

FACULTY OF EDUCATION

SYLLABUS

FOR

B.Sc. B.Ed. (Four Years Integrated Degree Programme)

(SEMESTER: I–IV)

Examinations: 2019–20



GURU NANAK DEV UNIVERSITY

AMRITSAR

- Note:** (i) **Copy rights are reserved.**
Nobody is allowed to print it in any form.
Defaulters will be prosecuted.
- (ii) **Subject to change in the syllabi at any time.**
Please visit the University website time to time.

SEMESTER-I

Paper	Course Title	Marks
	Perspectives in Education	
I	Yoga Education	50
	Curriculum and Pedagogic Studies	
II	English (Compulsory)	50
III	Punjabi (Compulsory)	50
	***Mudhli Punjabi (In lieu of (Punjabi Compulsory))	50
	***Punjab History & Culture (From Earliest Times to C 320) (In lieu of (Punjabi Compulsory))	50
IV, V & VI	Stream – 1- * Physics, Chemistry and Mathematics(PCM)	300
Select any one stream	Stream – 2- ** Chemistry, Botany, and Zoology (CBZ)	300
	Development of Self	
EPC I	Life Skills Education	50
VII	****Drug Abuse: Problem, Management and Prevention (Compulsory Paper)	50
	Total	500

Note:-

- * B.Sc Non-Medical students will opt for PCM and B.Sc Medical students will opt for CBZ and will remain the same throughout the course.
- ** Credit Hours where not specified will be governed by ordinances of B.A./B.Sc. programmes of the university.
- Syllabus of Chemistry in stream 1 will be same as that of in stream 2. Candidates will not be allowed to take same subject from stream 1 and 2.
- *** (Special Paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)
- **** Marks of this Paper will not be included in the Total Marks.

SEMESTER-II

Paper	Course Title	Marks
	Perspectives in Education	
I	Environmental Education	50
	Curriculum and Pedagogic Studies	
II	English (Compulsory)	50
III	Punjabi (Compulsory)	50
	***Mudhli Punjabi (In lieu of (Punjabi Compulsory))	50
	*** Punjab History & Culture (From C 320 to 1000 BC) (In lieu of (Punjabi Compulsory))	50
IV, V & VI Same as in semester 1	Stream – 1- * Physics, Chemistry and Mathematics(PCM)	300
	Stream – 2- ** Chemistry, Botany, and Zoology (CBZ)	300
EPC II	Understanding the Self	50
VII	****Drug Abuse: Problem, Management and Prevention (Compulsory Paper)	50
	Total	500

Note:-

- * B.Sc Non-Medical students will opt for PCM and B.Sc Medical students will opt for CBZ and will remain the same throughout the course.
- ** Credit Hours where not specified will be governed by ordinances of B.A./B.Sc. programmes of the university.
- Syllabus of Chemistry in stream 1 will be same as that of in stream 2. Candidates will not be allowed to take same subject from stream 1 and 2.
- *** (Special Paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)
- **** Marks of this Paper will not be included in the Total Marks.

B.SC. B.ED. (FOUR YEARS INTEGRATED DEGREE PROGRAMME)

SEMESTER-III

Paper	Course Title	Marks		
		T	P	Internship
	Perspectives in Education			
I	Understanding Education and its perspectives	100		
II	Gender, School and Society	50		
	Curriculum and Pedagogic Studies			
III	English (Compulsory)	50		
IV	Punjabi (Compulsory)	50		
	***Mudhli Punjabi (In lieu of (Punjabi Compulsory))	50		
	*** Punjab History & Culture (From 1000 to 1605 AD) (In lieu of (Punjabi Compulsory))	50		
V, VI & VII	*Physics, Chemistry and Mathematics (PCM)	300		
	*Chemistry Botany and Zoology (CBZ)	300		
VIII	****Drug Abuse: Problem, Management and Prevention (Compulsory Paper) (Only for those students who have not studied this paper in Semester-I)			
	Total	650		

Note:-

- * B.Sc Non-Medical students will opt for PCM and B.Sc Medical students will opt for CBZ and will remain the same throughout the course.
- ** Credit Hours where not specified will be governed by ordinances of B.A./B.Sc. programmes of the university.
- Syllabus of Chemistry in stream 1 will be same as that of in stream 2. Candidates will not be allowed to take same subject from stream 1 and 2.
- *** (Special Paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)
- **** Marks of this Paper will not be included in the Total Marks.

SEMESTER-IV

Paper	Course Title	Marks		
		T	P	Internship
	Perspectives in Education			
I	Language Proficiency and Communication Skills	50		
	Curriculum and Pedagogic Studies			
II	English (Compulsory)	50		
III	Punjabi (Compulsory)	100		
	***Mudhli Punjabi (In lieu of (Punjabi Compulsory))	50		
	*** Punjab History & Culture (From 1605 to 1849 AD) (In lieu of (Punjabi Compulsory))	50		
IV, V & VI	*Physics, Chemistry and Mathematics (PCM)	300		
	*Chemistry, Botany and Zoology (CBZ)	300		
EPC III	Drama and Art in Education	50		
VII	***** Environmental Studies (Compulsory)			
VIII	Drug Abuse: Problem, Management and Prevention (Compulsory Paper) (Only for those students who have not studied this paper in Semester-II)			
	Total	600		

Note:-

- * B.Sc Non-Medical students will opt for PCM and B.Sc Medical students will opt for CBZ and will remain the same throughout the course.
- ** Credit Hours where not specified will be governed by ordinances of B.A./B.Sc. programmes of the university.
- Syllabus of Chemistry in stream 1 will be same as that of in stream 2. Candidates will not be allowed to take same subject from stream 1 and 2.
- *** (Special Paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)
- **** Marks of this Paper will not be included in the Total Marks.
- ***** Marks of Paper EVS will not be included in Grand Total.

**SEMESTER-I
PAPER – I
YOGA EDUCATION**

Time 1:30 Hrs.

**Total Marks: 50
Terminal: 35
Sessional: 15**

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives

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

- Know the historical and philosophical background of Yoga.
- Understand different types of Yoga
- Correlate Yoga with Education
- Manage stress through Yoga
- Perform major Yogic Asanas.

SECTION–A

YOGA

- a) Yoga: Historical and philosophical background, Meaning, importance.
- b) Concept and educational implications of:
 - i) Raj yoga
 - ii) Hath yoga
 - iii) Jnana yoga
 - iv) Bhakti yoga
 - v) Karma yoga

SECTION–B

Major Yogic Texts: Nature of Chitta – Vritties, Concept of Vidya and Moksha. (Patanjali's Yoga Sutra)

SECTION–C

EDUCATION AND YOGA

- a) Education and Yoga - Promotion of intelligence, awareness and creativity through Yoga.

SECTION–D

- a) Stress and Yoga: Stress – Definition, Causes, Symptoms, Complications in life; Yogic management of stress related disorders – Anxiety, Depression and Suicidal tendencies.
- b) Importance of Meditation in school

SESSIONAL WORK:

**Performance in Unit tests and House examination: 05 marks
Attendance: 02 marks**

Assignment on the following (ANY TWO): 08 marks

- Preparation of a file (project report of the selected five asana, three physiological, psychological effects on human body).
- Participation in any five Asanas of the following: Shavasana, Sarvangasana, Halasana, Paschimottanasana, Bhujangasana, Dhanurashna, Chakrasana, Vajrashna, Gomukhasana, Matsyanana, Janu- Shirasana, Ardhmatsyendrasana, Padmasana .
- Participation in Neti, Kapalbhathi , Tratak Anulom- Vilom, Bhramari, Shitali, Ujjai Pranayam.

References:-

- Bijlani, R. (2010). *Back to Health through Yoga*. New Delhi: Rupa & Co.
- Gupta,S.N. Das.(1987). *Yoga Philosophy in Relation to Other System of Indian Thought*. New Delhi: Moti Lal
- Dass, B., & Hota, B. (2008). *Yoga for School Children*. New Delhi: Rupa & Co.
- Iyengar, B.K.S. (2005). *Light on life*. Oxford, Pan Macmillan Ltd.
- Iyengar, B.K.S. (2008). *Light on Yoga*. New Delhi: Harper Collins.
- Iyengar, B.K.S. (2009). *The Tree of Yoga*. New Delhi: Harper Collins.
- Iyengar, B.K.S. (2010). *Light on Pranayama*. New Delhi: Harper Collins.
- Kuvalayananda, Swami & Dr. S.L. Vinekar, (1971).*Yoga Theraphy, Kaivalyadhama, Lonavala.*
- Kuvalayananda, Swami. (1983). *Pranayama*. Bombay: Popular Prakashan.
- Kuvalayananda, Swami. (1983). *Asanas*. Bombay: Popular Prakashan, English/Hindi.
- Lal, Raman Bihari. (2008). *Siksha Ke Daarshnik Evam Samajshastriye Sidhant*. Meerut: Rastogi Publications.
- Nagendra, H.R. (1993). *Yoga in Education*. Banglore: Vivekananda Kendra.
- Niranananda, Swami. (1998). *Yoga Darshan*. Deoghar, Panchadashanam Paramahamsa Alakh Bara.
- Rai, Lajpat, Sawhney, R.C. and Selvamurthy, W.Selvamurthy (1998). *Meditation Techniques, their Scientific Evaluation*. Gurgaon: Anubhav Rai Publication.
- Raju, P.T. (1982).*The Philosophical Traditions of India*. Delhi: Moti Lal Banarsi Dass.
- Ram, Swami. (1999). *A Practical Guide to Holistic Health*. Pennsylvania, Himalayan Institute of Yoga.
- Reyna, R. (1971). *Introduction to Indian Philosophy*. New Delhi: Tata McGraw-Hill Publishing Co. Ltd.
- Saraswati, Swami Satyananda. (2005). *Asana, Pranayama, Mudra, Bandha*. Munger, Bihar School of Yoga.
- Singleton, M. (2010). *Yoga Body – The Origins of Modern Posture Practice*. Oxford, Oxford University Press.
- Sivananda, Sri Swami. (2007). *Janana Yoga*. Tehri Garhwal, The Divine Life Society.
- Taimini, I.K. (1979). *The Science of Yoga*. Madras: Adyar Publication.
- Venkakswaram, P.S. (2008). *Yoga for Healing*. New Delhi: Jaico Publishing House.
- Villodo, A. (2007). *Yoga, Power and Spirit*. New Delhi: Hay House Inc.
- Vivekananda, S. (2007). *Raj Yoga*. Calcutta: Ramakrishna Vedanta Math.
- Vivekananda, S. (2009). *Complete Book of Yoga*. Delhi: Vijay Goel Publisher.
- Yogindra, Shri, (1970). *Yoga Hygiene Simplified*. The Yoga Institute Bombay.

SEMESTER-I**PAPER-II: ENGLISH (COMPULSORY)****Time: 3 Hours****Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Texts Prescribed:-

1. *Tales of Life* (Guru Nanak Dev University, Amritsar) Stories at Sr.No.1, 2, 3, 5 and 6
2. *Prose for Young Learners* (Guru Nanak Dev University, Amritsar) Essays at Sr. No. 1, 2, 3, 5 and 6
3. *English Grammar in Use* (Fourth Edition) by Raymond Murphy, CUP

The syllabus is divided in four sections as mentioned below.

SECTION-A

English Grammar in Use, 4th Edition by Raymond Murphy, CUP (Units: 1-37)

SECTION-B

Paragraph Writing and English Grammar in Use (Units: 38-48)

SECTION-C

Tales of Life (Guru Nanak Dev University, Amritsar): Stories at Sr. No. 1, 2, 3, 5 and 6

SECTION-D

Prose for Young Learners: Essays at Sr. No. 1, 2, 3, 5 and 6

SEMESTER-I

PAPER-III: PUNJABI (COMPULSORY) ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

ਸਮਾਂ : 3 ਘੰਟੇ

ਕੁਲ ਅੰਕ : 50

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿੱਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

ਸੈਕਸ਼ਨ - ਏ

ਦੋ ਰੰਗ (ਕਵਿਤਾ ਭਾਗ) (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ ਅਤੇ ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ),
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।

(ਲੇਖਕ ਦਾ ਜੀਵਨ ਤੇ ਰਚਨਾ / ਪ੍ਰਸੰਗ ਸਹਿਤ ਵਿਆਖਿਆ/ਕਵਿਤਾ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ)

ਸੈਕਸ਼ਨ - ਬੀ

ਸੰਸਾਰ ਦੀਆਂ ਪ੍ਰਸਿੱਧ ਹਸਤੀਆਂ (ਜੀਵਨੀ ਨੰ: 1 ਤੋਂ 9 ਤੱਕ)

(ਸੰਪਾ. ਪ੍ਰਿੰ. ਤੇਜਾ ਸਿੰਘ, ਹਰਨਾਮ ਸਿੰਘ ਸ਼ਾਮ),

ਪੰਜਾਬੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।

(ਵਿਸ਼ਾ-ਵਸਤੂ/ਸਾਰ/ਨਾਇਕ ਬਿੰਬ)

ਸੈਕਸ਼ਨ - ਸੀ

(ੳ) ਪੈਰਾ ਰਚਨਾ (ਤਿੰਨ ਵਿੱਚੋਂ ਇਕ)

(ਅ) ਪੈਰਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ।

ਸੈਕਸ਼ਨ - ਡੀ

(ੳ) ਭਾਸ਼ਾ ਵੰਨਗੀਆਂ : ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਅਤੇ ਉਪ-ਭਾਸ਼ਾ ਵਿਚ ਅੰਤਰ, ਪੰਜਾਬੀ ਉਪਭਾਸ਼ਾਵਾਂ ਦੇ ਪਛਾਣ-ਚਿੰਨ੍ਹ।

(ਅ) ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ

SEMESTER-I**Mudhli Punjabi****ਮੁੱਢਲੀ ਪੰਜਾਬੀ****(In lieu of Compulsory Punjabi)**

ਸਮਾਂ : 3 ਘੰਟੇ

ਕੁਲ ਅੰਕ: 50

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ**ਸੈਕਸ਼ਨ-ਦੋ**

ਪੈਂਤੀ ਅੱਖਰੀ, ਅੱਖਰ ਕ੍ਰਮ, ਪੈਰ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ ਅਤੇ ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ ਅਤੇ ਮਾਤ੍ਰਵਾਂ (ਮੁੱਢਲੀ ਜਾਣ-ਪਛਾਣ)

ਲਗਾਖਰ (ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ) : ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ

ਸੈਕਸ਼ਨ-ਬੀ

ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ : ਮੁੱਢਲੀ ਜਾਣ-ਪਛਾਣ

(ਸਾਧਾਰਨ ਸ਼ਬਦ, ਸੰਯੁਕਤ ਸ਼ਬਦ, ਮਿਸ਼ਰਤ ਸ਼ਬਦ, ਮੂਲ ਸ਼ਬਦ, ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ)

ਸੈਕਸ਼ਨ-ਸੀ

ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ : ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇ-ਨਾਤੇ, ਖੇਤੀ ਅਤੇ ਹੋਰ ਧੰਦਿਆਂ ਆਦਿ ਨਾਲ ਸੰਬੰਧਤ।

ਸੈਕਸ਼ਨ-ਡੀ

ਹਫ਼ਤੇ ਦੇ ਸੱਤ ਦਿਨਾਂ ਦੇ ਨਾਂ, ਬਾਰ੍ਹਾਂ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ, ਰੁੱਤਾਂ ਦੇ ਨਾਂ, ਇਕ ਤੋਂ ਸੌ ਤਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿਚ

SEMESTER-I

Punjab History & Culture (From Earliest Times to C 320)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

Time: 3 Hours**Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

1. Physical features of the Punjab and its impact on history.
2. Sources of the ancient history of Punjab

SECTION-B

3. Harappan Civilization: Town planning; social, economic and religious life of the Indus Valley People.
4. The Indo-Aryans: Original home and settlements in Punjab.

SECTION-C

5. Social, Religious and Economic life during *Rig Vedic Age*.
6. Social, Religious and Economic life during *Later Vedic Age*.

SECTION-D

7. Teachings and impact of Buddhism
8. Jainism in the Punjab

Suggested Readings:-

1. L. M Joshi (ed.), *History and Culture of the Punjab*, Art-I, Patiala, 1989 (3rd edition)
2. L.M. Joshi and Fauja Singh (ed.), *History of Punjab*, Vol.I, Patiala 1977.
3. Budha Parkash, *Glimpses of Ancient Punjab*, Patiala, 1983.
4. B.N. Sharma, *Life in Northern India*, Delhi. 1966.
5. Chopra, P.N., Puri, B.N., & Das, M.N. (1974). *A Social, Cultural & Economic History of India*, Vol. I, New Delhi: Macmillan India.

SEMESTER-I**PAPER-IV, V & VI, STREAM-1
PHYSICS****PAPER-A: MECHANICS
(THEORY)****Time: 3 Hours****Marks: 35****Total Teaching Hrs: 45(3Hrs./week)****Pass Marks: 35%****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Cartesian and spherical polar co-ordinate systems, area, volume, velocity and Acceleration in these systems. Solid angle, Relationship of conservation laws and symmetries of space and time.

11 Lectures**SECTION-B**

Various forces in Nature (Brief introduction) centre of mass, equivalent one body problem, central forces, equation of motion under central force, equation of orbit and turning points. Kepler Laws. Concept of Ether and Michel son-Morley experiment.

11 Lectures**SECTION-C**

Inertial frame of reference. Galilean transformation and Invariance. Non Inertial frames, coriolis force and its applications. Variation of acceleration due to gravity with latitude. Foucault pendulum.

11 Lectures**SECTION-D**

Elastic collision in Lab and C.M. system, velocities, angles and energies, cross section of elastic scattering, Rutherford scattering. Rigid Body motion; Rotational motion, principal moments and Axes. Euler's equations, precession and elementary gyroscope.

12 Lectures**Books Suggested:-**

1. Mechanics, Berkeley Vol.-I, C. Kittle.
2. Mechanics, H.S. Hans & S.P. Puri.

SEMESTER-I**PAPER-IV, V & VI, STREAM-1
PHYSICS****PAPER-B: ELECTRICITY AND MAGNETISM
(THEORY)****Time: 3 Hours****Marks: 35****Total Teaching Hrs: 45(3Hrs./week)****Pass Marks: 35%****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Basic ideas of Vector Calculus Gradient, Divergence, curl and their physical significance. Laplacian in rectangular, cylindrical and spherical coordinates. Coulomb's Law for point charges and continuous distribution of charges. Electric field due to dipole, line charge and sheet of charge. Electric flux, Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's theorem.

12 Lectures**SECTION-B**

Work and potential difference. Potential difference as line integral of field. Electric potential due to a point charge, a group of point charges, dipole and quadrupole moments, long uniformly charged wire, charged disc. Stoke's theorem and its applications in Electrostatic field, curl $E=0$. Electric fields as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Potential due to arbitrary charge distribution and multipole moments.

11 Lectures**SECTION-C**

Poisson and Laplace's equation and their solutions in Cartesian and spherical coordinates. Concept of electrical images. Calculation of electric potential and field due to a point charge placed near an infinitely conducting sheet. Current and current density, equation of continuity. Microscopic form of Ohm's Law ($J=\sigma E$) and conductivity, Failure of Ohm's Law.

11 Lectures**SECTION-D**

Interaction between moving charges and force between parallel currents. Behaviour of various substances in magnetic field. Definition of M and H and their relation to free and bound currents. Permeability and susceptibility and their interrelationship. Orbital motion of electrons and diamagnetism, Paramagnetism and Ferromagnetism.

11 Lectures**Books Suggested:-**

1. Fundamentals of Electricity and Magnetism: Arthur F. Kipp.
2. Electricity and Magnetism, Berkeley Physics Course: Vol. II, E.M. Purcell.
3. Introduction to Classical Electrodynamics: David Griffith.
4. EM Waves and Radiating System: Edward C. Jordan and K.G. Balmain.
5. Fields and Waves Electromagnetic: David K. Cheng.

SEMESTER-I**PAPER-IV, V & VI, STREAM-1
PHYSICS****(PRACTICAL)****General Guidelines for Practical Examination: (4.5h/week)**

- | | | |
|----|--|------------------|
| I. | The distribution of marks is as follows: | Marks: 30 |
| | i) One experiment | 15 Marks |
| | ii) Brief Theory | 5 Marks |
| | iii) Viva-Voce | 5 Marks |
| | iv) Record (Practical file) | 5 Marks |
- II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
- III. Number of candidates in a group for practical examination should not exceed 12.
- IV. In a single group no experiment be allotted to more than three examinee in any group.
1. To study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations using objects of various geometrical shapes but of same mass).
 2. To establish relationship between torque and angular acceleration using fly wheel.
 3. To find the moment of inertia of a flywheel.
 4. Study of bending of beams and determination of Young's modulus.
 5. Determination of Poisson's ratio for rubber.
 6. To determine energy transfer, coefficient of restitution and verify laws of conservation of linear momentum and kinetic energy in elastic collisions using one dimensional collisions of hanging spheres.
 7. To verify the laws of vibrating string by Melde's experiment.
 8. Measure time period as a function of distance of centre of suspension (oscillation) from centre of mass, plot relevant graphs, determine radius of gyration and acceleration due to gravity.
 9. Find the value of 'g' by Kater's pendulum.
 10. Measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
 11. To measure logarithmic decrement, coefficient of damping, relaxation time, and quality factor of a damped simple pendulum.

