and S. R. Nagpal, Basic Abstract Algebra-Second Edition, Cambridge University Press, 1995.
- M. Artin, Algebra, Prentice-Hall of India Private Ltd., New Delhi, 1994.
- P.M. Cohn, Algebra Volume 1, John Wiley Pub., New York, 1974.
- I. N. Herstein, Topics in Algebra-Second Edition, Wiley Pub., New York, 1975.
- T. W. Hungerford, Algebra, Springer-Verlag, First Indian Reprint, 2004.
- S. Mac Lane and G. Birkhoff, Algebra-2nd Edition, AMS Chelsea Pub., AMS.
- N. Jacbson, Basic Algebra, Hind, Pub. Corp, 1984.

Proofs in Mathematics

- Proof in Mathematics : An Introduction , Jemes Frankilin ,Albert Daoud Quaker Hill Press.
- Journey into Mathematics :An introduction to proofs , Joseph J Rotman, Dover pub.

LaTex Programming

- LaTeX: A Document Preparation System, Leslie Lamport, Addison-Wesley, 1994.
- Guide to LaTeX, Helmut Kopka & Patrick W. Daly, Addison-Wesley, 2003.
- The LaTeX Companion, Frank Mittelbach, Michel Goossens, Johannes Braams, David Carlisle, & Chris Rowley, Addison-Wesley, 2004.
- More Math Into LaTeX, George Grätzer, Springer, 2007.

Education

Educational Psychology

- Ahlawat, Neeta (2010). Development of Psychology. Jaipur: RBSA Publishers.
- Chauhan, S. S. (1978) Advanced Educational Psychology. New Delhi: Vikas Publishing
- Hergenhahn, B. R. and Matthew H. Olson (2008) An Introduction to Theories of Learning. New Delhi: Prantice Hall of India
- Coon, Rennis and Mittere J. O. (2007) Introduction to Psychology. UK: Thomas press.
- Mistry Milan T., (2015) Psychology in Education, LAP LAMBERT Academic Publishing GmbH & Co., Saarbrucken, Germany.
- Mangal, S. K. (2015) Educational Psychology. New Delhi: PHI Learning Private Ltd.
- Mathur, S. S. (2012) Education Psychology. Agra: Agrawal Publications.
- Shrivastav, S. S. (ed.) (2007) Bhartiya Shiksha Manovignan (In Hindi). Lakhnow: Bhartiya ShikshaShodh Sansthan
- Shukla, S. S., (2014). Educational Psychology (Gujarati) (2nd Edition). Agra: Agrawal Publications

Educational Philosophy

- Bailey, R. & et. al. (2010). Philosophy of Education. U.S.A.: Sage Publication Ltd.
- Bhatia, K. K. & Narang, Philosophical and Sociological Basis of Education. Ludhiana: PrakashBrothers.
- Biswas, A. & Agarval, J. C., Seven Indian Education. New Delhi: Asian Prakashan Grugh.
- Bokil, V.P. (1903). Foundations of Education. Poona: Pub, By the author Sadashivpeth Poona.
- Chand, T. (2007). Development of Educational System in India. New Delhi: Anmol Publication PVTLTD.
- Chaube, S. P. &Chaube, A. Philosophical and Sociological Education. Agra-2: Vinod Pustak Mandir
- Chisholm, R.M. (1994). Theory of Knowledge. New Delhi: Prentice Hall.
- Dewey, J. (1963). Democracy and Education. New York : Mac Millan and Co.
- Dwivedi, K. (2014). Education Thoughts and Thinkers. New Delhi: Shree Publishers and Distributors.
- Kabir, H. (1961). Indian Philosophy of Education. Bombay : Asia Publishing House.
- Krishnamurti, B.H. (1998). Language, Education and Society. New Delhi: Sage Publications.
- Kumar, A. (2015). Philosophical Perspective of Education. New Delhi: A.P.H. Publishing Corporation. Macmillan Company.
- Ozmon, H. A. (2012). Philosophical Foundations of Education. New Jersey: Pearson Publication.
- Pathak, R.P. (2007). Philosophical and Sociological Perspective of Education. New Delhi: Atlantic Publishers and Distributors (P) LTD.
- Sharma, R.A. Metaphysics, Epistemology Axiology and Education. Meerut: Rolall and Co.
- Radhakrishnan, S. (1953). History of Philosophy: Eastern and Western Vol. I and II. London: George Allen and Unwin Limited.
- Bhatt , S. R.. Knowledge, Value and Education (An Axionoetic Analysis) GianPubli.:House – 110009.
- Sharma, R.N. (2000). Textbook of Educational Philosophy. New Delhi : Kanishka Publishers.
- Siddiqui, M.H. (2014). Philosophical and . New Delhi: A.P.H. Publishing Corporation.
- Singh, R.P. (1993). Indian Education: In-depth studies. New Delhi: Commonwealth Publishers.
- Singh, Y.K. & Nath, R. (2014). History of Indian Education System. New Delhi: A.P.H. Publishing Corporation.
- Taneja V. R. and Taneja S. (1980). Educational Thinkers, New Delhi : Atlantic Publishers.
- Vallikkat, S. (2015). Philosophy of education. New Delhi: A.P.H. Publishing Corporation.