SEMESTER-I**PAPER-IV, V & VI, STREAM-1
CHEMISTRY****INORGANIC CHEMISTRY-I
(THEORY)****Time: 3 Hrs.
45 Hrs (3 Hrs/week)****Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**I. Atomic Structure****10 Hrs.**

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ψ^1 and ψ^2 , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s,p,d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions.

SECTION-B**II. Periodic Properties****10 Hrs.**

Position of elements in the periodic table; effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

SECTION-C**III. Chemical Bonding****12 Hrs**

Covalent Bond –Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF_2 , BF_3 , CH_4 , PF_5 , SF_6 , IF_7 , SnCl_2 , XeF_4 , BF_4 , SnCl_6 . Valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2 and H_2O . MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear (BO , CN^- , CO , NO^+ , CO^+ , CN), diatomic molecules, multicenter bonding in electron deficient molecule (Boranes). Percentage ionic character from dipole moment and electronegativity difference.

SEMESTER-I**SECTION-D****IV. Ionic Solids****13Hrs**

Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurtzite, CaF₂ and antifluorite, radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born–Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan’s rule. Metallic bond– free electron, valence bond and band theories.

Weak Interactions –Hydrogen bonding, Vander Waals forces.

Books Suggested:-

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
4. Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
5. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
6. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.
7. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
8. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
9. University General Chemistry, C.N.R. Rao, Macmillan.
10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11. Inorganic Chemistry, A.G. Sharpe, ELBS.

SEMESTER-I**PAPER-IV, V & VI, STREAM-1
CHEMISTRY****ORGANIC CHEMISTRY-I
(THEORY)**

Time: 3 Hrs.
45 Hrs. (3 Hrs./Week)

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**I. Structure and Bonding****(5 Hrs.)**

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Vander Waals interactions, resonance, hyperconjugation, hydrogen bonding and Inductive and electrometric effects.

II. Mechanism of Organic Reactions**(6 Hrs.)**

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Reactive intermediates –Carbocations, carbanions, free radicals, carbenes, arenes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.

SECTION-B**III. Alkanes****(4 Hrs.)**

Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

IV. Alkenes and Alkynes**(8 Hrs.)**

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 .

Substitution at the allylic and vinylic positions of alkenes.

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

SEMESTER-I**SECTION-C****V. Alkyl Halides****(7 Hrs.)**

Nomenclature and classes of alkyl halides, chemical reactions. Mechanisms of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Nuclear and side chain reactions.

VI. Cycloalkanes:**(5 Hrs.)**

Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring : banana bonds.

SECTION-D**VII. Arenes and Aromaticity****(10 Hrs.)**

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: Molecular formula and Kekule structure. Stability and carbon carbon bond lengths of benzene, resonance structure.

Aromaticity : the Huckel's rule, aromatic ions.

Aromatic electrophilic substitution—general pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes.

Books suggested:-

1. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson education, 2008.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

SEMESTER-I**CHEMISTRY****(PRACTICAL)**

Duration: 3½ Hrs.
6 Period/Week

Marks: 30

Inorganic Chemistry: Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

Organic Chemistry Laboratory Techniques**Determination of Melting Point**

Naphthalene 80–82°C

Cinnamic acid 132.5–133°C

Benzoic acid 121.5–122°C

Salicylic acid 157.5–158°C

Urea 132.5–133°C

Acetanilide 113.5–114°C

Succinic Acid 184.5–185°C

m-dinitro benzene 90°C

P-dichlorobenzene 52°C

Aspirin 135°C

Determination of Boiling Point

Ethanol 78°C

Cyclo Hexane 81.4°C,

Benzene–80°C

Toluene 110°C

Practical Examination

1) Inorganic Mixture	18
2) Melting Point/Boiling point of organic substance	05
3) Viva–Voce	04
4) Note Book	03

Books Suggested:-

1. Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
2. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge. Standard Methods of Chemical Analysis, W.W. Scott: The Technical Press.
3. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
4. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
5. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.

SEMESTER-I**PAPER-IV, V & VI, STREAM-1
MATHEMATICS****PAPER-I: ALGEBRA****Time: 3 Hours****Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Linear independence of row and column vectors. Row rank, Column rank of a matrix, Equivalence of column and row ranks, Nullity of matrix, Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations.

SECTION-B

Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix. Quadratic Forms, quadratic form as a product of matrices. The set of quadratic forms over a field.

SECTION-C

Congruence of quadratic forms and matrices. Congruent transformations of matrices. Elementary congruent transformations. Congruent reduction of a symmetric matrix. Matrix Congruence of skew-symmetric matrices. Reduction in the real field. Classification of real quadratic forms in variables. Definite, semi-definite and indefinite real quadratic forms. Characteristic properties of definite, semi-definite and indefinite forms.

SECTION-D

Relations between the roots and coefficients of general polynomial equation in one variable. Transformation of equations and symmetric function of roots, Descarte's rule of signs, Newton's Method of divisors, Solution of cubic equations by Cardon method, Solution of biquadratic equations by Descarte's and Ferrari's Methods.

Books Recommended:-

1. K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
2. H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
3. Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
4. S.L. Loney: Plane Trigonometry Part-II, Macmillan and Company, London.
5. Shanti Narayan and P.K. Mittal: Text Book of Matrices.

SEMESTER-I**PAPER-IV, V & VI, STREAM-1
MATHEMATICS****PAPER-II: CALCULUS AND TRIGONOMETRY****Time: 3 Hours****Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Real number system and its properties, lub, glb of sets of real numbers, limit of a function, Basic properties of limits, Continuous functions and classification of discontinuities, Uniform continuities.

SECTION-B

Differentiation of hyperbolic functions, Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's theorem with various forms of remainders, Indeterminate forms.

SECTION-C

De-Moivre's Theorem and its applications, circular and hyperbolic functions and their inverses.

SECTION-D

Exponential and Logarithmic function of a complex numbers, Expansion of trigonometric functions, Gregory's series, Summation of series.

Books Recommended:-

1. N. Piskunov: Differential and Integral Calculus, Peace Publishers, Moscow.
2. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
3. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999.

SEMESTER-I**PAPER-IV, V & VI, STREAM-2
CHEMISTRY****INORGANIC CHEMISTRY-I
(THEORY)**

Time: 3 Hrs.
45 Hrs (3 Hrs/week)

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**I. Atomic Structure**

10 Hrs.

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ψ^1 and ψ^2 , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s,p,d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions.

SECTION-B**II. Periodic Properties**

10 Hrs.

Position of elements in the periodic table; effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

SECTION-C**III. Chemical Bonding**

12 Hrs

Covalent Bond –Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF_2 , BF_3 , CH_4 , PF_5 , SF_6 , IF_7 , SnCl_2 , XeF_4 , BF_4 , SnCl_6 . Valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2 and H_2O . MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear (BO , CN^- , CO , NO^+ , CO^+ , CN), diatomic molecules, multicenter bonding in electron deficient molecule (Boranes). Percentage ionic character from dipole moment and electronegativity difference.

SECTION-D**IV. Ionic Solids****13Hrs**

Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurtzite, CaF₂ and antifluorite, radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born–Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan’s rule. Metallic bond– free electron, valence bond and band theories.

Weak Interactions –Hydrogen bonding, Vander Waals forces.

Books Suggested:-

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
4. Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
5. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
6. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.
7. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
8. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
9. University General Chemistry, C.N.R. Rao, Macmillan.
10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11. Inorganic Chemistry, A.G. Sharpe, ELBS.

SEMESTER-I**PAPER-IV, V & VI, STREAM-2
CHEMISTRY****ORGANIC CHEMISTRY-II
(THEORY)****Time: 3 Hrs.****45 Hrs. (3 Hrs./Week)****Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**I. Structure and Bonding****(5 Hrs.)**

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Vander Waals interactions, resonance, hyperconjugation, hydrogen bonding and Inductive and electrometric effects.

II. Mechanism of Organic Reactions**(6 Hrs.)**

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles.

Reactive intermediates –Carbocations, carbanions, free radicals, carbenes, arenes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.

SECTION-B**III. Alkanes****(4 Hrs.)**

Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

IV. Alkenes and Alkynes**(8 Hrs.)**

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 .

Substitution at the allylic and vinylic positions of alkenes.

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

SECTION–C**V. Alkyl Halides****(7 Hrs.)**

Nomenclature and classes of alkyl halides, chemical reactions. Mechanisms of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Nuclear and side chain reactions.

VI. Cycloalkanes:**(5 Hrs.)**

Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

SECTION–D**VII. Arenes and Aromaticity****(10 Hrs.)**

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: Molecular formula and Kekule structure. Stability and carbon carbon bond lengths of benzene, resonance structure.

Aromaticity: the Huckel's rule, aromatic ions.

Aromatic electrophilic substitution—general pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes.

Books suggested:-

1. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson education, 2008.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

SEMESTER-I**PAPER-IV, V & VI, STREAM-2
CHEMISTRY****(PRACTICAL)****Duration: 3½ Hrs.
6 Period/Week****Marks: 30****Inorganic Chemistry:** Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.**Organic Chemistry Laboratory Techniques****Determination of Melting Point**

Naphthalene 80–82°C	Cinnamic acid 132.5–133°C
Benzoic acid 121.5–122°C	Salicylic acid 157.5–158°C
Urea 132.5–133°C	Acetanilide 113.5–114°C
Succinic Acid 184.5–185°C	m-dinitro benzene 90°C
P-dichlorobenzene 52°C	Aspirin 135°C

Determination of Boiling Point

Ethanol 78°C	Cyclo Hexane 81.4°C,
Benzene–80°C	Toluene 110°C

Practical Examination

1) Inorganic Mixture	18
2) Melting Point/Boiling point of organic substance	05
3) Viva-Voce	04
4) Note Book	03

Books Suggested:-

1. Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
2. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge. Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
3. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
4. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
5. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.

SEMESTER-I**PAPER-IV, V & VI, STREAM-2
BOTANY****PAPER-I A: DIVERSITY OF MICROBES
(THEORY)****Time: 3 Hrs.****Theory Lectures: 3 Hours/Week****Max. Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Algae: General characters, classification and economic importance, important features and life history of Chlorophyceae–Volvox, Oedogonium, Coleochaete, Xanthophyceae–Vaucheria; Phaeophyceae–Ectocarpus, Sargassum; Rhodophyceae–Polysiphonia.

SECTION-B

Viruses, Bacteria, General account of viruses and mycoplasma; bacteria–structure, nutrition, reproduction and economic importance; general account cyanobacteria. General characters.

SECTION-C

Classification and Economic Importance of Fungi. Important features and life history of Mastigomycotina–Pythium, Phytophthora; Zygomycotina–Mucor, Ascomycotina–accharomyces, Eurotium, Chaetomium. Peziza;

SECTION-D

Basidiomycotina–Puccinia, Agaricus;
Deuteromycotina–Cercospora. Colletotrichum
General account of Lichens

Suggested Readings:-

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. Introductory Mycology (4th Edition), Wiley - Blackwell, USA.
2. Dube, H.C., 2007, A Textbook of Fungi, Bacteria and Viruses (3rd edition), Scientific Publishers, India
3. Dube, H.C., 2012, An Introduction to Fungi (4th edition), Scientific Publishers., India.
4. James W. Brown. (2014). Principles of Microbial Diversity. ASM press, USA.
5. Ogunseitan, O. (2004). Microbial Diversity: Form and function in Prokaryotes. Wiley Publishers, USA.
6. Sharma, O.P., 2004, Text Book of Thallophytes. McGraw Hill Publishing Co., India.
7. Sharma, P.D., 2004, The Fungi, (2nd Edition) Rastogi Publication, India

SEMESTER-I**PAPER-IV, V & VI, STREAM-2
BOTANY****PAPER-I B: DIVERSITY OF CRYPTOGAMS
(THEORY)****Time: 3 Hrs.****Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Bryophyta: Amphibians of plants kingdom displaying alternation of generations; structure, reproduction

SECTION-B

Classification of Hepaticopsida (e.g. Marchantia); **Anthocerotopsida** (e.g. Anthoceros), **Bryopsida** (e.g. Funaria).

SECTION-C

Pteridophyta: The first vascular plant; important characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida; structure, reproduction in Rhynia,

SECTION-D

Lycopodium, Selaginella. Equisetum, Pteris and Marsilea.

Suggested Readings:-

1. Goffinet B. (2008). Bryophyte Biology. Cambridge University Press, UK.
2. Sambamurty, S.S. (2005). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and
3. Paleobotany. I K International Publishing House Pvt Ltd., India
4. Sharma, O.P. (2014). Bryophyta. Mc Graw Hill Education Pvt Ltd., India.

SEMESTER-I**PAPER-IV, V & VI, STREAM-2
BOTANY****PRACTICALS-I (BASED ON PAPER-IA AND IB)****Practical Hours: 4½ Hours/week****Marks: 30****Suggested Laboratory Exercises:-**

Teachers may select plants/material available in their locality/institution

1. Gram staining of bacteria.
2. Observation of disease symptoms in hosts infected by fungi, viruses and mycoplasma Section cutting of diseased material and identification of the pathogens as per the theory syllabus.
3. Study of the genera included under algae and fungi.
4. Study of morphology, reproductive structures and anatomy of the examples cited in theory under Bryophyta and Pteridophyta.

Suggested Readings: Lee, R.E. (2008). Phycology, Fourth Edition, Cambridge University Press, USA. Agrios, G.N. (1997). Plant Pathology, 4th edition, Academic Press, U.K.

ZOOLOGY**SEMESTER-I**

Paper	Maximum Marks		Hours of Teaching	
	Theory Marks	Practical Marks	Theory	Practical
ZOO-IA (Cell Biology)	35	—	3 Hrs	—
ZOO-IB (Biodiversity-I)	35	—	3 Hrs	—
PRACTICAL-I (RELATED TO ZOO-IA and ZOO-IB)	—	30	—	4½ Hrs

SEMESTER-I**PAPER-IV, V & VI, STREAM-2
ZOOLOGY****ZOO-IA: CELL BIOLOGY
(THEORY)****Max. Time: 3 Hrs.****Max Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Methods in Cell Biology.

- (a) Principles of light and phase contrast microscopy
- (b) Electron microscopy (TEM and SEM)
- (c) Fixation and fixatives
- (d) Staining techniques.

SECTION-B

Organization of Cell: Extra nuclear and nuclear, ultrastructure and functions of cell organelles

- (a) Plasma Membrane: Structure, osmosis, active and passive transport, endocytosis and exocytosis.
- (b) Endoplasmic reticulum: Structure, types and associated enzymes.
- (c) Mitochondria: Structure, mitochondrial enzymes and role of mitochondria in respiration and mitochondrial DNA.

SECTION-C

Organization of Cell:

- (a) Golgi complex: Structure and functions.
- (b) Ribosomes: Types of ribosomes, their structure and functions.
- (c) Lysosomes: Polymorphism and their function.
- (d) Centrosome: Structure and functions.

SECTION-D

Nucleus: Structure and functions of nuclear membrane, nucleolus and chromosomes.

An elementary idea of cell transformation in cancer.

An elementary idea of cellular basis of immunity.

Suggested Readings:-

1. Alberts, B., Bray, D., Lewis, J., Raff, M. Roberts, K., Watson J.D.(1998), Molecular Biology of the Cell, Garland Publ. Inc., New York.
2. Chandra Roy, S and DE Kumar, K. (2001), Cell Biology, New Central Book Agency (P) Ltd. Kolkata.
3. Cooper, G. M. (2004), The cell, A Molecular Approach, ASM press, Washington, D. C.
4. De Robertis, E.D.P. De Robertis, E.M.F. (1995) Cell Biology and Molecular Biology (Eighth Edition), W.B. Saunders Co., Philadelphia.
5. Karp, G. (1984). Cell Biology (4th ed), McGraw Hill, New York.
6. Pawar, C.B (1999), Cell Biology, Himalaya Publishing House, Bombay.

SEMESTER-I**PAPER-IV, V & VI, STREAM-2
ZOOLOGY****ZOO-IB: BIODIVERSITY-I
(PROTOZOA TO ANNELIDA)
(THEORY)****Max. Time: 3 Hrs.****Max Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Detailed Type study of the following animals**SECTION-A**

Protozoa: *Amoeba proteus*,
Paramecium caudatum (with special reference to Kappa particles in *P. aurelia*)
Plasmodium vivax. Introduction to Parasitic Protozoans.

SECTION-B

Parazoa (Porifera): *Sycon*,
Cnidaria (Coelentrata): *Obelia*

SECTION-C

Platyhelminthes: *Fasciola hepatica*,
Taenia solium
Larvae of *Fasciola hepatica* and *Taenia solium*

SECTION-D

Aschelminthes: *Ascaris*, Parasitic adaptations in Helminthes
Annelida: *Pheretima posthuma* (Earthworm)

Suggested Readings:-

1. Barnes, R.D. (1999), Invertebrate Zoology. W.B. Saunder, Philadelphia.
2. Dhama, P.S. & Dhama, J. K.(2001), Invertebrates, R. Chand & Co., New Delhi.
3. Barth, R. H. and Broshears, R. E (1982), The Invertebrate world. Holt Saunder, Japan.
4. Brusca, R. C. and Brusca, G. J. (2003), Invertebrates (2nd ed). Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
5. Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed.) Macmillan, New York.
6. Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
7. Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology (3rd ed). Oxford University Press, New York.
8. Pechenik, A. Jan. (2000), Biology of the invertebrates, (4th ed), McGraw Hill Book Co. Singapore.

SEMESTER-I

PAPER-IV, V & VI, STREAM-2
ZOOLOGY

PRACTICAL-I (RELATED TO ZOO-IA and ZOO-IB)

Time: 3 Hrs.

Marks: 30

Important Note for Practical:-

1. Candidates will be required to submit their original note books containing record of their laboratory work.
2. Wherever possible, students must be taken out for excursion to the field (Zoological gardens, sea shores, ponds and hill stations etc.) to study habitat and ecology of the animals.
3. As per the latest UGC guidelines (D.O.No. F. 14-6/2014(CPP-II) dated 01-08-2014) the dissections should not be conducted. The guidelines on this issue are available on the UGC website: www.ugc.ac.in

I. Classification up to orders with ecological notes and economic importance (if any) of the following animals (Through Specimens or slides):

A. Protozoa. *Amoeba, Euglena, Trypanosoma, Noctiluca, Eimeria, Monocystis, Paramecium Opalina, Vorticella, Balantidium, Nyctotherus* and *Polystomella*.

B. Parazoa. *Sycon, Grantia, Euplectella, Hyalonema, Spongilla, Euspongia*.

C. Cnidaria. *Porpita, Velella, Physalia, Aurelia, Rhizostoma, Metridium, Millipora, Alcyonium, Tubipora, Zoanthus, Madrepora, Favia, Fungia* and *Astrangia*.
Hydra (W.M.), *Hydra* with buds, *Obelia* (colony and medusa), *Sertularia, Plumularia, Tubularia, Bougainvillea* and *Aurelia*

D. Platyhelminthes.

Dugesia, Fasciola, Taenia, Echinococcus.

Miracidium, Sporocyst, Redia, Cercaria of *Fasciola*, scolex and proglottids of *Taenia* (mature and gravid).

E. Aschelminthes. *Ascaris* (male and female), *Trichinella, Ancylostoma*.

F. Annelida. *Pheretima, Nereis, Heteronereis, Polynoe, Eunice, Aphrodite, Chaetopterus, Arenicola, Tubifex* and *Pontobdela*

2. Study of the following permanent stained preparations:

A. L.S. and T.S. *Sycon*, gemmules, spicules and spongin fibers of a sponge.

B. T.S. *Hydra* (Testis and ovary region)

C. T.S. *Fasciola* (Different regions)

D. T.S. *Ascaris* (Male and Female)

E. T.S. *Pheretima* (pharyngeal and typhlosolar regions), Setae, septal nephridia, spermathecae and ovary of *Pheretima* (Earthworm).

3. Preparation of the following slides:

Temporary permanent preparation of freshwater Protozoanculture.

4. **Demonstration** of digestive, reproductive and nervous systems of earthworm with the help of charts/videos/models.

5. Cell Biology:

A. Paper chromatography.

B. Thin layers chromatography

- C. Gel electrophoresis through photographs or through research laboratories
- D. Familiarity with TEM & SEM.
- E. Study of different ultra structures of cell organelles through photographs.

6. Visit to a vermi-composting unit and submission of report.

Note:- Some changes can be made in the practicals depending on the availability of material.

Guidelines for conduct of practical Examination:-

- | | | |
|----|---|---|
| 1. | Identify and classify the specimens upto order. Write a note on their habit, habitat, special features and economic importance. | 6 |
| 2. | Identify the slides/micrographs and give two reasons for identification. | 6 |
| 3. | Make a temporary mount of protozoa. | 2 |
| 4. | Draw a well labelled sketch of the given system of the organism and explain to the examiner. | 5 |
| 5. | Write down the theory and procedure of gel electrophoresis/ paper chromatography/thin layer chromatography/ SEM & TEM. | 2 |
| 6. | Report | 5 |
| 7. | Viva-voce & Practical file. | 4 |

SEMESTER-I
EPC I
LIFE SKILLS EDUCATION

Total Marks: 50
Internal marks: 25
External marks: 25

Course Objectives:

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

- Understand the concept and need of life skills in life.
- Correlate life skills with Success in life.
- Develop the skill of creative thinking, decision making and problem solving ability.
- Manage stress using various Stress coping strategies.

UNIT I**INTRODUCTION TO LIFE SKILLS**

- a) Life Skills – concept, need and significance
- b) The Four Pillars of Education (analyse various life skills and social skills with respect to Four Pillars of Education- review them in the context of success in life and prepare a review report)
- c) Relationship between Life Skills and Success in Life (Listen to various motivational speeches by various motivational speakers- review atleast three speeches with respect to success in life and prepare a review report).

UNIT II**LIFE SKILLS IN EDUCATION**

- a) Skill of creative thinking (For skill of creative thinking; Brain storming session on some national/ international problems like Indo-Pak relations, terrorism, environment degradation etc. will be conducted along with elaboration of steps of creative problem solving used by the teachers to orient the students and provoke them for creative expressions- a reflective report to be prepared).
- b) Skill of decision making (for skill of decision making; students will be doing group discussions and debates on current issues, situation analysis will be done to develop decision making skills- atleast three situation analysis will be carried out for report purposes).
- c) Skill of Stress management (workshop on stress management like Yoga, Art of living, mediation etc. will be conducted- leading to writing of a reflective report)

Evaluation Scheme**a) Internal****Attendance****05 Marks****Assignments on the following****20 Marks**

- Prepare a chart showing various life skills. their need and significance.
- Collection of atleast five Anecdotes and 15 quotations with their analysis with respect to life skills.
- Visit to Deaf and Dumb school/ School for blind and Voluntary service in pingalwara or orphanage (for total 6 hours) and write an experiential report

b) External**25 Marks**

1. Evaluation on the basis of report.
2. Evaluation of PPT Presentation on the need and significance of life skills and viva will be done by the external.

SEMESTER-I**Note:**

- For internal evaluation a committee of three teachers (concerned teacher, HOD and a senior faculty nominated by the principal) will be constituted at the institution level and coordinated by the principal of the concerned college.
- The committee will assess the performance of the students and evaluate the records. The award list will be forwarded to the university by the principal of the institution.
- The record in the form of files, CD, pendrive be retained for at least three years in the institution.
- In case of any aberration or any complaint the university / external agency is authorized to review the internal awards.

References:-

- Dakar Framework for Action, (2000). Education for All: Meeting our Collective Commitments, Dakar, Senegal.
- Hariharan, M., & Rath, R. (2008). *Coping with Life Stress: The Indian Experience*. New Delhi: Sage.
- Life Skills Resource Manual, Schools Total Health Program, (2006). Health Education and Promotion International Inc., Chennai.
- Kumar, J., & Keval, (2008). *Mass Communication in India, JAICO Publication India Pvt. Ltd*
- Morgan and King, (1993). *Introduction to Psychology*. New Delhi: Tata McGraw-Hill Publishing Company Ltd.
- NCERT (2005). Adolescence Education in Schools- Life skills Development General Framework; National Population Education Project, Department Of Education in Social Science and Humanities, New Delhi, India.
- Rao, P.L. (2008). *Enriching Human Capital through Training and Development*. Delhi: Excel Books.
- Singh, M. (2003). Understanding Life Skills, Background paper prepared for Education for All: The Leap to Equality
- UNESCO and Indian National Commission for Co-operation with UNESCO (2001). Life Skills in Non-formal Education: A Review.
- YUVA School Life Skills Programme (2008). *Handbook for Teachers*, Vol. I – IV, Department of Education and State Council of Educational Research and Training, Delhi.

Web Sites:

- UNESCO - <http://www.unesco.org/>
- UNFPA - <http://www.unfpa.org/>
- UNICEF - <http://www.unicef.org/>
- United Nations - <http://www.un.org/>
- WHO - <http://www.who.int/en/>
- India Portal - www.indiaportal.gov.in

SEMESTER-I**PAPER-VII: DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY PAPER)****PROBLEM OF DRUG ABUSE****Time: 3 Hours****Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**Meaning of Drug Abuse:**

Meaning, Nature and Extent of Drug Abuse in India and Punjab.

SECTION-B**Consequences of Drug Abuse for:**

Individual:	Education, Employment, Income.
Family	: Violence.
Society	: Crime.
Nation	: Law and Order problem.

SECTION-C**Management of Drug Abuse:**

Medical Management: Medication for treatment and to reduce withdrawal effects.

SECTION-D

Psychiatric Management: Counselling, Behavioural and Cognitive therapy.

Social Management: Family, Group therapy and Environmental Intervention.

References:-

1. Ahuja, Ram (2003), *Social Problems in India*, Rawat Publication, Jaipur.
2. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
3. Inciardi, J.A. 1981. *The Drug Crime Connection*. Beverly Hills: Sage Publications.
4. Kapoor. T. (1985) *Drug epidemic among Indian Youth*, New Delhi: Mittal Pub.

5. Kessel, Neil and Henry Walton. 1982, *Alcoholism. Harmond Worth*: Penguin Books.
6. Modi, Ishwar and Modi, Shalini (1997) *Drugs: Addiction and Prevention*, Jaipur: Rawat Publication.
7. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
8. Ross Coomber and Others. 2013, *Key Concept in Drugs and Society*. New Delhi: Sage Publications.
9. Sain, Bhim 1991, *Drug Addiction Alcoholism, Smoking obscenity* New Delhi: Mittal Publications.
10. Sandhu, Ranvinder Singh, 2009, *Drug Addiction in Punjab: A Sociological Study*. Amritsar: Guru Nanak Dev University.
11. Singh, Chandra Paul 2000. *Alcohol and Dependence among Industrial Workers*: Delhi: Shipra.
12. Sussman, S and Ames, S.L. (2008). *Drug Abuse: Concepts, Prevention and Cessation*, Cambridge University Press.
13. Verma, P.S. 2017, "*Punjab's Drug Problem: Contours and Characteristics*", Economic and Political Weekly, Vol. LII, No. 3, P.P. 40-43.
14. World Drug Report 2016, United Nations office of Drug and Crime.
15. World Drug Report 2017, United Nations office of Drug and Crime.

SEMESTER-II**PAPER-I: ENVIRONMENTAL EDUCATION****Time 1:30 Hrs.****Total Marks: 50****Terminal: 35****Sessional: 15****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives

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

- Reflect upon the concept and need of environmental education.
- Define major eco-systems and their conservation.
- Understand the role of different agencies in the protection of environment.
- Develop desirable attitude, values and respect for protection of environment.

SECTION-A**ENVIRONMENTAL EDUCATION**

- a) Environmental education: Concept, objectives, need and guiding principles.
- b) Concept of ecology, environment, biosphere, community, population and ecosystem. Structural and functional components of ecosystem i.e. abiotic and biotic factors food chain, food- web & flow of energy.

SECTION-B

Pollution: Concept, types (air, soil, water, and noise pollution), sources, effect and control of pollution, green house effect, ozone depletion, and climate change.

SECTION-C**ENVIRONMENTAL CONCERNS**

- a) Need for sensitizing learners towards concern of environmental conservation (various school subjects and in co-curricular activities)
- b) Various ways and means of protection and preservation of environment with special reference to a forestation and solid waste management.
- c)

SECTION-D

Role of government and non-government organizations in protection and preservation of environment.

SEMESTER-II**SESSIONAL WORK:****Performance in unit tests and house examination 5 Marks****Files to be prepared and submitted for evaluation 10 Marks****Assignments on the following**

- Work on a project related to any issue of environmental preservation and protection.
- Conduct a survey of environmental problems of the community.

References:-

- Centre for Environmental Education (1997). *The Green Teacher: Ideas, Experience and Learning*. In Educating for the Environment. Ahmadabad: CEE.
- Dani, H.M (1996): *Environmental Education*. Publication Bureau, Panjab University, Chandigarh.
- Garg, K.K and Jain, S.C. *Environment Lessons For Common Man*. Environment Society of India.
- Ghanta R. and Rao, D.B. (1998). *Environmental Education, Problems and Prospectus*. New Delhi: Discovery Publishing House.
- Kohli, V.K. and Kohli, V. (2003). *Environmental Pollution and Management*. Ambala: Vivek Publishers.
- Mukherjee, Roma. (2002). *Environmental Management and Awareness Issues*. New Delhi: Sterling Publishers Pvt. Ltd.
- Raghunathan, M., & Pandey, M. (1999). *The Green Reader: An Introduction to Environmental Concerns & Issues*. Ahmadabad: Centre for Environment Education
- Rajagopalan, R. (2006): *Environmental Studies From Crisis to Cure*. Press Delhi: Oxford University.
- Reddy, K.P. and Reddy, D.N. (2002): *Environmental Education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- UNEP (2013). *Emerging issues in our global environment (year book)*. United Nations Environment Programme.
- UNESCO-UNEP (1980). *Environment Education: What, Why, How . . .* Paris: International Education Series.
- UNESCO-UNEP (1990). *Basic Concepts in Environmental Education*. In Environment Education Newsletter. Paris: UNESCO.

SEMESTER-II**PAPER-II: ENGLISH (COMPULSORY)****Time: 3 Hours****Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Texts Prescribed:

1. *Tales of Life* (Guru Nanak Dev University, Amritsar) Stories at Sr. No. 7, 9, 10, 11, 12
2. *Prose for Young Learners* (Guru Nanak Dev University, Amritsar) Essays at Sr. No. 7, 8, 9, 10, 11
3. *English Grammar in Use* (Fourth Edition) by Raymond Murphy, CUP (Units: 49-97)

The syllabus is divided in four sections as mentioned below.

SECTION-A

English Grammar in Use, 4th Edition by Raymond Murphy, CUP (Units: 49-81)

SECTION-B

Personal letter Writing and English Grammar in Use (Units: 82-97)

SECTION-C

Tales of Life (Guru Nanak Dev University, Amritsar) 7, 9, 10, 11, 12

SECTION-D

Prose for Young Learners (Fourth Edition) by Raymond Murphy, CUP 7, 8, 9, 10 and 11

SEMESTER-II

PAPER-III: PUNJABI (COMPULSORY) ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

ਸਮਾਂ: 3 ਘੰਟੇ

ਕੁਲ ਅੰਕ: 50

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਇੱਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿੱਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿੱਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

ਸੈਕਸ਼ਨ - ਏ

ਦੋ ਰੰਗ (ਕਹਾਣੀ ਭਾਗ) (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ ਅਤੇ ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ),
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।

(ਵਿਸ਼ਾ-ਵਸਤੂ/ਸਾਰ/ਲੇਖਕ ਦਾ ਜੀਵਨ ਤੇ ਰਚਨਾ)

ਸੈਕਸ਼ਨ - ਬੀ

ਸੰਸਾਰ ਦੀਆਂ ਪ੍ਰਸਿੱਧ ਹਸਤੀਆਂ (ਜੀਵਨੀ ਨੰ: 10 ਤੋਂ 18 ਤੱਕ)
(ਸੰਪਾ. ਪ੍ਰਿੰ. ਤੇਜਾ ਸਿੰਘ, ਹਰਨਾਮ ਸਿੰਘ ਸਾਮ),
ਪੰਜਾਬੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।

(ਵਿਸ਼ਾ/ਸਾਰ/ਨਾਇਕ ਬਿੰਬ)

ਸੈਕਸ਼ਨ - ਸੀ

(ੳ) ਸ਼ਬਦ-ਬਣਤਰ ਅਤੇ ਸ਼ਬਦ-ਰਚਨਾ : ਪਰਿਭਾਸ਼ਾ, ਮੁਢਲੇ ਸੰਕਲਪ।
(ਅ) ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ

ਸੈਕਸ਼ਨ - ਡੀ

(ੳ) ਦਫ਼ਤਰੀ ਚਿੱਠੀ ਪੱਤਰ
(ਅ) ਮੁਹਾਵਰੇ ਅਤੇ ਅਖਾਣ

SEMESTER-II

Mudhli Punjabi

ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In lieu of Compulsory Punjabi)

ਸਮਾਂ: 3 ਘੰਟੇ

ਕੁਲ ਅੰਕ: 50

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿੱਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿੱਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ

ਸੈਕਸ਼ਨ-ਏ

ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ
(ਨਾਂਵ, ਪੜਨਾਂਵ, ਕਿਰਿਆ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ, ਸਬੰਧਕ, ਯੋਜਕ ਅਤੇ ਵਿਸਮਿਕ)

ਸੈਕਸ਼ਨ-ਬੀ

ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ : ਮੁੱਢਲੀ ਜਾਣ-ਪਛਾਣ
(ੳ) ਸਾਧਾਰਨ ਵਾਕ, ਸੰਯੁਕਤ ਵਾਕ ਅਤੇ ਮਿਸ਼ਰਤ ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)
(ਅ) ਬਿਆਨੀਆ ਵਾਕ, ਪ੍ਰਸ਼ਨਵਾਚਕ ਵਾਕ ਅਤੇ ਹੁਕਮੀ ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)

ਸੈਕਸ਼ਨ-ਸੀ

ਪੈਰ੍ਹਾ ਰਚਨਾ
ਸੰਖੇਪ ਰਚਨਾ

ਸੈਕਸ਼ਨ-ਡੀ

ਚਿੱਠੀ ਪੱਤਰ (ਘਰੇਲੂ ਅਤੇ ਦਫ਼ਤਰੀ)
ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ

SEMESTER-II

**Punjab History & Culture (C. 320 to 1000 B.C.)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)**

Time: 3 Hours**Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

1. Alexander's Invasion and its Impact
2. Punjab under Chandragupta Maurya and Ashoka.

SECTION-B

3. The Kushans and their Contribution to the Punjab.
4. The Panjab under the Gupta Empire.

SECTION-C

5. The Punjab under the Vardhana Emperors
6. Socio-cultural History of Punjab from 7th to 1000 A.D.

SECTION-D

7. Development of languages and Education with Special reference to Taxila
8. Development of Art & Architecture

Suggested Readings:-

1. L. M Joshi (ed), *History and Culture of the Punjab*, Art-I, Punjabi University, Patiala, 1989 (3rd edition)
2. L.M. Joshi and Fauja Singh (ed.), *History of Punjab*, Vol.I, Punjabi University, Patiala, 1977.
3. Budha Parkash, *Glimpses of Ancient Punjab*, Patiala, 1983.
4. B.N. Sharma: *Life in Northern India*, Delhi. 1966.

SEMESTER-II**PAPER-IV, V & VI, STREAM-1
PHYSICS****PAPER-A: RELATIVITY AND ELECTROMAGNETISM
(THEORY)****Time: 3 Hours****Marks: 35****Total Teaching Hrs: 45(3h/week)****Pass Marks: 35%****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Postulates of special theory of relativity. Lorentz transformations, observer and viewer in relativity. Relativity of simultaneity, Length, Time, velocities. Relativistic Doppler effect. Variation of mass with velocity, mass-energy equivalence, rest mass in an inelastic collision, relativistic momentum & energy, their transformation, concepts of Minkowski space, four vector formulation.

11 Lectures**SECTION-B**

Invariance of charge, E in different frames of references. Fields of a point charge moving with constant velocity, Lorentz's force, Definition of B. Biot Savart's Law and its application to long straight wire, circular current loop and solenoid. Ampere's Circuital law and its application. Divergence and curl of B. Hall effect, derivation of Hall coefficient. Vector potential, current-density and its applications. Transformation equation of E and B from one frame to another.

11 Lectures**SECTION-C**

Faraday's Law of EM induction, Displacement current, Mutual inductance and reciprocity theorem. Self inductance, L for solenoid, Coupling of Electrical circuits. Analysis of LCR series and parallel resonant circuits, Q-factor, Power consumed, power factor.

11 Lectures**SECTION-D**

Maxwell's equations their derivation and characterizations, E.M. waves and wave equation in a medium having finite permeability and permittivity but with conductivity σ). Poynting vector, Impedance of a dielectric to EM waves. EM waves in a conducting medium and Skin depth. EM wave velocity in a conductor and anomalous dispersion. Response of a conducting medium to EM waves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence.

12 Lectures**Books Suggested:-**

1. Introduction to Electrodynamics: D.J. Griffiths
2. Physics of Vibrations and Waves: H.J. Pain.
3. EM Waves and Radiating Systems: Edward C. Jordan and K.G. Balmain.
4. Fields and Waves Electromagnetic: David K. Cheng.

SEMESTER-II**PAPER-IV, V & VI, STREAM-1
PHYSICS****PAPER-B: VIBRATION AND WAVES
(THEORY)****Time: 3 Hours****Marks: 35****Total Teaching Hrs: 45(3h/week)****Pass Marks: 35%****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Simply harmonic motion, energy of a SHO. Compound pendulum. Torsional pendulum
Electrical Oscillations Transverse Vibrations of a mass on string, superposition of two
perpendicular SHM having periods in the ration 1:1 and 1:2.

11 Lectures**SECTION-B**

Decay of free Vibrations due to damping. Differential equation of damped harmonic motion,
types of motion, types of damping. Determination of damping co-efficient- Logarithmic
decrement, relaxation time and Q-Factor. Electromagnetic damping (Electrical oscillator).

11 Lectures**SECTION-C**

Differential equation for forced mechanical and electrical oscillators. Transient and steady state
behaviour. Displacement and velocity variation with driving force frequency, variation of phase
with frequency, resonance. Power supplied to an oscillator and its variation with frequency.
Q-value and band width. Q-value as an amplification factor. Stiffness coupled oscillators,
Normal co-ordinates and normal modes of vibration. Inductive coupling of electrical oscillators.

12 Lectures**SECTION-D**

Types of waves, wave equation (transverse) and its solution characteristic impedance of a string.
Impedance matching. Reflection and Transmission of waves at boundary. Reflection and
transmission of energy. Reflected and transmitted energy coefficients. Standing waves on a
string of fixed length. Energy of vibrating string. Wave and group velocity.

11 Lectures**Books Suggested:-**

1. Fundamentals of Vibrations and Waves: S.P. Puri.
2. Physics of Vibrations and Waves: H.J. Pain

SEMESTER-II**PAPER-IV, V & VI, STREAM-1
PHYSICS****(PRACTICAL)****Marks: 30****General Guidelines for Practical Examination:**

- I. The distribution of marks is as follows :
- | | |
|-----------------------------|----------|
| i) One experiment | 15 Marks |
| ii) Brief Theory | 5 Marks |
| iii) Viva-Voce | 5 Marks |
| iv) Record (Practical file) | 5 Marks |
- II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
- III. Number of candidates in a group for practical examination should not exceed 12.
- IV. In a single group no experiment be allotted to more than three examinee in any group.
1. To determine low resistance with Carey-Foster's Bridge.
 2. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
 3. To study the induced e.m.f. as a function of the velocity of the magnet.
 4. Study of phase relationships using impedance triangler for LCR circuit and calculate impedance.
 5. Resonance in a series LCR circuits for different R-value and calculate Q-value.
 6. Resonance in a parallel LCR circuits for different R-value and calculate Q-value.
 7. Capacitance by flashing and quenching of a neon lamp.
 8. To compare capacitance of two capacitors by de-Sauty's bridge.
 9. To determined L using Anderson Bridge.
 10. To find the value of B_H the horizontal component of earth's magnetic field in the lab using a deflection & vibration magnetometer.
 11. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.

SEMESTER-II**PAPER-IV, V & VI, STREAM-1
CHEMISTRY****INORGANIC CHEMISTRY-II
(THEORY)****Time: 3 Hrs.****45 Hrs. (3 Hrs./Week)****Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**I. p-Block Elements-I****10Hrs.**

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16, hydrides of boron-diborane and higher boranes, Borazine, borohydrides, fullerenes.

SECTION-B**II. s-Block Elements****10 hrs.**

Comparative studies, diagonal relationship, salient features of hydrides, salvation and complexation tendencies.

III. Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

SECTION-C**IV. p-Block Elements-II****10 Hrs.**

Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide, Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

SECTION-D**V. Chemistry of Transition Elements****15 Hrs.**

Characteristic properties of *d*-block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. General characteristics of elements of Second and Third Transition Series, comparative treatment with their 3d analogues in respect of ionic radii, oxidation states, magnetic behaviour.

Books Suggested:-

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman & Hall Ltd., 1991.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.
4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994,
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company, 1984.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004,
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11. Inorganic Chemistry, A.G. Sharpe, ELBS.