SEMESTER- 2

Physics

Quantum Mechanics

Online Resources

- https://nptel.ac.in/courses/115106066 (Introduction to Quantum Mechanics, Prof S Lakshmi Baria, IIT Madras)
- https://archive.nptel.ac.in/courses/115/101/115101107/ (Quantum Mechanics, Prof P Ramadevi, IIT Bombay)
- https://archive.nptel.ac.in/courses/115/103/115103104/ (Advanced Quantum Mechanics, Prof Saurav Basu, IIT Guwahati)

Suggested Reading: (Available in market and Latest)

- A text book of Quantum Mechanics, by Mathews &Venkatesan, TMH Publication (2010).
- Quantum mechanics G. Aruldhas; Prentice-Hall of India Pvt. Ltd. 2002.
- Quantum mechanics by Ghatak& Loknathan.
- Quantum Mechanics Concepts and Applications by Nouredine Zettili.
- Introduction to Quantum Mechanics by Griffiths.

Solid State Physics

Online Resources:

- https://archive.nptel.ac.in/courses/115/108/115108127/ (Band Theory of Solids, Prof S ramesha, IISc Bangalore)
- https://archive.nptel.ac.in/courses/115/103/115103108/ (Superconductivity, Prof S basu, IIT Guwahati)
- https://www.youtube.com/watch?v=djYvlGgBwQI (Band Theory of solids, Prof H. C. Verma)
- https://youtu.be/5EiZjZjG-IY (Crystal Structure, Prof Annabutta, NPTEL course, IIT Madras)
- https://www.youtube.com/watch?v=DDLljK1ODeg (Prof. G. Rangarajan, NPTEL course, IIT Madras)

Suggested Reading: (Available in market and Latest)

- Introduction to Solid State Physics, C. Kittel (Wiley Eastern)
- Elementary Solid-State Physics, M. Ali Omar (Addison Wesley)
- Elements of Solid-State Physics, J. P. Srivastava (Prentice Hall India)
- Solid State Physics, M.A. Wahab (Nerosa Publishers)

Laboratory Experiments in Physical Sciences-2

- B.Sc. Practical physics, C.L. Arora (S.Chand)
- A text book of Practical Physics, Indu Prakash & Ramkrishna (Kitab Mahal)
- Practical Physics, S.L.Gupta and V. Kumar (Pragati Prakashan)
- An advanced course in Practical Physics, D. Chattopadhyay & P. C. Rakshit (New central Book Agency

Remote Sensing and Applications

- Introduction to Ionosphere and Magnetosphere: J.A. Ratcliff (CUP)
- The Solar-Terrestrial Environment: JK. Hargreaves (CUP)
- Introduction Space Physics: M.J. Kievelson (CUP)
- Chemistry Sensing and Image Interpretation: T.M. Lillesand and R.L. Kiefer, (John Wiley & Sons).

Botany

Anatomy of Higher Plants

- Comparative Plant Anatomy- Carlquist, S. (1961).
- Cutter, E.G. Plant Anatomy Part-1, Cells and Tissues, Edwardarnold, London. (1969).
- Cutter, E.G. Plant Anatomy: Experiments and Interpretation. Part II, Edwardarnold, London. (1971).
- Fahn, A. Plant Anatomy, Second Edition, Pergamon Press, Oxford. (1974).
- B. P. Pandey, Plant Anatomy, S. Chand and Co. Ltd., New Delhi. (1977).
- An Introduction to Plant Anatomy- Eames, A.J. and Macdaniels, L.H. (1947).
- Anatomy of Seed Plants- Esau, K. (1977).
- Physiological Plant Anatomy- Haberlandt, G. (1914).
- An Introduction to Plant Structure and Development- Charles, B. Beck (2010).
- Integrative Plant Anatomy- Dickison, W.C. (2000).
- Plant Anatomy- Mauseth, J.D. (1988).
- Plant Anatomy, Pijush Roy, New Central Book Agancy P Ltd. (2012).

Biochemistry & Enzymology

- Biochemistry & Molecular Biology of Plants, Second edition, print or electronic version, 2015, Wiley Blackwell
- A general biochemistry textbook - Check online booksellers for inexpensive older versions.
- Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
- Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Living-stone
- Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman and Company
- Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Biochemistry by Satyanarayan
- *Lehninger principles of biochemistry* (8th ed.). W.H. Freeman.

Analytical Techniques

- Instrumental methods of analysis H.H.Wilard,L.L.Merritt, J A Dean.
- Instrumental Methods of Chemical analysis.
- Analytical Chemistry G.D. Chritiain. Wiley
- Introduction of instrumental analysis. R.P.Braun
- Essentials of Nuclear Chemistry- H.J.Arnikar
- A text book of quantitative Inorganic analysis A I Vogel.
- Pharmo copie of India Britiesh Pharma copoeia
- Standard methods of Chemical analysis A Series of Volutms Edited F.J.Welcher R.G. Krieger publ-Company
- Principles of Instrumental Analysis Fifth edition Skoog, Holler, Niemay

Laboratory Experiments in Plant Science-2

- A textbook of Practical Botany, Bendre and Kumar, Rastogi Publications
- Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
- Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
- Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
- Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
- Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
- Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
- Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
- Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
- Konika Sharma, Manual of Microbiology – Tools and Techniques , Ane books, Delhi
- International student edition: Microbiology- A laboratory Manual 4th edition. By James G. Chappuccino & Natalie Sherman
- Bacteriological Techniques By F.J. Baker
- Introduction to Microbial Techniques By Gunasekaran.

Chemistry

Organic mechanism and stereochemistry

- Advanced organic Chemistry: Reactions, Mechanisms and Structure by Jerry March, 4th edition, Wiley publication India Pvt. ltd.
- A Guidebook to Mechanism in Organic Chemistry by Peter Sykes,6th Edition, Pearson Education
- Organic chemistry by Stanley pine, 5th edition, McGraw Hill publication
- Organic chemistry by I L Finar, Vol.I, 6th edition, Pearson Education
- Organic Chemistry 2nd edition by Clayden, Greeves Warren & Wothers–Oxford University Press
- Principles of Organic Synthesis: R.O.C Norman & J.M. Coxon (ELBS)
- Modern Methods of Organic Synthesis: W. Carruthers (Cambridge)
- Organic Reaction Mechanism: V.K.Ahluwalia and R.K.Parashar (Narosa)
- Organic synthesis by Jagdamba singh & L.D.S. Yadav, 6th edition, Pragati Prakashan
- Stereochemistry: Conformation and Mechanism by P.S. Kalsi ,Multi colour Edition, New Age international publishers
- Stereochemistry of organic compounds by D Nasipuri,4th edition, New Age international publishers