SEMESTER-II**PAPER-IV, V & VI, STREAM-1
CHEMISTRY****CHEMISTRY (PHYSICAL CHEMISTRY-I)
(THEORY)**

**Time: 3 Hrs.
45 Hrs. (3 Hrs./Week)**

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note: Log table and scientific calculators are allowed

SECTION-A**I. Gaseous States**

11 Hrs.

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waal's equation of state.

Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waal's equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases.

SECTION-B**II. Liquid State**

11 Hrs.

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquids crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

SECTION-C**III. Colloidal State**

11 Hrs.

Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical and electrical properties, stability of colloids, protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers. general applications of colloids.

SECTION-D**IV. Solutions, Dilute Solutions and Colligative Properties****12 Hrs.**

Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Books Suggested:-

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. University General Chemistry, C.N.R. Rao, Macmillan.

SEMESTER-II**PAPER-IV, V & VI, STREAM-1
CHEMISTRY****(PRACTICAL)****Duration: 3½ Hrs.
6 Period/Week****Marks: 30****Crystallisation:**

Concept of indication of crystallisation. Phthalic acid from hot water (using fluted filter paper & stem less funnel)

Acetanilide from boiling water.

Naphthalene from Ethanol

Benzoic acid from water

Physical Chemistry

1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalysed by Hydrogen ions at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.

Viscosity, Surface Tension (Pure Liquids)

3. To study the viscosity and surface tension of CCI glycerine solution in water.
4. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
5. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
6. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Practical Examination:

	Marks
1) Crystallisation	05
2) Physical Experiment	18
3) Viva-Voce	04
4) Note Book	03

Books Suggested:-

1. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
5. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
6. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand & Co.
8. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.
9. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

SEMESTER-II**PAPER-IV, V & VI, STREAM-1
MATHEMATICS****PAPER-I: CALCULUS AND DIFFERENTIAL EQUATIONS****Time: 3 Hours****Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Asymptotes, Tests for concavity and convexity, Points of inflexion, Multiple Points, Curvature, Tracing of Curves (Cartesian and Parametric coordinates only).

SECTION-B

Integration of hyperbolic functions. Reduction formulae. Definite integrals. Fundamental theorem of integral calculus. Quadrature, rectification.

SECTION-C

Exact differential equations. First order and higher degree equations solvable for x, y, p . Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Orthogonal trajectories.

SECTION-D

Linear differential equations with constant and variable coefficients. Variation of Parameters method, reduction method, series solutions of differential equations. Power series method, Bessel and Legendre equations (only series solution).

Books Recommended:-

1. D.A. Murray: Introductory Course in Differential Equations. Orient Longman (India), 1967.
2. G.F. Simmons: Differential Equations, Tata McGraw Hill, 1972.
3. E.A. Coddington: An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.
4. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
5. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999. 52

SEMESTER-II**PAPER-IV, V & VI, STREAM-1
MATHEMATICS****PAPER-II: CALCULUS****Time: 3 Hours****Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Limit and Continuity of functions of two variables, Partial differentiation, Change of variables, Partial derivatives and differentiability of real-valued functions of two variables, Schwartz's and Young's Theorem, Statements of Inverse and implicit function theorems and applications.

SECTION-B

Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobians, Envelopes. Evolutes, Maxima, Minima and saddle points of functions of two variables.

SECTION-C

Lagrange's undetermined multiplier method, Double and Triple Integrals, Change of variables., Applications to evaluation of areas, Volumes, Surfaces of solid of revolution, Change of order of integration in double integrals.

SECTION-D

Application to evaluation of area, volume, surface of solids of revolutions.

Books Recommended:-

1. Narayan, S. and P.K. Mittal: Integral Calculus. Sultan Chand & Sons.
2. Kreyszig, E.: Advanced Engineering Mathematics.
3. Narayan S. and P.K. Mittal: Differential Calculus, Sultan Chand & Sons.

SEMESTER-II**PAPER-IV, V & VI, STREAM-2
CHEMISTRY****INORGANIC CHEMISTRY-II
(THEORY)****Time: 3 Hrs.****45 Hrs. (3 Hrs./Week)****Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**I. p-Block Elements-I****10Hrs.**

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16, hydrides of boron-diborane and higher boranes, Borazine, borohydrides, fullerenes.

SECTION-B**II. s-Block Elements****10 hrs.**

Comparative studies, diagonal relationship, salient features of hydrides, salvation and complexation tendencies.

III. Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

SECTION-C**IV. p-Block Elements-II****10 Hrs.**

Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide, Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

SECTION-D**V. Chemistry of Transition Elements****15 Hrs.**

Characteristic properties of *d*-block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. General characteristics of elements of Second and Third Transition Series, comparative treatment with their 3d analogues in respect of ionic radii, oxidation states, magnetic behaviour.

Books Suggested:-

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman & Hall Ltd., 1991.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.
4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994,
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company, 1984.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004,
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11. Inorganic Chemistry, A.G. Sharpe, ELBS.

SEMESTER-II**PAPER-IV, V & VI, STREAM-2
CHEMISTRY****CHEMISTRY (PHYSICAL CHEMISTRY-I)
(THEORY)**

**Time: 3 Hrs.
45 Hrs. (3 Hrs./Week)**

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note: Log table and scientific calculators are allowed

SECTION-A**I. Gaseous States**

11 Hrs.

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waal's equation of state.

Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waal's equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases.

SECTION-B**II. Liquid State**

11 Hrs.

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquids crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

SECTION-C**III. Colloidal State**

11 Hrs.

Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical and electrical properties, stability of colloids, protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers. general applications of colloids.

SECTION-D**IV. Solutions, Dilute Solutions and Colligative Properties****12 Hrs.**

Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Books Suggested:-

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. University General Chemistry, C.N.R. Rao, Macmillan.

SEMESTER-II**PAPER-IV, V & VI, STREAM-2
CHEMISTRY****(PRACTICAL)****Duration: 3½ Hrs.
6 Period/Week****Marks: 30****Crystallisation:**

Concept of indication of crystallisation. Phthalic acid from hot water (using fluted filter paper & stem less funnel)

Acetanilide from boiling water.

Naphthalene from Ethanol

Benzoic acid from water

Physical Chemistry

1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalysed by Hydrogen ions at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.

Viscosity, Surface Tension (Pure Liquids)

1. To study the viscosity and surface tension of CCI glycerine solution in water.
2. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
3. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
4. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Practical Examination:**Marks**

- | | |
|------------------------|----|
| 1) Crystallisation | 05 |
| 2) Physical Experiment | 18 |
| 3) Viva-Voce | 04 |
| 4) Note Book | 03 |

Books Suggested:-

1. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
5. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
6. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand & Co.
8. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.
9. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

SEMESTER-II**PAPER-IV, V & VI, STREAM-2
BOTANY****PAPER-II A: CELL BIOLOGY
(THEORY)****Time: 3 Hrs.****Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Structure and Function of Nucleus; Ultrastructure; nuclear membrane; nucleolus.

SECTION-B

Extra nuclear Genome: Presence and function of mitochondrial and plastid DNA; plasmids. structure and function of other organelles: Golgi bodies, ER, Peroxisomes, Vacuoles

SECTION-C

Chromosome Organization: Morphology; centromere and telomere; chromosome alterations; deletions, duplications, translocations, inversions; variations in chromosome number, Aneuploidy, polyploidy; sex chromosomes.

SECTION-D

The Cell Envelopes: Plasma membrane; bilayer lipid structure; functions; the cell wall.

Suggested Readings:-

1. Gupta, P.K. (2013). A Text-book of Cell and Molecular Biology (3rd edition). Rastogi Publications, Meerut, India
2. Johnson, A., Raff, L. and Walter, R. (2008). Molecular Biology of the Cell (5th Edition). Taylor and Francis Group, USA.
3. Karp, G. (2013). Cell and Molecular Biology: Concepts and Experiments (7th Edition). Wiley Publishers, USA.
4. Kleinsmith, L.J. and Kish, V.M. (1995). Principles of Cell and Molecular Biology (2nd edition). Harper Collins College Publishers, New York, USA.
5. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Bretscher, A. and Ploegh, H. (2016). Molecular Cell Biology, W.H. Freeman & Co., New York, USA.
6. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics (5th Edition). John Wiley and Sons Inc., U.S.A.

SEMESTER-II**PAPER-IV, V & VI, STREAM-2
BOTANY****PAPER-II B: GENETICS
(THEORY)****Time: 3 Hrs.****Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

DNA the Genetic Material: DNA structure; replication; DNA-protein interaction; the nucleosome model; genetic code; satellite and repetitive DNA.

SECTION-B

Cell Division: Mitosis; meiosis. **Genetic Inheritance:** Mendelism; laws of segregation and independent assortment; linkage analysis; allelic and non-allelic interactions.

SECTION-C

Gene expression: Structure of gene; transfer of genetic information; transcription, translation, protein synthesis, tRNA; ribosomes; regulation of gene expression in prokaryotes and eukaryotes; proteins, 1D, 2D, and 3D structure.

SECTION-D

Genetic Variations: Mutations, spontaneous and induced; transposable genetic elements; DNA, damage and repair.

Suggested Readings:-'

1. Brown, T.A. (2011). Genetics: A Molecular Approach (3rd Edition). BIOS Scientific Publishers, UK.
2. Fletcher, H., Hickey, I. and Winter, P. (2010). Instant Notes on Genetics (3rd edition) Taylor and Francis Group, USA.
3. Gardner, E.J., Simmons, M.J. and Snustad, D.P. (2012). Principles of Genetics (8th Edition). Wiley Sons, USA.
4. Gupta, P.K. (2016). Cell and Molecular Biology, Rastogi Publications, Meerut, India.
5. Kleinsmith, L.J. and Kish, V.M. (1995). Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA.
6. Krebs, B. E., Goldstein, E.S. and Kilpatrick, S.T. (2011). Lewins Genes X. Jones and Bartlett Publishers, LLC, UK.
7. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Bretscher, A. and ploegh, H. (2016). Molecular Cell Biology, W.H. Freeman & Co., New York, USA.
8. Singh, B.D. (2007). Molecular Genetics. Kalyani Publishers, India.
9. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics (5th Edition). John Wiley and Sons Inc., U.S.A.

SEMESTER-II**PAPER-IV, V & VI, STREAM-2
BOTANY****BOTANY PRACTICAL-II (BASED ON PAPERS-II A AND II B)****Practical Hours: 4½ Hours/week****Marks: 30****Suggested Laboratory Exercises**

1. Teachers may select plants/material available in their locality/institutions.
2. To study cell structure from onion leaf peels; demonstration of staining and mounting methods.
3. Comparative study of cell structure in onion cells, Hydrilla and Spirogyra. Study of cyclosis in Tradescantia Staminal Cells.
4. Study of plastids to examine pigment distribution in plants (e.g. Cassia, Lycopersicon and Capsicum). 4. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
5. Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.
6. Examination of various stages of mitosis and meiosis using appropriate plant material (e.g. onion root tips, onion flower buds).
7. Preparation of karyotypes from dividing root tip cells and pollen grains.
8. Cytological examination of special types of chromosomes: bar body, lampbrush and polytene chromosomes.
9. Working out the laws of inheritance using seed mixtures.
10. Working out the mode of inheritance of linked genes from test cross and/or F2 data.

Suggested Readings:-

1. Fukui, K. and Nakayama, S. 1996. Plant Chromosomes; Laboratory Methods, CRC Press, Boca Raton, Florida.
2. Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology; Structure and Function, Jones and Barlett Publishers, Boston, Massachusetts.
3. Harns, N. and Oparka, K.J. 1994. Plant Cell Biology, A Practical Approach. IRL Press, at Oxford University Press, Oxford, UK.
4. Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes; Analysis. Manipulation and Engineering, Harwood Academic Publishers, Australia.
5. Plopper, G. (2016). Principles of Cell Biology. Jones and Barnett Learning, Boston, Massachusetts.

SEMESTER-II

PAPER-IV, V & VI, STREAM-2
ZOOLOGY

Paper	Maximum Marks		Hours of Teaching	
	Theory Marks	Practical Marks	Theory	Practical
			Credit Hrs. per Week (60 min. each)	
ZOO-IIA (Ecology)	35	—	3 Hrs	—
ZOO-IIB (Biodiversity-II)	35	—	3 Hrs	—
PRACTICAL-II (RELATED TO ZOO-IIA and ZOO-IIB)	—	30	—	4½ Hrs

SEMESTER-II**PAPER-IV, V & VI, STREAM-2
ZOOLOGY****ZOO-II A: ECOLOGY
(THEORY)****Max. Time: 3 Hrs.****Max Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Ecology: Definition, Subdivisions and scope of ecology.
 Ecosystem: Components, ecological energetics, food web, major ecosystems of the world.
 Ecological factors: Temperature, light and soil as ecological factors.

SECTION-B

Nutrients: Biogeochemical cycles and concept of limiting factors.
 Ecological Adaptations: Morphological, physiological and behavioural adaptations in animals in different habitats.

SECTION-C

Population: Characteristics and regulations of population. Inter and Intra Specific relationship: Competition, Predation, Parasitism, Commensalism and Mutualism.
 Biotic community: Characteristics, ecological succession, ecological niche.

SECTION-D

Natural resources: Renewable and nonrenewable natural resources and their conservations.
 Environmental Issues: Causes, impact and control of environmental pollution.

Suggested Readings:-

1. Anderwartha, H.G. and Birch, L. C. (1970), The distribution and abundance of animals, University of Chicago Press, Chicago London.
2. Beeby, A. (1992), Applying Ecology, Chapman and Hall Madras.
3. Begon, M., Harper J. L. and Townsend, C. R. (1995), Ecology – Individuals, populations and communities, Blackwell Science, Cambridge UK.
4. Brewer, R. (1994), The science of Ecology, Saunders College of Publishing, New York.
5. Chapman, J. L. and Resis, M. J. (1995), Ecology- Principles and applications, Cambridge University Press, Cambridge UK.
6. Kaeighs, S. C. (1974), Ecology with special references to animal and Man, Prentice Hall Inc.
7. Kormondy, E.J. (1975), Concept of Ecology, Englewood Cliffs, N.J. Prentice Hall Inc.
8. Krebs C.J. (1982), Ecology, Harper & Row, New York.
9. Putmann, R. J. and Wratten, S. D. (1984), Principles of Ecology, Crown Helm, London.

SEMESTER-II**PAPER-IV, V & VI, STREAM-2
ZOOLOGY****ZOO-II B: BIODIVERSITY-II
(ARTHROPODA TO HEMICHORDATA)
(THEORY)****Max. Time: 3 Hrs.****Max Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Arthropoda: Type study- Prawn
Type study- *Periplaneta americana* (Cockroach),
Social organizations in insects (Honey bee and Termite)

SECTION-B

Mollusca: Type study- *Pila globosa*, Torsion, Pearl formation

SECTION-C

Echinodermata: Type study - *Asterias* (Star fish), Study of Echinoderm larvae

SECTION-D

Hemichordata: Type study - *Balanoglossus* (External characters only). Affinities of Hemichordates with Non-Chordates and Chordates

Suggested Readings:-

1. Barnes, R.D. (1999), Invertebrate Zoology. W.B. Saunder, Philadelphia.
2. Dhami, P.S. & Dhami, J. K., Invertebrates, R. Chand & Co., New Delhi, 2001.
3. Barth, R. H. and Broshears, R. E (1982), The Invertebrate world. Holt Saunder, Japan.
4. Brusca, R. C. and Brusca, G. J. (2003), Invertebrates (2nd ed), Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
5. Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed), Macmillan, New York.
6. Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
7. Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology (3rd ed), Oxford University Press, New York.
8. Pechenik, A. Jan. (2000), Biology of the invertebrates, (4th ed), McGraw Hill Book Co. Singapore.

SEMESTER-II

PAPER-IV, V & VI, STREAM-2
ZOOLOGY

PRACTICAL-II (RELATED TO ZOO-II A and ZOO-II B)

Time: 3hrs.

Marks: 30

Important Note for Practical:-

1. Candidates will be required to submit their original note books containing record of their laboratory work.
2. Wherever possible, students must be taken out for excursion to the field (Zoological gardens, sea shores, ponds and hill stations etc.) to study habitat and ecology of the animals.
3. As per the latest UGC guidelines (D.O.No. F. 14-6/2014(CPP-II) dated 01-08-2014) the dissections should not be conducted. The guidelines on this issue are available on the UGC website: www.ugc.ac.in

1. Classification up to orders with ecological notes and economic importance (if any) of the following animals :

- A. Arthropoda : *Peripatus*, *Palaemon* (prawn), *Lobster*, *Cancer* (crab), *Sacculina*, *Eupagurus* (hermit Crab), *Lepas*, *Balanus*, *Cyclops*, *Daphnia*, *Lepisma*, *Periplaneta* (cockroach), *Schistocerca* (locust), *Poeciloceris* (ak grasshopper), *Gryllus* (cricket), *Mantis* (praying mantis), *Cicada*, *Forficula* (earwig), Dragonfly, Termite queen, Bug, Moth, Beetles, *Polistes*, (wasp), *Apis* (honey bee), *Bombyx*, *Pediculus* (body louse) Millipede and Centipede, *Palamnaeus* (scorpion), *Aranea* (spider) and *Limulus* (king Crab).
- B. Mollusca: *Anodonta*, *Mytilus*, *Ostrea*, *Cardium*, *Pholas*, *Solen* (razor fish), *Pecten*, *Haliothis*, *Patella*, *Aplysia*, *Doris*, *Limax*, *Loligo*, *Sepia*, *Octopus*, *Nautilus* shell (Complete and T.S.), *Chiton*, *Dentalium*.
- C. Echinodermata: *Asterias*, *Echinus* *Ophiothrix*, *Antedon*.
- D. Hemichordata: *Balanoglossus*.

2. Study of the following permanent stained preparations:

- A. Trachea and mouth parts of Insects
- B. Radula and osphradium of *Pila*
- C. T.S. Star fish (Arm).

3. Demonstration of digestive and nervous systems of *Periplaneta* (cockroach) with the help of charts/models/videos.**4. Ecology:**

- A. Study of animal adaptations with the help of specimens, charts and models.
- B. Study of abiotic and biotic components of an ecosystem.
- C. Study of different types of nests of birds.
- D. Study and preparation of Zoogeographical charts.

5. Assignment

Note:- Some changes can be made in the practicals depending on the availability of material.

Guidelines for conduct of practical Examination:-

1. Identify and classify the specimens upto order. Write a note on their habit, habitat, special features and economic importance. 6
2. Draw a well labelled sketch of the given system of the animal & explain it to the examiner. 4
3. Identify the slides/models and give two reasons for identification. 4
4. Identify the adaptive feature/nest. 4
5. Mark the distribution of animals of a realm on the map. 4
6. Assignment 3
7. Viva-voce & Practical file. 5

SEMESTER-II**EPC II****COURSE TITLE: UNDERSTANDING THE SELF****Total Marks: 50****Internal marks: 25****External marks: 25**

Course Objectives: After Completion of Course, the Students will be able to:

- To help student teachers discover and develop open-mindedness, the attitude of a self-motivated learner, having self-knowledge and self-restraint.
 - To help student teachers develop the capacity for sensitivity, sound communication skills and ways to establish peace and harmony.
 - To develop the capacity to facilitate personal growth and social skills in their own students
- Curriculum Transaction:** In these workshops/ discourses sharing of case studies/ watching movies or documentaries, brain storming exercises, training session, physical excursions, meditations etc. should be encouraged. Students will write reflective journals and give feedback to each session and maintain record.

SECTION – A: EXPLORING THE AIM OF LIFE**Objectives**

- To enable students to develop a vision of life for themselves.
- To encourage students to give conscious direction to their lives to take responsibility for their actions.
- To develop a holistic understanding of the human self and personality.

Workshop Themes

1. Understanding different dimensions of self and personality and way in which they influence the dynamics of identity formation, values and direction of life.
2. Philosophy of Yoga and its role in well-being.
3. Developing positivity, self-esteem and emotional integration.
4. Writing a self-reflective journal

SECTION – B DEVELOPING SENSITIVITY**Objectives**

- To enable students to examine and challenge the stereotypical attitudes and prejudices that influence identity formation and the process of individuation.
- To encourage students to develop the capacity for perspective taking and appreciating different points of view.
- To develop sensitivity towards needs of children by connecting with one's own childhood experiences

SEMESTER-II**Workshop Themes**

1. Defining consciously one's own values towards self and society and develop a capacity to understand and appreciate divergent points of view.
2. Developing the capacity for empathic listening and communication skills.
3. Understanding group dynamics and communication
4. Exploring and practicing ways to facilitate personal growth and develop social skills in students while teaching

Evaluation scheme**a) Internal****Attendance****05 Marks****Assignments on the following**

Writing of reflective journal

Participation in the workshops

20 Marks**b) External****25 marks**

1. Evaluation on the basis of reflective journal.
2. Evaluation of PPT Presentation on the report of yoga and its practices on the development of well being and viva will be done by the external.