Inorganic Chemistry

- Cotton, F. A. Wilkinson, G. Murillo, C. A. (1999). Advance Inorganic Chemistry (6th Ed.). New York: Wiley Interscience.
- J D Lee, Fifth Edition Lee, J. D. (1991). Concise Inorganic Chemistry (4th Ed). New York: Wiley Interscience
- Huheey, J. E. Keiter, E. A. Keiter, R. L. (1997). Inorganic Chemistry: Principles of Structure and reactivity (4th Ed.). New Delhi: Pearson Education.
- Huheey, J. E. (1993). Inorganic Chemistry. New Delhi: Pearson Education.
- Cotton, F.A. Wilkinson, G. (1999). Advanced Inorganic Chemistry. New York: Wiley. VCH.
- Madan, R. L. (2010). Inorganic Chemistry. New Delhi: S. Chand and Co.
- Chandra, A. K. (1994). Introductory Quantum Chemistry (4th Ed.). New Delhi: Tata- McGraw Hill.
- Prasad, R. K. (2010). Quantum Chemistry (4th Ed.). New Delhi: New Age International.

Laboratory Experiments in Chemistry-2

- A handbook of quantitative and qualitative analysis – H. T. Clarke
- Comprehensive Practical Organic Chemistry: Qualitative Analysis by V K Ahluwalia & S. Dhingra.
- Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
- An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.
- Quantitative chemical analyses: Organic Reactions, Chromatographic Separation and physicochemical experiments by G. N. Mukherjee Calcutta University Press
- Vogel's Textbook of practical organic chemistry by Fumiss Brain S.
- Elementary practical organic chemistry Part-1 (small scale preparation) by A.I. Vogel.
- Elementary practical organic chemistryPart-2 (Qualitative organic chemistry) by A.I. Vogel.
- Elementary practical organic chemistry Part-3 (Quantitative organic chemistry) by A. I. Vogel
- Vogel's Qualitative Inorganic Analysis, Revised by G Svehla, Sixth Edition, Longman, 1987
- Vogels Textbook of Quantitative Chemical Analysis, 6th Edition, 2002.
- Advanced Practical Inorganic Chemistry, Gurdeep raj, Goel Publishing House, 2001.

Nanochemistry

- Klabunde, K.J. (Ed.), "Nanoscale Materials in Chemistry", John Wiley & Sons Inc. 2001
- Nalwa, H.S. (Ed.), "Encyclopedia of Nanoscience and Nanotechnology" 2004
- Sergeev, G.B. Nanochemistry, Elsevier, B.V. 2010
- Schmid, G. (Ed.), "Nanoparticles", Wiley-VCH Verlag GmbH & Co. KgaA.2004
- Rao, C.N.R., Müller, A. and Cheentham, A.K. (Eds.),"Chemistry of Nanomaterials", Wiley – VCH.2005
- Nano Materials Synthesis and Characterization. V. Rajendran

Mathematics

Combinatorics and Graph Theory

- "Combinatorics and Graph theory" – by **Harris** John, **Hirst** Jeffry L., **Mossinghoff**, 2nd ed.,(2008) Springer
- "Graph Theory"- by Bondy J A, Murthy U.S.,(2008) Springer
- "Discrete Mathematics & its Applications" –by Rosen K.H.6th ed , Tata McGraw Hill
- "Combinatorics –Topics, Techniques &Algorithms"–by Peter J. Cameron-Cambridge University Press, 1994.
- **"**Introductory Combinatorics (4th Edition)**"-** by Richard A. Brualdi, Pearson Education
- "Introduction to graph theory" - by D B West, Prentice Hall
- John Clerk and Derek Allan Holton : A first look at Graph Theory (Allied Publishers Ltd./World Scientific).
- Foo, Kean Pew., Mingyan. (2018). Principles and Techniques in Combinatorics, world scientific
- Mittal, K. V. (2016). Optimization Method in Operational Research System Analysis, New Age inter.pub.