Note:-

- For internal evaluation a committee of three teachers (concerned teacher, HOD and a senior faculty nominated by the principal) will be constituted at the institution level and coordinated by the principal of the concerned college.
- The committee will assess the performance of the students and evaluate the records. The award list will be forwarded to the university by the principal of the institution.
- The record in the form of files, CD, pendrive be retained for at least three years in the institution.
- In case of any aberration or any complaint the university / external agency is authorized to review the internal awards.

ESSENTIAL READINGS:-

- **Antoine de Saint-Exupery.** (1977). *The Little Prince*. London, UK:
- **Wordsworth** Edition Translated by Irene Testot-ferry (available in Hindi).
- **Dalal, A.S. (2001).** Our Many Selves. Pondicherry, India: *Sri Aurobindo Ashram*.
- **Frankl, V. (1946).** *Man's Search for Meaning*. New York: Pocket Books.
- **Joshi, K. (ed) (2005).** *The Aim of Life*. Auroville, India: Saiier.
- **Krishnamurti, J. (1953).** *Education and the Significance of Life*, Ojai,
- **California, USA:** Krishnamurti Foundation Trust.
- **NCERT, (2006).** *Education for Peace, Position Paper*. New Delhi: NCERT.
- **Walk with Me: A Guide for Inspiring Citizenship Action. (2006).** New Delhi: Pravah Pub.

Readings for Discussion:-

- **Bach, R. (1994).** Jonathan Livingston Seagull, London, UK: HarperCollins Publications.
- **Chatterjee, D. (1998).** *Leading Consciously*, MA, USA: Butterworth-

SEMESTER-II**PAPER-VII: DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY PAPER)****DRUG ABUSE: MANAGEMENT AND PREVENTION****Time: 3 Hours****Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**Prevention of Drug abuse:**

Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.

SECTION-B

School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

SECTION-C**Controlling Drug Abuse:**

Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program

SECTION-D

Legislation: NDPs act, Statutory warnings, Policing of Borders, Checking Supply/Smuggling of Drugs, Strict enforcement of laws, Time bound trials.

References:-

1. Ahuja, Ram (2003), *Social Problems in India*, Rawat Publication, Jaipur.
2. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
3. Inciardi, J.A. 1981. *The Drug Crime Connection*. Beverly Hills: Sage Publications.
4. Kapoor. T. (1985) *Drug epidemic among Indian Youth*, New Delhi: Mittal Pub.
5. Kessel, Neil and Henry Walton. 1982, *Alcoholism. Harmond Worth*: Penguin Books.
6. Modi, Ishwar and Modi, Shalini (1997) *Drugs: Addiction and Prevention*, Jaipur: Rawat Publication.
7. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
8. Ross Coomber and Others. 2013, *Key Concept in Drugs and Society*. New Delhi: Sage Publications.

9. Sain, Bhim 1991, *Drug Addiction Alcoholism, Smoking obscenity* New Delhi: Mittal Publications.
10. Sandhu, Ranvinder Singh, 2009, *Drug Addiction in Punjab: A Sociological Study*. Amritsar: Guru Nanak Dev University.
11. Singh, Chandra Paul 2000. *Alcohol and Dependence among Industrial Workers*: Delhi: Shipra.
12. Sussman, S and Ames, S.L. (2008). *Drug Abuse: Concepts, Prevention and Cessation*, Cambridge University Press.
13. Verma, P.S. 2017, “*Punjab’s Drug Problem: Contours and Characteristics*”, Economic and Political Weekly, Vol. LII, No. 3, P.P. 40-43.
14. World Drug Report 2016, United Nations office of Drug and Crime.
15. World Drug Report 2017, United Nations office of Drug and Crime.

SEMESTER–III**PAPER–I: UNDERSTANDING EDUCATION AND ITS PERSPECTIVES**

Credits: 4
Time: 3 Hrs.

Total Marks: 100
Terminal: 70
Sessional Work: 30

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

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

- Develop an insight into the fundamentals of Education.
- Understand the interdisciplinary nature of Education.
- Reflect upon the educational thoughts of Indian and Western thinkers.
- Critically examine the issues and concerns of education in the socio-cultural contexts of India.
- Understand the role of different agencies in promoting socialization.
- Correlate School with Societal needs.

SECTION–A**BASES OF EDUCATION**

- a) Education: Concept, aims and functions, difference with related terms (Training, Instruction, Indoctrination and Teaching).
- b) Types and Agencies of Education
- c) Education as a discipline and its interdisciplinary nature.

SECTION–B**INDIAN AND WESTERN PERSPECTIVE OF EDUCATION**

- a) Indian: Mahatma Gandhi, Swami Vivekananda, Jiddu Krishnamurthy;
- b) Western: Plato, John Dewey, Montessori

SECTION–C**SOCIO-CULTURAL CONTEXT**

- a) Education as an instrument of social change; Education in relation to Social Equity.
- b) Impact of Socio-cultural trends on the aims and organization of education.
- c) Inculcation of Value based education in Society.

SECTION-D**SOCIALIZATION AND SCHOOL**

- a) Socialisation: Concept and Process , Role of school and Family
- b) Social mobility and Social Stratification
- c) School as a sub system

SESSIONAL WORK

Performance in unit tests and house examination 10 Marks

Files to be prepared and submitted for evaluation 20 Marks

Assignments on the following (any two)

- Comparison of educational contribution of any two thinkers.
- Rationale of including study of value education in school curriculum
- Frame analytical model representing education as a sub system

References:-

- Acker, S. (1994). *Feminist theory and the study of gender and education; In S. Acker, Gendered Education: Sociological Reflections on women, Teaching and Feminism*, Buckingham: Open University Press.
- Barks, O. (1971). *Sociology of Education* Ed. 2 Landon: Batsford
- Crapo, H. (ed.) (1970). *Family, Class and education*. London: Longman
- Collins R (1979). *The Credential Society: an Historical Sociology of Education and Stratification*. New York: Academic Press.
- Dash, B.N. (2004). *Theories of Education & Education in the Emerging Indian Society*. New Delhi: Dominant Publishers and Distributors.
- David, M. E. (1980). *State the Family and education*, London: Routledge and kegan Paul Desai Lips.
- Gupta, D. (1991). *Social Stratification*. New Delhi: Oxford University Press.
- Hilary M. (1989). *Sex and Gender an Introduction*, California Mountain view, Mayfield Publishing Company.
- Kumar, K. (1991). *Political agenda of Education*, New Delhi: Sage.
- Mathur, S. S. (2015). *A sociological approach to Indian education*, Vinod Pub, Agra.
- McKeown, R. (2002). *Education for sustainable Development Toolkit*. University of Tennessee, Knoxville, TN.
- Tyler, W. (1977). *The sociology of educational inequality*, London.
- Weiner, M. (1991). *The State and the Child in India: Child Labour and Education Policy in Comparative Perspective*. Princeton: Princeton University Press.

SEMESTER–III**PAPER–II: GENDER, SCHOOL AND SOCIETY**

Credits 2
Time 1: 30 Hrs.

Max. Marks: 50
Terminal: 35
Sessional: 15

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

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

- Develop an insight into the different gender issues and concerns in the society.
- Understand various Constitutional provisions related to gender.
- Identify various efforts taken by different agencies to tackle gender issues in India.
- Perform his/her role for minimizing gender inequalities in the society.

SECTION–A**GENDER, ISSUES AND CONCERNS**

- a) Gender: Concept ,Issues and Concerns in terms of Equity and Equality

SECTION–B

- a) Constitutional Provisions and policy interventions (school education) in the context to gender.
 b) Construct of Gender in National Curriculum Framework- 2005

SECTION–C

- a) Sensitisation towards gender equality: Role of Family, and Society.
 b) Role of Education sector (Curricular and Co- curricular activities) for minimising gender inequalities

SECTION–D

Initiatives of Government and Non—Government organisation in dealing with gender issues

Sessional Work**Performance in unit tests and house examination 5 Marks****Files to be prepared and submitted for evaluation 10 Marks****Assignments on the following**

Organizing discussion/ debate/ seminar on the following:

- Gender stereotyping
- Gender Equity and Equality (Report to be filed)

A critical study of schemes such as KGBV, NPEGEL, NanhiChaa

References:-

- Chanana, K (1988). *Socialisation, Education and Women*. Nehru memorial Museum and Library: New Delhi.
- Kakkar, S. (1978). *Indian Childhood: Cultural Ideas, And Social Reality*. New Delhi: Oxford.
- Sandra, L. Bem (1987). *Gender Schema Theory and its Implications for Child Development: raising gender a schematic children in a gender schematic society*, in M.R. Walsh, (ed). *The Psychology of Women*. Harvard University Press Cambridge, 206-226.
- Kakkar S. (1991). *The Inner World: A Psycho-analytic study of childhood and society in India*. Delhi: Oxford University Press.
- Kumar, K. (1991). *Political agenda of Education*, New Delhi: Sage.
- Unterhalter, E (2006). *Measuring Gender Inequality in south Asia*, London, UNICEF
- Victoria A Velk off (1998). *Women of the world : women's education in India* U.S>Dept of Com. Retrieved 25 Dec. 2006
- Nambissan, G. (2010). *Exclusion and Discrimination in Schools: Experiences of Dalit Children*; Working paper series, 1(1), Indian Institute of Dalit Studies and UNICEF
- Michael, G.Pelete. (2011). *Gender, Sexuality and body politics in modern Asia*, Ann ArborMI: Association for Asian studies.

SEMESTER–III**PAPER–III: ENGLISH (COMPULSORY)****Time: 3 Hours****Max. Marks: 50**

Important Note: The textbook *Making Connections* (3rd edition) is significantly different from its 2nd edition. The third edition (by Kenneth J Pakenham, Jo McEntire, Jessica Williams) is to be followed for this course.

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Texts Prescribed:

1. *Making Connections* by Kenneth J. Pakenham, Jo McEntire, Jessica Williams, 3rd Edition. CUP.
2. *Moments in Time: An Anthology of Poems*, GNDU, Amritsar.
3. *English Grammar in Use* (Fourth Edition) by Raymond Murphy, CUP

Syllabus is divided into four sections as mentioned below:

Section A- *English Grammar in Use* (Fourth Edition) by Raymond Murphy, CUP: Units 98-130

Section B – Essay writing and *English Grammar in Use*: Units 131-145

Section C- *Moments in Time*: Poems at Sr. No. 1-6

Section D- *Making Connections* by Kenneth J. Pakenham, 3rd Edn. CUP: Unit-I (Global Health) and Unit-II (Multicultural Societies)

SEMESTER-III

PAPER-IV: PUNJABI (COMPULSORY) ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

ਸਮਾਂ ਤਿੰਨ ਘੰਟੇ

ਕੁਲ ਅੰਕ : 50

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਇੱਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿੱਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿੱਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

ਸੈਕਸ਼ਨ - ਏ

ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਵਾਰਤਕ (ਸੰਪਾ. ਡਾ. ਗੁਰਬਚਨ ਸਿੰਘ ਤਾਲਿਬ),
ਪੰਜਾਬੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
(ਵਿਸ਼ਾ-ਵਸਤੂ/ਸਾਰ/ਕਲਾ ਪੱਖ)

ਸੈਕਸ਼ਨ - ਬੀ

ਚੋਣਵੇਂ ਪੰਜਾਬੀ ਇਕਾਂਗੀ (ਇਕਾਂਗੀ ਸੰਗ੍ਰਹਿ)
ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਕਸਤੂਰੀ ਐਂਡ ਸੰਨਜ਼, ਅੰਮ੍ਰਿਤਸਰ।

- | | |
|--------------------|--------------|
| 1. ਸੁਹਾਗ | ਆਈ.ਸੀ.ਨੰਦਾ |
| 2. ਨਵਾਂ ਚਾਨਣ | ਹਰਚਰਨ ਸਿੰਘ |
| 3. ਅੰਨ੍ਹੇ ਨਿਸ਼ਾਨਚੀ | ਅਜਮੇਰ ਔਲਖ |
| 4. ਅਰਮਾਨ | ਜਤਿੰਦਰ ਬਰਾੜ |
| 5. ਚਾਬੀਆਂ | ਆਤਮਜੀਤ ਸਿੰਘ |
| 6. ਮਿੱਟੀ ਦਾ ਬਾਵਾ | ਪਾਲੀ ਭੁਪਿੰਦਰ |
| 7. ਸੰਧਰਾਂ | ਕੇਵਲ ਧਾਲੀਵਾਲ |

ਵਿਸ਼ਾ ਵਸਤੂ/ਪਾਤਰ ਚਿਤਰਨ/ਰੰਗ ਮੰਚ ਦੇ ਪੱਖ ਤੋਂ

ਸੈਕਸ਼ਨ - ਸੀ

- (ੳ) ਸੰਖੇਪ ਰਚਨਾ (ਪ੍ਰੈਸੀ)
(ਅ) ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿੱਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦ ਜੋੜਾਂ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ

ਸੈਕਸ਼ਨ - ਡੀ

ਮੂਲ ਵਿਆਕਰਨਕ ਇਕਾਈਆਂ : ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਵੰਨਗੀਆਂ
(ਭਾਵੰਸ਼, ਸ਼ਬਦ, ਵਾਕੰਸ਼, ਉਪ-ਵਾਕ ਅਤੇ ਵਾਕ)

SEMESTER-III***Mudhli Punjabi****ਮੁੱਢਲੀ ਪੰਜਾਬੀ****(In lieu of Compulsory Punjabi)****ਪਾਠ-ਕ੍ਰਮ****ਸਮਾਂ: ਤਿੰਨ ਘੰਟੇ****ਕੁਲ ਅੰਕ: 50****ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ**

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿੱਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿੱਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ**ਸੈਕਸ਼ਨ- ਏ**

ਵਿਆਕਰਣਕ ਇਕਾਈਆਂ ਦੀ ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ; ਵਾਕਾਂਸ਼, ਉਪਵਾਕ ਅਤੇ ਵਾਕ

ਸੈਕਸ਼ਨ- ਬੀ

ਪੈਰਾ ਰਚਨਾ, ਚਿੱਠੀ ਪੱਤਰ,

ਸੈਕਸ਼ਨ- ਸੀ

ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ

ਸੈਕਸ਼ਨ- ਡੀ

ਪੈਰਾ ਅਧਾਰਿਤ ਪ੍ਰਸ਼ਨ

ਸੰਖੇਪ ਰਚਨਾ

SEMESTER-III

Punjab History & Culture (From 1000 to 1605 A. D)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

Time: 3 Hours**Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

1. Society and Culture of Punjab during the Turko-Afghan rule.
2. The Punjab under the Mughals

SECTION-B

3. Bhakti movement and its impact on Society of Punjab
4. Sufism in Punjab with special reference to Baba Farid.

SECTION-C

5. Guru Nanak-Life and travels
6. Teachings of Guru Nanak, Concept of Sangat, Pangat and dharmsal.

SECTION-D

7. Contribution of Guru Angad Dev, Guru Amar Das and Guru Ram Das.
8. Compilation of Adi Granth and martyrdom of Guru Arjun Dev

Suggested Readings:-

1. Chopra, P.N., Puri, B.N., & Das, M.N.(1974). *A Social, Cultural & Economic History of India*, Vol. II. New Delhi: Macmillan India.
2. Grewal, J.S. (1994). *The Sikhs of the Punjab*, Cambridge University Press, New Delhi.
3. Singh, Fauja (1972). *A History of the Sikhs*, Vol. II, I. Patiala: Punjabi University.
4. Singh, Kushwant (2011). *A History of the Sikhs- Vol. I (1469-1839)*. New Delhi: Oxford University Press.
5. Singh, Kirpal (1990). *History and Culture of the Punjab-Part II (Medieval Period)*. Patiala: Publication Bureau, Punjabi University.

SEMESTER–III**PAPER–V, VI & VII: PHYSICS, STREAM–1****PAPER–A: STATISTICAL PHYSICS & THERMODYNAMICS
(THEORY)****Time: 3 Hours****Marks: 35****Total Teaching Hrs. : 45(3h/week)****Pass Marks: 35%****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION–A

Basic ideas of Statistical Physics, Scope of Statistical Physics, Basic ideas about probability, Distribution of four distinguishable particles into compartments of equal size. Concept of macrostates, microstates, Thermodynamic Probability, Effects of constraints on the system. Distribution of particles in two compartments. Deviation from the state of maximum probability. Equilibrium state of dynamic system. Distribution of distinguishable n particles in k compartments of unequal sizes.

SECTION–B

Phase space and division into elementary cells. Three kinds of statistics. The basic approach in three statistics. Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of law of distribution of molecular speeds. Need for Quantum Statistics – B.E. Statement of planck's law of Radiation Wien's Displacement and Stefan's law. Fermi Dirac (FD) statistics. Comparison of M.B, B.E and F.D statistics.

SECTION–C

Statistical definition of entropy, Change of entropy of system, additive nature of entropy, Law of increase of entropy, Reversible and irreversible processes, and their examples, work done in reversible process, examples of increase in entropy in natural processes, entropy and disorder, Brief review of Terms, Laws of Thermodynamics, Carnot Cycle, Entropy changes in carnot cycle, Applications of thermodynamics to thermoelectric effect, change of entropy along reversible path in P-V diagram. Heat death of universe.

SECTION–D

Derivation of Maxwell Thermodynamics relations, Cooling produced by adiabatic stretching, Adiabatic Compression, change of internal energy with volume, Specific heat and constant pressure and constant volume. Expression for C_p-C_v , Change of state and Claypron equation.

Books Suggested:-

1. Statistical Mechanics: B.B. Laud, (Macmillan India Ltd.) 1981.
2. Statistical Physics: Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.
3. Statistical Physics and Thermodynamics: V.S. Bhatia
4. A Treatise on Heat: M.N. Saha & B.N. Srivastava (The Indian Press Pvt. Ltd., Allahabad), 1965.

SEMESTER-III**PAPER-V, VI & VII: PHYSICS, STREAM-1****PAPER-B: OPTICS AND LASERS
(THEORY)****Time: 3 Hours****Marks: 35****Total Teaching Hrs: 45(3h/week)****Pass Marks: 35%****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**Interference of Light:**

Superposition of light waves and interference, young's double slit experiment, Conditions for sustained interference pattern, Coherent sources of light, Interference pattern by division of wave front, Fresnel Biprism, Displacement of fringes, Change of phase on reflection, Interference in thin films due to reflected and transmitted light, non reflecting films, Newton's Rings. Michelson Interferometer.

SECTION-B**Diffraction:**

Huygen'sfresnel theory, half-period zones, Zone plate, Distinction between fresnel and fraunhofer diffraction. Fraunhofer diffraction at rectangular and circular apertures, Effect of diffraction in optical imaging, Resolving power of telescope in diffraction grating, its use as a spectroscopic element and its resolving power, Resolving power of microscope.

SECTION-C**Polarization:**

Plane Polarized light, Elliptically polarized light, wire grid polarizer, Sheet polarizer, Maull's Law, Brewster Law, Polarization by reflection, Scattering, Double reflection, Nicol prism, Retardation plates, Production Analysis of polarized light, Quarter and half wave plates.

SECTION-D**Laser Fundamentals:**

Derivation of Einstein relations, Concept of stimulated emission and population inversion, broadening of spectral lines, three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes. Components of laser devices, condition for laser action, types of lasers, Ruby and Nd:YAG lasers, He-Ne and CO₂ lasers construction, mode of creating population inversion and output characteristics, application of lasers –a general outline.

Books Suggested:-

1. Fundamentals of Optics: F.A. Jenkins and Harvey E White, (McGraw Hill) 4th Edition, 2001.
2. Optics: Ajoy Ghatak, (McMillan India) 2nd Edition, 7th Reprint, 1997
3. Optics: Born and Wolf, (Pergamon Press) 3rd Edition, 1965.
4. Laser Fundamentals: W.T. Silfvast (Foundation Books), New Delhi, 1996.
5. Laser and Non-Liner Optics: B.B. Laud (New Age Pub.) 2002
6. Laser: Svelto, Plenum Press) 3rd Edition, New York

SEMESTER–III**PAPER–V, VI & VII: PHYSICS, STREAM–1****(PRACTICAL)****General Guidelines for Practical Examination: (4.5h/week)**

- I. The distribution of marks is as follows :
- | | |
|-----------------------------|------------------|
| i) One experiment | Marks: 30 |
| ii) Brief Theory | Marks: 15 |
| iii) Viva–Voce | Marks: 5 |
| iv) Record (Practical file) | Marks: 5 |
- II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
- III. Number of candidates in a group for practical examination should not exceed 12.
- IV. In a single group no experiment be allotted to more than three examinee in any group.
1. To determine refractive index of glass and liquid using spectrometer.
 2. To determine the Cauchy's constants.
 3. To study the refractive index of a doubly refracting prism.
 4. To set up Newton's rings to determine wavelength of sodium light.
 5. To determine the wavelength by using plane diffraction grating (Use Hg source)
 6. To determine dispersive power of plane diffraction grating.
 7. To determine resolving power of a telescope.
 8. To determine resolving power of a grating.
 9. To measure an accessible (Horizontal and vertical) height using sextant.
 10. To measure inaccessible height by using sextant.
 11. Verify laws of probability distribution by throwing of similar coins.