Advanced Linear Algebra

- Linear Algebra a Geometric Approach – S. Kumaresan, PHI.
- Linear Algebra Theory and Applications – Ward Cheney, David Kincaid. Jones and BartletIndia Pvt. Ltd.
- Introduction to Linear Algebra – Serge Lang. Springer (India).
- Matrix and Linear Algebra – K. B. Dutta, Prentice Hall.
- A Textbook of Matrices – Shanti Narayan, P K Mittal, S. Chand Group.
- An Introduction to Linear Algebra – V. Krishnamurthy, Affiliated East-west Press Pvt Ltd. , New Delhi.
- Elementary Linear Algebra Applications Version- Chris Rorres & Howard Anton, WileyIndia Pvt Ltd (2011)
- Linear Algebra and Its Applications- Gilbert Strang, Nelson Engineering
- Linear Algebra, Lenneth Hoffman, Ray Kunze, 2nd edition Prentice Hall of India New Delhi (1971)
- Advanced linear algebra, Steven Roman, 3rd edition, Springer (2008)
- Linear Algebra Problem Book - P. R. Halmos.
- Linear Algebra with Applications - Jeanne, L. Agnew & Robert C. Knapp Brooks / Col publishing Co, California.

Practical: Combinatorics , Graph Theory and Advanced Linear Algebra

- "Combinatorics and Graph theory" – by Harris John, Hirst Jeffry L., Mossinghoff, Michael, 2nd ed.,(2008) Springer.
- "Graph Theory"- by Bondy J A, Murthy U.S.,(2008) Springer
- "Discrete Mathematics & its Applications" –by Rosen K.H.6th ed , Tata McGraw Hill
- "Combinatorics –Topics, Techniques &Algorithms"–by Peter J. Cameron-Cambridge University Press, 1994.
- "Introductory Combinatorics (4th Edition)"- by Richard A. Brualdi, Pearson Education
- "Introduction to graph theory" - by D B West, Prentice Hall
- John Clerk and Derek Allan Holton : A first look at Graph Theory (Allied Publishers Ltd./World Scientific).
- Linear Algebra Theory and Applications – Ward Cheney, David Kincaid. Jones and BartletIndia Pvt. Ltd. Complex Analysis by Karunakaran, Second Edition, Narosa Publishing House, 2006.
- Introduction to Linear Algebra – Serge Lang. Springer (India).
- Matrix and Linear Algebra – K. B. Dutta, Prentice Hall. Foundations of Complex Analysisby S. Ponnusamy, Narosa Publishing House, 1977.
- A Textbook of Matrices – Shanti Narayan, P K Mittal, S. Chand Group Notes on ComplexFunction Theory by D. Sarasan, Hindustan Book Agency, 1994.
- Introduction to Linear Algebra – V. Krishnamurthy, Affiliated East-west Press Pvt Ltd. L VAhlfors, Complex Analysis,3rd edition, McGraw Hill, International Editions, New YorK-1966
- Elementary Linear Algebra Applications Version- Chris Rorres & Howard Anton, WileyIndia Pvt Ltd (2011)
- Linear Algebra and Its Applications- Gilbert Strang, Nelson Engineering
- Lenneth Hoffman, Ray Kunze, Linear Algebra, 2nd edition Prentice Hall of India New Delhi (1971)
- P B Bhattacharya, Phani Bhusan Bhattacharya, S K Jain, S R Nagpaul, First course in Steven Roman, Advanced linear algebra, New Age International Ltd Publishers, NewDelhi (2008)
- Steven Roman, Advanced linear algebra, 3rd edition, Springer (2008)
- Linear Algebra Problem Book - P. R. Halmos.
- Linear Algebra with Applications - Jeanne, L. Agnew & Robert C. Knapp Brooks / Col publishing Co, California.