SEMESTER-III
PAPER-V, VI & VII: CHEMISTRY, STREAM-1
CHEMISTRY (ORGANIC CHEMISTRY-A)
(THEORY)

Time: 3 Hrs.
45 Hrs (3 Hrs/week)

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

I. Stereochemistry Organic Compounds **(12 Hrs.)**

Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism—determination of configuration of geometric isomers. E & Z system of nomenclature.

SECTION-B

II. Isomerism **(11 Hrs.)**

Conformational isomerism—conformational analysis of ethane and n-butane; conformation of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

III. Alcohols

Classification and nomenclature. Monohydric alcohols—nomenclature. Acidic nature. Reactions of alcohols. Dihydric alcohols—nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage $[Pb(OAc)_4]$ and $[HIO_4]$ and pinacol-pinacolone rearrangement.

SECTION-C

IV. Phenols **(11 Hrs.)**

Nomenclature, structure and bonding, Preparation of phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols—electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Reimer Tiemann reaction.

V. Preparation of Aldehydes and Ketones

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids.

SECTION-D**VI. Properties of Aldehydes and Ketones****(11 Hrs.)**

Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, LiAlH_4 and NaBH_4 reductions. Halogenation of enolizable ketones. Halogenation of enolizable ketones.

Books Suggested:-

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol. I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.
7. University General Chemistry, C.N.R. Rao, Macmillan.

SEMESTER-III
PAPER-V, VI & VII: CHEMISTRY, STREAM-1
CHEMISTRY (PHYSICAL CHEMISTRY-B)
(THEORY)

Time: 3 Hrs.
45 Hrs (3 Hrs/week)

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

I. Thermodynamics-I

11 Hrs.

Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law- Joule-Thomson coefficient and inversion temperature, Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

SECTION-B

II. Thermochemistry:

12 Hrs.

Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

III. Thermodynamics-II & III

Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of Entropy : Entropy as a state function, entropy as a function of V & T , entropy as a function of P & T , entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

SECTION-C

IV. Third Law of Thermodynamics:

11 Hrs.

Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P, V and T .

Equilibrium

V. Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of K_p, K_c, K_a and their relationship, Clausius-Clapeyron equation, applications.

SECTION-D**VI. Introduction to Phase Equilibrium****11 Hrs.**

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO₂ and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H₂O), (FeCl₃-H₂O) and CuSO₄-H₂O system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-H₂O and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consolute temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.

Books Suggested:-

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company, 1989.

SEMESTER-III**PAPER-V, VI & VII: CHEMISTRY, STREAM-1****(PRACTICAL)**

Duration: 3½ Hrs.
6 Period/Week

Marks: 30

Quantitative Analysis**Volumetric Analysis**

- Determination of acetic acid in commercial vinegar using NaOH.
- Determination of alkali content-antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- Estimation of hardness of water by EDTA.
- Estimation of ferrous and ferric by dichromate method.
- Estimation of copper using sodiumthiosulphate.

Gravimetric Analysis

Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime)

Organic Chemistry Laboratory Techniques**Thin Layer Chromatography**

Determination of R_f values and identification of organic compounds.

- Separation of green leaf pigments (spinach leaves may be used).
- Preparation and separation of 2, 4. dinitrophenylhydrazones of acetone, 2-butanone, 2-Butanone, hexan-2 and 3-one using toluene and light petroleum (40 : 60).
- Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

Practical Examination

1) Volumetry / Gravimetry	16
2) Thin Layer chromatography	07
3) Viva-Voce	04
4) Note Book	03

Books Suggested:-

- Vogel's Textbook of Quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Jeffery and J. Mandham, ELBS.
- Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
- Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.
- Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
- Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
- Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
- Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.

SEMESTER-III**PAPER-V, VI & VII: MATHEMATICS, STREAM-1****PAPER-I: ANALYSIS****Time: 3 Hours****Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion.

SECTION-B

Series of non-negative terms. Comparison tests. Cauchy's integral test. Ratio test. Cauchy's root test. Raabe's test, logarithmic test. De Morgan's and Bertrand's test. Kummer's test, Cauchy condensation test, Gauss test, Alternating series. Leibnitz's test, absolute and conditional convergence.

SECTION-C

Partitions, Upper and lower sums. Upper and lower integrals, Riemann integrability. Conditions of existence of Riemann integrability of continuous functions and of monotone functions. Algebra of integrable functions.

SECTION-D

Improper integrals and statements of their conditions of existence. Test of the convergence of improper integral, Beta and Gamma functions.

Books Recommended:-

1. Malik, S.C. and Savita Arora: Mathematical Analysis, Wiley Eastern Ltd. (1991).
2. Apostol, T.M.: Mathematical Analysis, Addison Wesley Series in Mathematics (1974).
3. Narayan, S. and P.K. Mittal: Integral Calculus, Sultan Chand & Sons.

SEMESTER-III**PAPER-V, VI & VII: MATHEMATICS, STREAM-1****PAPER-II: ANALYTICAL GEOMETRY****Time: 3 Hours****Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Transformation of axes, shifting of origin, Rotation of axes in two dimension and three dimension, The invariants, Joint equation of pair of straight lines, equations of bisectors

SECTION-B

Parabola and its properties. Tangents and normal, Pole and polar, pair of tangents at a point, Chord of contact, equation of the chord in terms of mid point and diameter of conic.

SECTION-C

Ellipse and hyperbola with their properties. Tangents and normal, Pole and polar. pair of tangents at a point, Chord of contact, Identifications of curves represented by second degree equation (including pair of lines).

SECTION-D

Intersection of three planes, condition for three planes to intersect in a point or along a line or to form a prism, Sphere: Section of a sphere by a plane, spheres of a given circle. Intersection of a line and a sphere. Tangent line, tangent plane, power of a point w.r.t. a sphere, radical planes.

Books Recommended:-

1. Gorakh Prasad and H.C. Gupta: Text Book on Coordinate Geometry.
2. S.L. Loney: The Elements of Coordinate Geometry, Macmillan and Company, London.
3. Narayan, S.: Analytical Solid Geometry, Sultan Chand & Sons (2005).
4. Kreyszig, E.: Advanced Engineering Mathematics.
5. Thomos, G.B. and Finney, R.L.: Calculus and Analytic Geometry.

SEMESTER-III
PAPER-V, VI & VII: CHEMISTRY, STREAM-2
CHEMISTRY (ORGANIC CHEMISTRY-A)
(THEORY)

Time: 3 Hrs.
45 Hrs (3 Hrs/week)

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

I. Stereochemistry Organic Compounds **(12 Hrs.)**

Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism—determination of configuration of geometric isomers. E & Z system of nomenclature.

SECTION-B

II. Isomerism **(11 Hrs.)**

Conformational isomerism—conformational analysis of ethane and n-butane; conformation of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

III. Alcohols

Classification and nomenclature. Monohydric alcohols—nomenclature. Acidic nature. Reactions of alcohols. Dihydric alcohols—nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage $[Pb(OAc)_4]$ and $[HIO_4]$ and pinacol-pinacolone rearrangement.

SECTION-C

IV. Phenols **(11 Hrs.)**

Nomenclature, structure and bonding, Preparation of phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols—electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Reimer Tiemann reaction.

V. Preparation of Aldehydes and Ketones

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids.

SECTION-D**VI. Properties of Aldehydes and Ketones****(11 Hrs.)**

Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, LiAlH_4 and NaBH_4 reductions. Halogenation of enolizable ketones. Halogenation of enolizable ketones.

Books Suggested:-

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol. I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.
7. University General Chemistry, C.N.R. Rao, Macmillan.

SEMESTER-III
PAPER-V, VI & VII: CHEMISTRY, STREAM-1
CHEMISTRY (PHYSICAL CHEMISTRY-B)
(THEORY)

Time: 3 Hrs.
45 Hrs (3 Hrs/week)

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

I. Thermodynamics-I

11 Hrs.

Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law- Joule-Thomson coefficient and inversion temperature, Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

SECTION-B

II. Thermochemistry:

12 Hrs.

Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

III. Thermodynamics-II & III

Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of Entropy : Entropy as a state function, entropy as a function of V & T , entropy as a function of P & T , entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

SECTION-C

IV. Third Law of Thermodynamics:

11 Hrs.

Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P, V and T .

Equilibrium

V. Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of K_p, K_c, K_a and their relationship, Clausius-Clapeyron equation, applications.

SECTION-D**VI. Introduction to Phase Equilibrium****11 Hrs.**

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO₂ and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H₂O), (FeCl₃-H₂O) and CuSO₄-H₂O) system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-H₂O and ethanol-water system. Partially miscible liquids Phenol-water, triethylamine-water, Nicotine-water System. Lower and upper consolute temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.

Books Suggested:-

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company, 1989.

SEMESTER-III**PAPER-V, VI & VII: CHEMISTRY, STREAM-1****(PRACTICAL)**

Duration: 3½ Hrs.
6 Period/Week

Marks: 30

Quantitative Analysis**Volumetric Analysis**

- Determination of acetic acid in commercial vinegar using NaOH.
- Determination of alkali content-antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- Estimation of hardness of water by EDTA.
- Estimation of ferrous and ferric by dichromate method.
- Estimation of copper using sodiumthiosulphate.

Gravimetric Analysis

Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime)

Organic Chemistry Laboratory Techniques**Thin Layer Chromatography**

Determination of R_f values and identification of organic compounds.

- Separation of green leaf pigments (spinach leaves may be used).
- Preparation and separation of 2, 4. dinitrophenylhydrazones of acetone, 2-butone, 2-Butanone, hexan-2 and 3-one using toluene and light petroleum (40 : 60).
- Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

Practical Examination

1) Volumetry / Gravimetry	16
2) Thin Layer chromatography	07
3) Viva-Voce	04
4) Note Book	03

Books Suggested:-

- Vogel's Textbook of Quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Jeffery and J. Mandham, ELBS.
- Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
- Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.
- Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
- Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
- Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
- Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.

SEMESTER-III
PAPER-V, VI & VII: BOTANY, STREAM-2

PAPER-A: STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS-I (THEORY)

Time: 3 Hrs.

Max. Marks: 35

Theory Lectures: 3 Hours/Week

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

The basic body plan of a flowering plant-modular type of growth. Diversity in plant form in annuals, biennials and perennials; trees-largest and longest-lived. Branching pattern; monopodial and sympodial growth; canopy architecture.

SECTION-B

The Shoot System: The shoot apical meristem and its histological organization; meristematic and permanent tissue, formation of internodes. Cambium and its functions; formation of secondary xylem.

SECTION-C

A general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; role of woody skeleton; secondary phloem-structure function relationships; periderm.

SECTION-D

Leaf: Origin, development, arrangement and diversity in size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.

Suggested Readings:-

1. Beck, C.B. (2010). An Introduction to Plant Structure and Development: Plant anatomy for the Twenty First Century (2nd Edition). Cambridge University Press, UK.
2. Cutler, D. F., Botha, T. and Stevenson, D. M. (2007). Plant Anatomy: An Applied Approach. Blackwell Publishing, Oxford, UK.
3. Dickison, W.C. (2000). Integrative Plant Anatomy. Academic Press, California, USA.
4. Mauseth, J.D. (1988). Plant Anatomy, The Benjamin/Cummings Publishing Company Inc., Menlo Park, California, USA.
5. Peau, K (1977) Anatomy of Seed Plants, 3rd edition. John Wiley & Sons, New York.
6. Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1999). Biology of Plants, 5th edition. W.H. Freeman and Co., Worth Publishers, New York.
7. Rudall, P. J. (2007). Anatomy of Flowering Plants: An Introduction to Structure and Development (3rd Edition). Cambridge University Press, UK.
8. Thomas, P. (2000) Trees: Their Natural History, Cambridge University Press, Cambridge.

SEMESTER-III
PAPER-V, VI & VII: BOTANY, STREAM-2
PAPER-B: STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING
PLANTS-II (THEORY)

Time: 3 Hrs.

Theory Lectures: 3 Hours/Week

Max. Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

The Root System: The root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

SECTION-B

Vegetative Reproduction: various methods of vegetative propagation. Detailed study and types of grafting and budding, economic aspects. Flower: A modified shoot; structure, development and varieties of flower; functions;

SECTION-C

Structure of anther and pistil; the male and female gametophytes; types of pollination; attractions and reward for pollinators; (sucking and foraging types); pollen-pistil interaction self incompatibility.

SECTION-D

Double fertilization: formation of seed endosperm and embryo : fruit development and maturation Significance of Seed: Suspended animation; ecological adaptation; unit of genetic recombination with reference to reshuffling of genes and replenishment; dispersal strategies.

Suggested readings:

1. Bhojwani, S.S. and Bhatnagar, S.P. (2000). The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas Publishing House, Delhi.
2. Hartmann, H.T. and Kestler, D.E. (1976). Plant Propagation: Principles and Practices, 3rd edition, Prentice Hall of India Pvt. Ltd., New Delhi.
3. Mauseth, J.D. (1988). Plant Anatomy, The Benjamin/Cummings Publishing Company Inc., Menlo Park, California, USA.
4. Peau, K. (1977). Anatomy of Seed Plants, 3rd edition. John Wiley & Sons, New York.
5. Pegeri, K. and Vander Pijl (1979). The Principles of Pollination Biology, Pergamon Press, Oxford.
6. Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1999). Biology of Plants, 5th edition. W.H. Freeman and Co., Worth Publishers, New York.

SEMESTER–III**PAPER–V, VI & VII: BOTANY, STREAM–2****BOTANY PRACTICALS–III (Based on Papers–III A and III B)****Practical Marks: 30****Practical Hours: 4½ Hours/week****Suggested Laboratory Exercises**

1. Study of any commonly occurring dicotyledonous plant (for example *Solanum nigrum* or *Kalanchoe*) to the body plan, organography and modular type of growth.
2. Life forms exhibited by flowering plants (by a visit to a forest or a garden, Study of treelike habit in cycads, bamboo, banana, traveller's tree (*Revenala madagascariensis*) and *Yucca* and comparison with true trees as exemplified by conifers and dicotyledons.
3. L.S. Shoot tip to study the cytohistological zonation and origin of leaf primordia.
4. Monopodial and sympodial types of branching in stems (especially rhizomes).
5. Anatomy of primary and secondary growth in monocots and dicots using free hand razor technique (*Solanum*, *Boerhavia*, *Helianthus*, *Mirabilis*, *Nyctanthus*, *Draceana*, *Maize*) hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood, Microscopic study of wood in T.S., T.L.S. and R.L.S.
6. Field study of diversity in leaf shape, size, thickness, surface properties. Internal structure of leaf. Structure and development of stomata (using epidermal peels of leaf).
7. Anatomy of the root. Primary and secondary structure.
8. Examination of a wide range of flowers available in the locality and methods of their pollination.
9. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using in vitro pollen germination.
10. Structure of ovule and embryo sac development using serial sections from permanent slides.
11. Nuclear and cellular endosperm. Embryo development in monocots and dicots (using permanent slides/dissections).
12. Simple experiments to show vegetative propagation (leaf cuttings in *Bryophyllum*, *Sansevieria*, *Begonia*; stem cuttings in *rose*, *Salix*, money plant, *Sugarcane* and *Bougainvillea*).
13. Germination of non-dormant and dormant seeds.

Suggested Readings (for laboratory exercises):

1. Bhojwani, S.S. and Bhatnagar, P. (2000). *The Embryology of Angiosperms* (4th revised and enlarged edition), Vikas Publishing House, New Delhi.
2. Mauseth, J.D. (1988). *Plant Anatomy*, The Benjamin/Cumminas Publishing Co., Inc., Mehlo Park, California, USA.
3. Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1992). *Biology of Plants* (5th Edition). Worth Publishers, New York.
4. Steeves, T.A. and Sussex, I.M. (1989). *Patterns in Plant Development* (2nd Edition). Cambridge University Press, Cambrid.

SEMESTER-III**PAPER-V, VI & VII: ZOOLOGY, STREAM-2****ZOOLOGY**

Paper	Maximum Marks		Hours of Teaching	
	Theory Marks	Practical Marks	Theory	Practical
ZOO-IIIA (Evolution)	35	—	3 Hrs	—
ZOO-IIIB (Biodiversity-III)	35	—	3 Hrs	—
PRACTICAL-III (RELATED TO ZOO-IIIA and ZOO-IIIB)	—	30	—	4½ Hrs

SEMESTER-III
PAPER-V, VI & VII: ZOOLOGY, STREAM-2
ZOO-III A: Evolution
(THEORY)

Max. Time: 3 Hrs.

Max Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Introduction to evolution
 Evidences of organic evolution
 Theories of organic evolution

SECTION-B

Origin of life
 Concept of micro, macro and mega-evolution
 Concept of Species
 Speciation

SECTION-C

Fossils, its types and significance
 Evolutionary rate
 Origin & Extinction of reptiles
 Evolution of man (in Brief)

SECTION-D

Migration & Parental Care in Pisces
 Flight adaptation & Bird migration
 Adaptive radiations like scales & fins in fish, poison apparatus in snakes and dentition in Mammals.

Suggested Readings:-

1. Avers, C. J.(1989). Evolution Process and Pattern in Evolution, Oxford University, Press, New York, Oxfor.
2. Ayala, F. J. and Valentine J. W. (1979). Evolving the theory and Process of Organic Evolution, Benjamin Cumming.
3. Bhamarah, H.S.(1993), Juneka K., Cytogenetics & Evolution, Anmol Publication Pvt. Ltd.
4. Brookfield, A. P. (1986). Modern aspects of Evolution. Hutchinson London, Melbourne.
5. Colbert. E.H.(1989), Evolution of Vertebrates, (2nd ed), Wiley Eastern Ltd.
6. Dobzhansky, Ayala, Stebbins & Valentine (1952), Evolution W.H. Freeman.
7. Gallow, P. (1983). Evolutionary principles. Chapman and Hall.
8. Freeman, S. and Herron, Jon C. (2007). Evolutionary analysis, Pearson Prentice Hall, New Jersey.
9. Futuyma, D. J. (1998), Evolutionary Biology, Sinauer Assoc. Inc. Pub. USA.
10. Meglitsch, P. A. (1991), Invertebrate Zoology (3rd ed), Oxford University Press.
11. Minkoff, E. C. (1983), Evolutionary Biology, Addison Wesley Pub. Co., London.
12. Wen-Hsiung Li (1997), Molecular Evolution, Sinauer associates Inc.Pub. USA.

SEMESTER-III
PAPER-V, VI & VII: ZOOLOGY, STREAM-2
ZOO-III B: Biodiversity-III
(Chordates)
(THEORY)

Max. Time: 3 Hrs.

Max Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Urochordata: External features and affinities of *Herdmania*
 Cephalochordata: Type study-*Amphioxus*

SECTION-B

Cyclostomata: External Characters of *Petromyzon*
 Affinities of Cyclostomata

Pisces: Type study-*Labeo*

SECTION-C

Amphibia: Type study-Frog
 Reptilia: Type study-*Uromastix*

SECTION-D

Aves: Type study-Pigeon
 Mammals: Type study-Rat

Suggested Reading Material:-

1. Dhama, P.S. & Dhama J.K. (1998), Vertebrates, R. Chand & Co., New Delhi.
2. Goodrich, E. S. (1958), Structure and Development of Vertebrates, Vol. I and II. D. E. Publication, New York.
3. Hildebrand, M. and Goslow. Jr. G.E. (2001), Analysis of Vertebrates Structure, John Wiley, N. Y.
4. Jollie, M. (1968), Chordate Morphology, Reinhold, New York.
5. Kardong, K. V. (1995), Vertebrates – Comparative Anatomy, Function, Evolution. W.B.C. Pub. , Oxford.
6. Kent, G. C. and Carr, R. K. (2001), Comparative Anatomy of the Vertebrates (9th ed), McGraw Hill Higher Education, New York.
7. Linzey, D. (2001), Vertebrate Biology, McGraw Hill Publishing Company, New York.
8. Pough, F. H., Heiser, J. B. and McFarland, W. N. (1990), Vertebrate Life (3rd ed), Macmillan Pub. Co., New York.
9. Young, J. Z. (1982), The Life of Vertebrates, New York.
10. Parker, T.J. and Haswell, W.A (1981) Text Book of Zoology, Vol. II (Vertebrates), ELBS and Macmillan Press Ltd.

SEMESTER-III**PAPER-V, VI & VII: ZOOLOGY, STREAM-2****PRACTICAL-III (Related to ZOO-III A and ZOO-III B)****Time: 3hrs.****Marks: 30****Important Note for Practical:-**

1. Candidates will be required to submit their original note books containing record of their laboratory work.
2. Wherever possible, students must be taken out for excursion to the field (Zoological gardens, sea shores, ponds and hill stations etc.) to study habitat and ecology of the animals.
3. As per the latest UGC guidelines (D.O.No. F. 14-6/2014(CPP-II) dated 01-08-2014) the dissections should not be conducted. The guidelines on this issue are available on the UGC website: www.ugc.ac.in

I. Classification up to order level, except in case of Pisces and Aves where classification up to subclass level, habits, habitat, external characters and economic importance (if any) of the following animals is required :

Urochordata : *Herdmania, Molgula, Pyrosoma, Doliolum, Salpa & Oikopleura.*

Cephalochordata : *Amphioxus.* Study of the following prepared slides:
T.S. *Amphioxus* through various regions, Pharynx of *Amphioxus*

Cyclostomata : *Myxine, Petromyzon & Ammocoetes* Larva.

Chondrichthyes : *Zygaena* (hammer head shark), *Pristis* (saw fish), *Narcine* (electric ray), *Trygon*, *Rhinobatus* and *Chimaera* (rabbit fish).

Actinoptergii : *Polypterus, Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Tetradon, Echeneis and Solea.*

Dipneusti (Dipnoi) : *Protopterus* (african lung fish)

Amphibia : *Uraeotyphlus, Necturus, Amphiuma, Amblystoma* and its Axolotl Larva, *Triton, Salamandra, Hyla, Rhycophorus*

Reptilia : *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Vipera, Crocodilus, Gavialis, Chelone* (turtle) and *Testudo* (tortoise), Differences in nonpoisonous and poisonous snakes.

Aves : *Casuaris, Ardea, Anas, Milvus, Pavo, Eudynamics, Tyto* and *Alcedo.*

Mammalia : *Ornithorynchus, Echidna, Didelphis, Macropus, Loris, Macaca, Manis, Hystrix, Funambulus, Panthera, Canis, Herpestes, Capra, Pteropus.*

II. Study of the following systems with the help of charts/models/videos:

<i>Herdmania</i>	: General anatomy
<i>Labeo</i>	: Digestive and reproductive systems, heart, afferent and branchial arteries, cranial nerves and internal ear.
Chick	: Digestive, arterial, venous and urino-genital systems.
White Rat	: Digestive, arterial, venous and urino-genital systems.

Study of permanent slides of whole mount of Pharynx of *Herdmania* and *Amphioxus*.
Cycloid scales of *Labeo*, blood smear of mammal, Histology of rat/rabbit (compound tissues)

Demonstration of evolutionary phenomena like homology, analogy, mimicry, crypsis.
Study of evolution of horse/elephant/man.

Study of fossils.

Assignment

Note:- Some changes can be made in the practicals depending on the availability of material.

Guidelines for conduct of Practical Examination:

1. Draw a labelled sketch of the system of the given animal & explain it to the Examiner. 4
2. Identify and classify the specimens upto order level. Write a short note on habitat, special features, feeding, habits and economic importance of the specimens. 8
3. Identify and write a note on the evolutionary phenomenon in the given specimen. 4
4. Identify the slides/specimens, give two reasons for identification. 5
5. Assignment 4
6. Viva-voce & Practical file. 5

SEMESTER–III**PAPER–VIII: DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY PAPER)****(Only for those students who have not studied this paper in Semester–I)****PROBLEM OF DRUG ABUSE****Time: 3 Hours****Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION–A**Meaning of Drug Abuse:**

Meaning, Nature and Extent of Drug Abuse in India and Punjab.

SECTION–B**Consequences of Drug Abuse for:**

Individual:	Education, Employment, Income.
Family	: Violence.
Society	: Crime.
Nation	: Law and Order problem.

SECTION–C**Management of Drug Abuse:**

Medical Management: Medication for treatment and to reduce withdrawal effects.

SECTION–D

Psychiatric Management: Counselling, Behavioural and Cognitive therapy.

Social Management: Family, Group therapy and Environmental Intervention.

References:-

1. Ahuja, Ram (2003), *Social Problems in India*, Rawat Publication, Jaipur.
2. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
3. Inciardi, J.A. 1981. *The Drug Crime Connection*. Beverly Hills: Sage Publications.
4. Kapoor. T. (1985) *Drug epidemic among Indian Youth*, New Delhi: Mittal Pub.

5. Kessel, Neil and Henry Walton. 1982, *Alcoholism. Harmond Worth*: Penguin Books.
6. Modi, Ishwar and Modi, Shalini (1997) *Drugs: Addiction and Prevention*, Jaipur: Rawat Publication.
7. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
8. Ross Coomber and Others. 2013, *Key Concept in Drugs and Society*. New Delhi: Sage Publications.
9. Sain, Bhim 1991, *Drug Addiction Alcoholism, Smoking obscenity* New Delhi: Mittal Publications.
10. Sandhu, Ranvinder Singh, 2009, *Drug Addiction in Punjab: A Sociological Study*. Amritsar: Guru Nanak Dev University.
11. Singh, Chandra Paul 2000. *Alcohol and Dependence among Industrial Workers*: Delhi: Shipra.
12. Sussman, S and Ames, S.L. (2008). *Drug Abuse: Concepts, Prevention and Cessation*, Cambridge University Press.
13. Verma, P.S. 2017, "*Punjab's Drug Problem: Contours and Characteristics*", Economic and Political Weekly, Vol. LII, No. 3, P.P. 40-43.
14. World Drug Report 2016, United Nations office of Drug and Crime.
15. World Drug Report 2017, United Nations office of Drug and Crime.

SEMESTER-IV**PAPER-I: LANGUAGE PROFICIENCY AND COMMUNICATION SKILLS**

Credits 2
Time 1: 30 Hrs.

Max. Marks: 50
Terminal: 35
Sessional: 15

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

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

- Understand the concept and process of communication.
- Enhance his/her skills of listening, speaking, reading and writing.
- Develop the required communication skills necessary for classroom interaction.
- Develop a thorough understanding of linguistics and paralinguistic skills.

SECTION-A**COMMUNICATION SKILLS**

- a) Communication: Meaning, definitions, process, types, channels, objectives, principles, barriers of communication and how to remove the barriers of communication.
- b) Listening Skills: Meaning, process, importance, levels, barriers, techniques to improve listening abilities. Feedback skills- Importance, characteristics, steps for improving, role of modern technology in feedback.

SECTION-B

Speaking and Conversation Skills: Introduction, objectives, principles, components, understanding the cues, forms of polite speech. Conversation- types, vital points of good conversation.

SECTION-C**PHONETICS**

- a) The Sounds: Language, phonetics, phonetic transcription, IPA, uses of phonetic transcription, consonant sounds, nasal and other components, vowels.

SECTION-D

- a) Classification of Phonetic sounds: Consonants, vowels, the syllable- structure, strong and weak syllables, types of syllables.
- b) Paralinguistic's: Stress, intonation and tempo.

Sessional Work:**Performance in unit tests and house examination 05 Marks****Files to be prepared and submitted for evaluation 10 Marks****Assignments on the following**

Writing of letters (formal, informal) , Reports, minutes of the meeting

- Oral presentation on any current topic

References:-

- Block, C.C.(1997). Teaching the Language Arts, 2nd Ed. Allyn and Bacon
- Mckay, et al. (1995). *The Communication Skills Book, 2nd Ed.* New Harbinger Publications.
- Hornbyn, A. S. (2001). Oxford Advanced Learner's Dictionary, OUP
- Thomsan, A.J., & Martinet. (2002). A Practical English Grammar. OUP

SEMESTER-IV**PAPER-II: ENGLISH (COMPULSORY)****Time: 3 Hours****Max. Marks: 50**

Important Note: The textbook *Making Connections* (3rd edition) is significantly different from its 2nd edition. The third edition (by Kenneth J Pakenham, Jo McEntire, Jessica Williams) is to be followed for this course.

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Texts Prescribed:-

1. *Making Connections* by Kenneth J. Pakenham, Jo McEntire, Jessica Williams, 3rd Edition. CUP.
2. *Moments in Time: An Anthology of Poems*, GNDU, Amritsar.
3. *English Grammar in Use* (Fourth Edition) by Raymond Murphy, CUP.

Syllabus is divided into four sections as mentioned below:

SECTION-A

English Grammar in Use (Fourth Edition) by Raymond Murphy, CUP: Revision of Units 26-37, 42-48, 92- 97, 113-120.

SECTION-B

Moments in Time: Poems at Sr. No. 7-12

SECTION-C

Making Connections by Kenneth J. Pakenham, 3rd Edn. CUP: Unit-III (Aspects of Language) and Unit-IV (Sustaining Planet Earth)

SECTION-D

Essay type question based on the section “Beyond the reading” from the text, *Making Connections*.

SEMESTER-IV

PAPER-III: PUNJABI (COMPULSORY) ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

ਸਮਾਂ ਤਿੰਨ ਘੰਟੇ

ਕੁਲ ਅੰਕ : 50

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਦਸ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

ਸੈਕਸ਼ਨ - ਏ

ਮੇਰੀ ਜੀਵਨ ਗਾਥਾ (ਸਵੈ-ਜੀਵਨੀ) : ਡਾ. ਦੀਵਾਨ ਸਿੰਘ,
ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਅਮ੍ਰਿਤਸਰ
(ਨਾਇਕ ਬਿੰਬ/ਸਵੈ ਜੀਵਨੀ ਦੇ ਤੌਰ ਤੇ ਪਰਖ/ਵਾਰਤਕ ਸ਼ੈਲੀ)

ਸੈਕਸ਼ਨ - ਬੀ

ਫਾਸਲੇ (ਨਾਟਕ) : ਜਤਿੰਦਰ ਬਰਾੜ,
ਨਾਨਕ ਸਿੰਘ ਪੁਸਤਕਮਾਲਾ, ਅਮ੍ਰਿਤਸਰ
(ਵਿਸ਼ਾ/ਸਾਰ/ਨਾਟਕ ਕਲਾ)

ਸੈਕਸ਼ਨ - ਸੀ

(ੳ) ਲੇਖ ਰਚਨਾ (ਸਮਾਜਕ, ਸਭਿਆਚਾਰਕ, ਇਤਿਹਾਸਕ ਅਤੇ ਵਿਦਿਅਕ ਸਰੋਕਾਰਾਂ ਸੰਬੰਧੀ)
(ਅ) ਅਖਬਾਰ ਨੂੰ ਇਸ਼ਤਿਹਾਰ (ਨਿੱਜੀ, ਦਫ਼ਤਰੀ)

ਸੈਕਸ਼ਨ - ਡੀ

ਵਿਆਕਰਨ

(ੳ) ਸ਼ਬਦ-ਜੋੜਾਂ ਦੇ ਨਿਯਮ
(ਅ) ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ

SEMESTER-IV

ਮੁੱਢਲੀ ਪੰਜਾਬੀ
ਪੰਜਾਬ ਦਾ ਇਤਿਹਾਸ ਤੇ ਸੱਭਿਆਚਾਰ
 (In lieu of Compulsory Punjabi)

Time: 3 Hrs.

Marks: 50

ਨੋਟ: ਵਿਦਿਆਰਥੀ ਨੂੰ 5 ਪ੍ਰਸ਼ਨ ਦਾ ਜਵਾਬ ਦੇਣਾ ਹੋਵੇਗਾ। ਹਰ ਸੈਕਸ਼ਨ ਵਿੱਚੋਂ ਇੱਕ ਪ੍ਰਸ਼ਨ ਦਾ ਜਵਾਬ ਦੇਣਾ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਉਹ ਕਿਸੇ ਵੀ ਸੈਕਸ਼ਨ ਵਿੱਚੋਂ ਕਰ ਸਕਦਾ ਹੈ।

SECTION-A

ਸਿੱਖ ਧਰਮ ਦੀ ਸਥਾਪਨਾ: ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਜੀ ਦਾ ਜੀਵਨ ਤੇ ਉਪਦੇਸ਼ (1469-1539): ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਜੀ ਦਾ ਜੀਵਨ, ਰੱਬ ਸਬੰਧੀ ਵਿਚਾਰ, ਗੁਰੂ ਦਾ ਮਹੱਤਵ, ਸਿੱਖਿਆਵਾਂ। ਸੰਗਤ-ਪੰਗਤ, ਗੁਰਗੱਦੀ ਦੀ ਸਥਾਪਨਾ ਇਸ ਦਾ ਸਮਾਜ ਤੇ ਪ੍ਰਭਾਵ।

SECTION-B

ਸਿੱਖ ਪੰਥ ਦਾ ਵਿਕਾਸ: ਗੁਰੂ ਅੰਗਦ ਦੇਵ ਜੀ (1539-1522): ਗੁਰੂ ਅੰਗਦ ਦੇਵ ਜੀ ਦਾ ਸਿੱਖ ਧਰਮ ਦੇ ਵਿਕਾਸ ਵਿੱਚ ਯੋਗਦਾਨ, ਗੁਰਮੁੱਖੀ ਲਿੱਪੀ।

SECTION-C

ਗੁਰੂ ਅਮਰਦਾਸ ਤੋਂ ਗੁਰੂ ਰਾਮਦਾਸ ਜੀ ਤੱਕ (1522-1581): ਗੁਰੂ ਅਮਰਦਾਸ ਜੀ ਦਾ ਸਿੱਖ ਧਰਮ ਦੇ ਵਿਕਾਸ ਵਿੱਚ ਯੋਗਦਾਨ: ਗੋਇੰਦਵਾਲ ਸਾਹਿਬ ਦੀ ਸਥਾਪਨਾ, ਮੰਜੀ ਪ੍ਰਥਾ ਅਤੇ ਸਮਾਜਿਕ ਸੁਧਾਰ, ਗੁਰੂ ਰਾਮਦਾਸ ਜੀ ਦਾ ਯੋਗਦਾਨ, ਰਾਮਦਾਸਪੁਰਾ ਦੀ ਸਥਾਪਨਾ, ਮਸੰਦ ਪ੍ਰਥਾ।

SECTION-D

ਗੁਰੂ ਅਰਜਨ ਦੇਵ ਜੀ ਦੇ ਸਮੇਂ ਸਿੱਖ ਪੰਥ ਦਾ ਵਿਕਾਸ (1581-1606): ਗੁਰੂ ਅਰਜਨ ਦੇਵ ਜੀ ਦਾ ਯੋਗਦਾਨ, ਹਰਿਮੰਦਰ ਸਾਹਿਬ ਦਾ ਨਿਰਮਾਣ, ਆਦਿ ਗ੍ਰੰਥ ਸਾਹਿਬ ਦਾ ਸੰਕਲਨ, ਗੁਰੂ ਅਰਜਨ ਦੇਵ ਜੀ ਦੀ ਸ਼ਹਾਦਤ ਤੇ ਇਸਦਾ ਮਹੱਤਵ।

Suggested Readings:-

1. Kirpal Singh (ed.), **History and Culture of the Punjab, Patiala, Part II**, 1990 3rd Edition.
2. Fauja Singh (ed.), **History of the Punjab**, Vol.III, Patiala, 1987.
3. G.S Chhabra, **The Advanced of the Punjab**, Vol. I
4. J.S Grewal, **The Sikhs of the Punjab**, The New Cambridge History of India, Cambridge, 1991.
5. Khushwant Singh **A History of Sikhs**, Vol. I OUP, New Delhi, 1990.

SEMESTER-IV

Punjab History & Culture (From 1605 to 1849 A.D)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

Time: 3 Hours**Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

1. Politicization of Sikhism under Guru Hargobind.
2. Martyrdom of Guru Teg Bahadur

SECTION-B

3. Creation of Khalsa
4. Khalsa and its impact on the Punjab

SECTION-C

5. Rise of Banda Bahadur and his achievements.
6. Rise of Misls.

SECTION-D

7. Ranjit Singh's rise to power; Civil, Military and Land Revenue Administration.
8. Art and Architecture, Fair, Festivals and Folk Music in the Punjab during the medieval period.

Suggested Readings:-

1. Chopra P.N., Puri, B.N., & Das, M.N.(1974), *A Social, Cultural & Economic History of India*. Vol.II, Macmillan India Limited, New Delhi.
2. Grewal, J.S. (1994). *The Sikhs of the Punjab*, Cambridge University Press, New Delhi.
3. Singh, Fauja (1972). *A History of the Sikhs*, Vol. III, Patiala: Punjabi University.
4. Singh, Kushwant (2011). *A History of the Sikhs- Vol. I (1469-1839)*. New Delhi: Oxford University Press.
5. Singh, Kirpal (1990). *History and Culture of the Punjab-Part II (Medieval Period)*. Patiala: Publication Bureau, Punjabi University.

SEMESTER-IV
PAPER-IV, V & VI: PHYSICS, STREAM-1
PAPER-A: QUANTUM MECHANICS
(THEORY)

Time: 3 Hours**Marks: 35****Total Teaching Hrs: 45(3h/week)****Pass Marks: 35%****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**Formalism of Wave Mechanics:**

Brief introduction to need and development of quantum mechanics, photoelectric effect, Compton effect, Wave particle duality, De broglie hypothesis, Uncertainty principle, Guassian wave packet. Operator correspondence. Normalization and probability interpretation of wave function. Superposition principle.

SECTION-B

Expectation value, Probability current and conservation of probability. Admissibility conditions or wave function. Ehrenfest theorem, Eigen function and eigen value. Operator formalism, orthogonal system, expansion in eigen functions, Hermitian operator, simultaneous eigen function, equation of motion.

SECTION-C

Application of Schrodinger wave equation to one dimensional problems: Fundamental postulates of wave mechanics, Schrodinger's wave equation for a free particle and equation of a particle subject to forces. One dimensional step potential for $E > V_0$, one dimensional step potential for $0 < E < V_0$, one dimensional potential barrier of finite height and width, Quantum mechanical tunnelling effect, particle in one dimensional box with infinitely hard walls, one dimensional square well of finite depth

SECTION-D

Application of Schrodinger equation to three dimensional problems: Free particle in three dimensional rectangular box, Eigen wave function, Eigen values of momentum, energy and degeneracy, three dimensional harmonic oscillator (Cartesian coordinates) wave function, energy levels, degeneracy, Schrodinger's wave equation in spherical polar co-ordinates, Schrodinger wave equation for spherically symmetric potential for hydrogen atom, wave function of H atom, solution of $R(r), \Theta(\theta), \Phi(\phi)$ equations.

Books Suggested:-

1. A Text book of Quantum Mechanics: P.M. Mathews and K. Venkatesan, (Tata McGraw Hill Pub. Co, Delhi) 2002.
2. Quantum Mechanics: J.L. Powell and B. Craseman (Narosa Pub. House, New Delhi) 1997.
3. Elements of Modern Physics: S.H. Patil, (McGraw Hill), 1998.
4. Introduction to Quantum Mechanics, L. Pauling and E.B. Wilson (Tata McGraw Hill Pub.Co., Delhi), 2002.

SEMESTER-IV**PAPER-IV, V & VI: PHYSICS, STREAM-1****PAPER-B: ATOMIC AND MOLECULAR SPECTRA
(THEORY)****Time: 3 Hours****Marks: 35****Total Teaching Hrs: 45(3h/week)****Pass Marks: 35%****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Introduction to Atomic Spectra: Observation of spectra, Types of spectra, Light sources, Spectral analysis, Units in spectroscopy, Bohr's Theory, Spectral series, Representation of spectral lines by terms, Energy level Diagram, Bohr's correspondence Principle, Ritz combination Rule, Continuum at series limit, Evidences in favour of Bohr's Theory, Experimental confirmation of Bohr's theory, Frank-Hertz Experiment.

SECTION-B

One Electron Atomic Spectra: Spectrum of Hydrogen atom, Line structure, Normal Zeeman effect, electron spin, Stern Gerlach experiment, spin orbit coupling, electron magnetic moment, total angular momentum, Hyperfine structure, examples of one electron systems, anomalous Zeeman effect, Lande g factor (Sodium D-Lines).

SECTION-C

Many Electron System Spectra: Exchange symmetry of wave function, exclusion principle, shells, subshells in atoms, atomic spectra (Helium), spectra of alkaline earth atoms, LS coupling, selection rules, Regularities in atomic spectra.

SECTION-D

Interaction energy ideas, X-ray spectra, Mosley law, Absorption spectra, Auger effect, Molecular bonding, Molecular spectra, selection rules, symmetric structure, Rotational Vibrational, electronic level and spectra of molecules, Raman spectra. Introduction to Raman spectra

Books Suggested:-

1. Introduction to Atomic Spectra: H.E. White- Auckland (McGraw Hill), 1934.
2. Spectroscopy Vol. I, II & III: Walker & Straughen
3. Introduction to Molecular Spectroscopy: G.M. Barrow-Tokyo (McGraw Hill, 1962).
4. Spectra of Diatomic Molecules: Herzberg-New York, 1944.