Mathematical Aptitude

- Quantitative Aptitude for CompetitiveExaminations , RS Aggarwal/ S Chand Publishing; Revised edition
- Verbal Reasoning by B.S. Sijwalii (Author), Indu Sijwali (Author)
- Course in Mental Ability and Quantitative Aptitude by Edgar Thorpe

Education

Fundamentals of Research in Education

- Agrawal, Y.P. (1988). Better Sampling: Concepts, Techniques and Evaluation. New Delhi: Sterling Publishers Private Ltd.
- Anastasi, A. (1988). Psychological Testing. New York: the Macmillan company.
- Backstrom, C.H. & Gerald, H. (1981) Survey Research. New York: John Wilev & Sons.
- Best J. W. (1993). Research in Education. New Delhi: Prentice-Hall of India Pvt. Ltd.
- Bogdan, R and Taylor, S.J. (1975) Introduction to Qualitative Research Methods. New York .JohnWilev & Sons.
- Bogdan R.C. & Biklen, S.K. (1998). Introduction to Qualitative Research of Education: An Introduction to Theory and Methods. Boston: Allyn and Bacon.
- BUCH, M.B. (Ed). (1974). A Survey of Research in Education. CASE: MSU Baroda.
- BUCH, M. B. (Ed) (1979). Second survey of Research in Education. Baroda: SERD.
- BUCH, M.B. (Ed) (1986). Third survey of Research in Education. New Delhi: NCERT.
- Buch, M.B. (Ed). (1991). Fourth Survey of Research in Education. New Delhi: NCERT.
- Campbell W.G. (1969). Form and Style in Thesis Writing. Boston: Houghton Mifflin Company.
- Champion, C.M. (1981). The Design of Educational Experiments. New York: McMillan Publishing Co. Inc.
- Champion, D.J. (1981). Basic Statistics for Social Research. New York: McMillan Publishing Co. Inc.
- Cohen, L. & Manion L. (1994). Research Methods in Education. lonlon: Rouletege.

Educational Sociology

- Aggrawal, J.C. (1999). **Philosophical and Sociological Bases of Education.** New Delhi:Vikas Publishing House.
- Bhatia & Narang (2013). **Philosophical and Sociological Bases of Education.** Ludhiana: Tandon Publications.
- Brown, F. J. (1954).**Educational Sociology (2nd Edition).** New York: Prentice Hall.
- Brubacher, J. S. (1962). **Modern Philosophies of Education.** New Delhi: McGraw Hill.
- Chanda, S.S. & Sharma, R. K. (2002).**Sociology of Education.** New Delhi: Atlantic Publishers.
- Cook & Cook. **Sociological approach to Education.** New York: McMillan and Co.
- Chaube, S. P. and Chaube, A. (2000). **Philosophical and Sociological Foundations of Education.** Agra: Vinod Pustak Mandir.
- Havinghurst R. J. & Neugarten, B. L.(1967). **Society and Education.** Allyn & Bacon.(n.d.).
- Mathur, S. S. **A Sociological Approach to Indian Education.** Agra: Vinod Pustak Mandir.
- Ogburn, W. F. & Nimkoff, W. F. (1966). **A handbook of Sociology.** New Delhi: Eurasia Publishing House (Pvt.) Ltd.
- Rao, C. N. (2005). **Sociology-Principles of Sociology with an introduction to Social Thought.** New Delhi: S. Chand & Company.
- Ravi, S. S. (2015). **Philosophical and Sociological Bases of Education.** New Delhi: Prentice Hall India Pvt. Ltd.
- Saikia, P. (2017). **Sociological Foundations of Education.** Guwahati: DVS Publishers.(n.d.).
- Saxena, **N. R. Philosophical and Sociological Foundation of Education.** Meerut: Surya Publishing.

॥ न हि ज्ञानेन सदृशं पवित्रमिह विद्यते ॥

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