SEMESTER-IV**PAPER-IV, V & VI: PHYSICS, STREAM-1****(PRACTICAL)****General Guidelines for Practical Examination: (4.5h/week)**

- | | | |
|---|--|------------------|
| I | The distribution of marks is as follows: | Marks: 30 |
| | i) One experiment | 15 Marks |
| | ii) Brief Theory | 5 Marks |
| | iii) Viva-Voce | 5 Marks |
| | iv) Record (Practical file) | 5 Marks |
- II. There will be one sessions of 3 hours duration. The paper will have one session.
Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
- III. Number of candidates in a group for practical examination should not exceed 12.
- IV. In a single group no experiment be allotted to more than three examinee in any group.
1. To study adiabatic expansion of gas and hence to calculate value of γ .
 2. To find the coefficient of Thermal Conductivity of a bad conductor by Lee's method.
 3. To plot a calibration curve of a given thermocouple (copper constantan) using a potentiometer.
 4. To study the photoelectric effect and determine the value of planck's constant.
 5. To determine the ionization potential of mercury.
 6. Study of variation of light intensity with distance using photovoltaic cell (Inverse Square Law)
 7. To determine the heating efficiency of an electric kettle with varying voltage.
 8. To study the absorption spectra of iodine vapours.
 9. To study the rotation of plane of polarization by using polarimeter.
 10. To determine the specific rotation of sugar using Laurent's half shade polarimeter
 11. To study the characteristics of Photovoltaic cell.

SEMESTER-IV**PAPER-IV, V & VI: CHEMISTRY, STREAM-1****CHEMISTRY (INORGANIC CHEMISTRY-A)
(THEORY)**

**Time: 3 Hrs.
45 Hrs (3 Hrs/week)**

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**I. Coordination Compounds**

11 Hrs.

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

SECTION-B**II. Non-aqueous Solvents**

12 Hrs.

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH₃ and liquid SO₂.

III. Oxidation and Reduction

Use of redox potential data-analysis of redox cycle, redox stability in water-Frost, Latimer and Pourbaix diagrams.

SECTION-C**IV. Chemistry of Lanthanide Elements**

11 Hrs.

Electronic structure, oxidation states and ionic radii and lanthanide contraction. Electronic absorption and magnetic properties of lanthanides.

V. Chemistry of Actinides

General features and chemistry of actinides, similarities between the later actinides and the later lanthanides. Electronic and magnetic properties of actinides and their general comparison with the lanthanide elements.

SECTION-D**VI. Bioinorganic Chemistry**

11 Hrs.

Essential and trace elements in biological processes, metalloporphyrins and special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca²⁺.

Books Suggested:-

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
4. Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
5. Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison-Wesley Publishing Company, 1984.
6. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11. Inorganic Chemistry, A.G. Sharpe, ELBS.
12. University General Chemistry, C.N.R. Rao, Macmillan.

SEMESTER-IV
PAPER-IV, V & VI: CHEMISTRY, STREAM-1
CHEMISTRY (ORGANIC CHEMISTRY-B)
(THEORY)

Time: 3 Hrs.

Max. Marks: 35

45 Hrs (3 Hrs/week)

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

I. Carboxylic Acids

(12 Hrs.)

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

II. Carboxylic Acids Derivatives

Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability & reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

SECTION-B

III. Ethers and Epoxides

(11 Hrs.)

Nomenclature of ethers and methods of their formation, physical properties. Chemical reaction-cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

IV. Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

SECTION-C

V. Organic Compounds of Nitrogen

(11 Hrs.)

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hofmann bromamide reaction. Physical properties. Stereochemistry of amines. separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts.

SECTION-D**VI. Organometallic Compounds****(11 Hrs.)**

Organomagnesium Compounds: The Grignard reagents formation, structure and chemical reactions.

Organolithium Compounds: Formation and chemical reactions.

Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.

Book Suggested:-

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

SEMESTER-IV**PAPER-IV, V & VI: CHEMISTRY, STREAM-1****(PRACTICAL)**

Duration: 3½ hrs.
6 Period/Week

Marks: 30

Qualitative Analysis

Detection of elements (N, S and halogens)

Detection of functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds and preparing their derivatives.

Practical Examination

1) Detection of Elements	05
2) Detection of functional group and derivative preparation	18
3) Viva-Voce	04
4) Note Book	03

Book Suggested:-

1. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.

SEMESTER-IV**PAPER-IV, V & VI: MATHEMATICS, STREAM-1****STATICS AND VECTOR CALCULUS****Time: 3 Hours****Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A

Composition and resolution of forces (parallelogram law, triangle law, polygon law, Lami's Theorem, $(\lambda-\mu)$ theorem). Resultant of a number of coplanar forces, parallel forces.

Moments, Varignon's theorem of moments, Couples, Resultant of two Coplanar Couples, Equilibrium of two coplanar couples, Resultant of a force and a couple. Equilibrium of coplanar forces.

SECTION-B

Friction, Laws of friction, Equilibrium of a particle on a rough plane. Centre of Gravity: Centre of gravity of a rod, triangular lamina, solid hemisphere, hollow hemisphere, solid cone and hollow cone.

SECTION-C

Vector differentiation, Gradient, divergence and curl operators, line integrals, Vector identity, Vector integration.

SECTION-D

Theorems of Gauss, Green, Stokes and problems based on these.

Books Recommended:

1. S.L. Loney: Statics, Macmillan and Company, London.
2. R.S. Verma: A Text Book on Statics, Optical Pvt. Ltd., Allahabad.
3. Spiegel, M.R.: Introduction to Vector Calculus and Tensor.
4. Spiegel, M.R.: Vector Analysis.

SEMESTER-IV**PAPER-IV, V & VI: MATHEMATICS, STREAM-1****SOLID GEOMETRY****Time: 3 Hours****Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms

SECTION-B

Cone with a vertex at the origin as the graph of homogeneous equation of second degree in x, y, z . Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve, right circular and elliptic cones.

SECTION-C

Equation of surface of revolution obtained by rotating the curve $f(x, y) = 0$ about the z -axis in the form of $f(x^2 + y^2, z) = 0$. Equation of ellipsoid, hyperboloid and paraboloid in standard forms.

SECTION-D

Surfaces represented by general equation of 2nd degree $S = 0$. Tangent lines, tangent planes and Normal plane.

Books Recommended:

1. Narayan, S.: Analytical Solid Geometry, Sultan Chand & Sons (2005).
2. Kreyszig, E.: Advanced Engineering Mathematics.

SEMESTER-IV**PAPER-IV, V & VI: CHEMISTRY, STREAM-2****CHEMISTRY (INORGANIC CHEMISTRY-A)
(THEORY)**

**Time: 3 Hrs.
45 Hrs (3 Hrs/week)**

Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**I. Coordination Compounds**

11 Hrs.

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

SECTION-B**II. Non-aqueous Solvents**

12 Hrs.

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH₃ and liquid SO₂.

III. Oxidation and Reduction

Use of redox potential data-analysis of redox cycle, redox stability in water-Frost, Latimer and Pourbaix diagrams.

SECTION-C**IV. Chemistry of Lanthanide Elements**

11 Hrs.

Electronic structure, oxidation states and ionic radii and lanthanide contraction. Electronic absorption and magnetic properties of lanthanides.

V. Chemistry of Actinides

General features and chemistry of actinides, similarities between the later actinides and the later lanthanides. Electronic and magnetic properties of actinides and their general comparison with the lanthanide elements.

SECTION-D**VI. Bioinorganic Chemistry**

11 Hrs.

Essential and trace elements in biological processes, metalloporphyrins and special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca²⁺.

Books Suggested:-

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
4. Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
5. Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison-Wesley Publishing Company, 1984.
6. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11. Inorganic Chemistry, A.G. Sharpe, ELBS.
12. University General Chemistry, C.N.R. Rao, Macmillan.

SEMESTER-IV
PAPER-IV, V & VI: CHEMISTRY, STREAM-2
CHEMISTRY (ORGANIC CHEMISTRY-B)
(THEORY)

Time: 3 Hrs.

Max. Marks: 35

45 Hrs (3 Hrs/week)

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

I. Carboxylic Acids

(12 Hrs.)

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

II. Carboxylic Acids Derivatives

Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability & reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

SECTION-B

III. Ethers and Epoxides

(11 Hrs.)

Nomenclature of ethers and methods of their formation, physical properties. Chemical reaction-cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

IV. Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

SECTION-C

V. Organic Compounds of Nitrogen

(11 Hrs.)

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hofmann bromamide reaction. Physical properties. Stereochemistry of amines. separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts.

SECTION-D**VI. Organometallic Compounds****(11 Hrs.)**

Organomagnesium Compounds: The Grignard reagents formation, structure and chemical reactions.

Organolithium Compounds: Formation and chemical reactions.

Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.

Book Suggested:-

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

SEMESTER-IV**PAPER-IV, V & VI: CHEMISTRY, STREAM-2****(PRACTICAL)**

Duration: 3½ hrs.
6 Period/Week

Marks: 30

Qualitative Analysis

Detection of elements (N, S and halogens)

Detection of functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds and preparing their derivatives.

Practical Examination

1) Detection of Elements	05
2) Detection of functional group and derivative preparation	18
3) Viva-Voce	04
4) Note Book	03

Book Suggested:-

1. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.

SEMESTER-IV**PAPER-IV, V & VI: BOTANY, STREAM-2****PAPER-A: DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS-I (THEORY)****Time: 3 Hrs.****Theory Lectures: 3 Hours/Week****Max. Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Characteristics of seed plants; Evolution of the seed habit; Distinguishing features of angiosperms and gymnosperms. Angiosperms: Origin and evolution. Some examples of primitive angiosperms.

SECTION-B

General features of gymnosperms and their classification; evolution and diversity of Gymnosperms including fossil and living gymnosperms; Geological time scale and fossilization

SECTION-C

Morphology of vegetative and reproductive parts; Anatomy of root, Stem and leaf; Reproduction and life cycle of Pinus, Cycas,

SECTION-D

Morphology of vegetative and reproductive parts; Anatomy of root, Stem and leaf; Reproduction and life cycle of Ephedra and Ginkgo

Suggested Readings:-

1. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms, New Age International Limited, New Delhi.
2. Gifford, E.M. and Foster, A.S. (1988). Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
3. Pellant, C. (1994). Fossils, Dragon's World, Great Britain
4. Sporne, K.R. (1965). The Morphology of Gymnosperms, Hutchinson & Co. (Publishers) Ltd., London.
5. Taylor, T. N., Taylor, E. L. and Krings, M. (2008). Paleobotany: The Biology and Evolution of Fossil Plants (2nd Edition). Elsevier Inc. Netherlands.
6. Vashistha, P. C. (2016). Botany for degree students. S.Chand and Company, New Delhi

SEMESTER-IV
PAPER-IV, V & VI: BOTANY, STREAM-2
Paper-IV B: DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS-II
(THEORY)

Time: 3 Hrs.

Theory Lectures: 3 Hours/Week

Max. Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Angiosperm taxonomy; Brief history, Aims and fundamental components (alpha-taxonomy, Omega-taxonomy, Holotaxonomy); Identification, keys. Taxonomic literature. Botanical nomenclature: Taxonomic ranks; Type concept; Principle of priority.

SECTION-B

Botanical nomenclature: Taxonomic ranks; Type concept; Principle of priority. Major contribution of cytology, Phytochemistry and taxometrics to taxonomy. Classification of angiosperms; Salient features of the systems proposed by Bentham and Hooker, Engler and Prantl

SECTION-C

Diversity of flowering plants as illustrated by members of the families Ranunculaceae, Brassicaceae, Rutaceae, Fabaceae, Apiaceae, Acanthaceae,

SECTION-D

Diversity of flowering plants as illustrated by members of the families Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae, Orchidaceae and Poaceae.

Suggested Readings:-

1. Bendre, A. (2007). Practical Botany, Rastogi Publications, Meerut.
2. Davis, P.H. and Heywood, V.H. (1963). Principles of Angiosperm Taxonomy, Oliver and Boyd, London.
3. Gifford, E.M. and Foster, A.S. (1988). Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
4. Jeffrey, C. (1982). An Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
5. Jones, S.B., Jr. and Luchsinger, A.E. (1986). Plant Systematics (2nd edition). McGraw- Hill Book Co., New York.
6. Radford, A.E. (1986). Fundamental of Plant Systematics, Harper and Row, New York

SEMESTER-IV**PAPER-IV, V & VI: BOTANY, STREAM-2****BOTANY PRACTICALS-IV (BASED ON PAPERS-IV A AND IV B)****Practical Marks: 30****Practical Hours: 4½ Hours/week****Suggested Laboratory Exercises**

1. Angiosperms The following species are suitable for study.
2. This list is only indicative. Teachers may select plants available in their locality. Teachers may select plants/material available in their locality/institution.
 1. Ranunculaceae: Ranunculus, Delphinium
 2. Brassicaceae: Brassica, Alyssum, Iberis, Coronopus.
 3. Malvaceae: Hibiscus, Abutilon.
 4. Rutaceae: Murraya, Citrus.
 5. Fabaceae: Faboideae: Lathyrus, Cajanus, Melilotus, Trigonella, Caesalpinioideae: Cassia, Caesalpinia, Mimosoideae: Prosopis, Mimosa, Acacia.
 6. Apiaceae: Coriandrum. Foeniculum, Anethum.
 7. Acanthaceae: Adhatoda, Peristrophe.
 8. Apocynaceae: Vinca, Thevetia, Nerium.
 9. Asclepiadaceae: Calotropis.
 10. Solanaceae: Solanum, Withania, Datura.
 11. Euphorbiaceae: Euphorbia, Phyllanthus.
 12. Lamiaceae: Ocimum, Salvia.
 13. Chenopodiaceae: Chenopodium, Beta.
 14. Liliaceae: Asphodelus, Asparagus.
 15. Poaceae: Avena, Triticum, Hordeum Poa, Sorghum.
3. The Students should be made familiar with the use of identification keys including use of computers in taxonomy. The teachers should prevent students from collecting plants from the wild and submitting them for the practical examination. Instead, the student should be asked to prepare field reports.

Gymnosperms

Cycas (i) Habit, armour, of leaf bases on the stem (if specimen is not available show photography), very young leaf (circinate vernation) and old foliage leaves, sclae leaf, bulbils, male cone (specimen); Microsporophyll, megasporophyll mature seed. (ii) Study through permanent slides—normal root (T.S.), stem (T.S.) (if sections are not available show photographs), ovule (L.S.). (iii) Study through hand sections or dissections-coralloid root (T.S.), rachis (T.S.), leaflet (V.S.), microsporophyll (V.S.) pollen grains (W.M.).

Pinus (i) Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cone, 1st year, 2nd year and 3rd year female cones, winged seeds. (ii) Study through permanent slides-root (T.S.), female cone (L.S.) ovule (L.S.), embryo (W.M.) showing polycotyledonous condition. (iii) Study through hand sections or dissections-young stem (T.S.), old stem (wood) (T.L.S. and R.L.S.), needle (T.S. male cone (L.S.), male cone (T.S.), Pollen grains (W.M.).

Ephedra (i) Habit and structure of whole and female cones. (ii) Permanent slides-female cone (L.S.). (iii) Hand sections/dissections-node (L.S.), internode (T.S.), macerated stem to see vessel structure; epidermal peel mount of vegetative parts to study stomata, male cone (T.S. and L.S.), pollen grains. Ginkgo (i) Habit and structure of whole plant. (ii) Permanent slides-male and female reproductive parts. (iii) pollen grains

Suggested Readings:-

1. Angiosperm Phylogeny Group (2003). An update of the Angiosperm Phylogeny Group classification for the orders and families of the flowering plants: APG
2. Botanical Journal of the Linnaean Society 141: 399-436. 2. Cronquist, A. (1981). An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
3. Simpson, M.C. (2006). Plant Systematics. Elsevier, Amsterdam

SEMESTER-IV**PAPER-IV, V & VI: ZOOLOGY, STREAM-2**

Paper	Maximum Marks		Hours of Teaching	
	Theory Marks	Practical Marks	Theory	Practical
ZOO-IVA (Biochemistry)	35	—	3 Hrs	—
ZOO-IVB (Animal Physiology)	35	—	3 Hrs	—
PRACTICAL-IV (RELATED TO ZOO-IVA and ZOO-IVB)	—	30	—	4½ Hrs

SEMESTER-IV
PAPER-IV, V & VI: ZOOLOGY, STREAM-2
ZOO-IVA: Biochemistry
(THEORY)

Max. Time: 3 Hrs.

Max Marks: 35

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Biochemistry and its scope

Classification and functions of:

Carbohydrates

Proteins

Lipids

Nucleic acids

SECTION-B

Enzymes:

Nature and their classification

Coenzymes.

Lipid Metabolism:

B-Oxidation of fatty acid

Ketosis

SECTION-C

Carbohydrate Metabolism:

Glycolysis

Tricarboxylic acid cycle

Hexose monophosphate shunt

Glycogenesis

Glycogenolysis

Gluconeogenesis

Oxidative Phosphorylation

SECTION-D

Protein Metabolism:

Metabolism of amino acids

Oxidative deamination

Transamination

Decarboxylation

Hydrolysis of proteins

Ornithine cycle

Suggested Reading Material:-

1. Conn, E.E., Stump. P.K. Bruening, S. and Doi R.H. (1987), Outlines of Biochemistry (5th ed), John Wiley and Sons Inc., New York.
2. Fischer, J. and Arriold, J.R.P. (2001). Instant notes in Chemistry for Biologists, Viva Books Pvt. Ltd.
3. Harper, H.A. (2000): Harper's Biochemistry (25th ed).
4. Holde, K.E.V., Johnson, W.C. and Shing, P. (1998). Principles of Physical Biochemistry Prentice Hall, Inc., USA.
5. Lehninger, A (2000). Principles of Biochemistry, (3rd ed).
6. Morris, H. Best, L.R., Pattison, S., Arena, S. (2001). Introduction to General Organic Biochemistry, (7th ed), Wadsworth Group.
7. Rawn, J.D. (1989), Biochemistry, Niel Patterson Publication U.S.A. North Carolina.
8. Robert, K., Murray, Mayes Daryl, K. Granner, Victor, W., Woodwell (1990), Harper's Biochemistry, 22nd Edition, Prentice Hall International Inc.
9. Sheehon, D (2000). Physical Biochemistry: Principles and Applications – John Wiley & Sons Ltd., England.
10. Stryer, L. (1988). Biochemistry (3rd ed), San Francisco W.H. Freeman.

SEMESTER-IV**PAPER-IV, V & VI: ZOOLOGY, STREAM-2****ZOO-IV B: Animal Physiology
(THEORY)****Max. Time: 3 Hrs.****Max Marks: 35****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Digestion: Digestion of dietary constituents, regulation of digestive processes and absorption. Extra and intra cellular digestion, enzymatic digestion and symbiotic digestion.

Respiration: Transport of O₂ and CO₂, Oxygen dissociation curve of haemoglobin, Bohr effect, chloride (-) shift, Haldane effect and control of breathing.

SECTION-B

Heart: Origin and regulation of heart beat, cardiac cycle, electrocardiogram, cardiac output, Blood pressure and micro-circulation.

Blood: Composition and functions of blood and lymph. Blood clotting. Blood groups including Rh factor, haemopoiesis and haemostasis.

Excretion: Urine formation and osmoregulation.

SECTION-C

Muscles: Ultrastructure, chemical and physical basis of skeletal muscle contraction.

Neural Integration: Structure of neuron, resting membrane potential, Origin and propagation of impulse along the axon, synapse and myoneural function.

SECTION-D

Physiology of Behavior: Taxes and reflexes, instinctive and motivate learning and reasoning

Endocrine: Structure and physiology of thyroid, parathyroid, adrenal, hypothalamus, pituitary, pancreas and gonads.

Suggested Reading Material:-

1. Guyton, A.S.(1994), Text Book of Medical Physiology, 7th Edition, W.B. Saunders Company.
2. Hill, R. W., Wyse, G. K. and Anderson, N. (2004), Animal physiology, Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
3. Hoar, W. S. (1984), General and Comparative Physiology, Prentice Hall of India Pvt. Limited, New Delhi, India.
4. Prosser, C.L. (1984), Comparative Animal Physiology, Satish Book Enterprise Books seller & Publishers, Agra.
5. Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2001), Life – The Science of Biology (6th ed), Sinauer Assoc. Inc., USA.
6. Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations, W.H. Freeman and Company, New York.
7. Taneja, S.K.(1997), Biochemistry & Animal Physiology, Trueman Book Co.
8. Willmer, P. Stone, G. and Johnston, I (2000). Environmental Physiology of Animals, Blackwell Science.
9. Withers, P.C. (1992), Comparative Animal Physiology, Saunder College Publishing, New York.

SEMESTER-IV

PAPER-IV, V & VI: ZOOLOGY, STREAM-2

PRACTICAL-IV (Related to ZOO-IVA and ZOO-IV B)

Time: 3hrs.

Marks: 30

Important Note for Practical:

1. Candidates will be required to submit their original note books containing record of their laboratory work.
2. Wherever possible, students must be taken out for excursion to the field (Zoological gardens, sea shores, ponds and hill stations etc.) to study habitat and ecology of the animals.
3. As per the latest UGC guidelines (D.O.No. F. 14-6/2014(CPP-II) dated 01-08-2014) the dissections should not be conducted. The guidelines on this issue are available on the UGC website: www.ugc.ac.in
 1. Study of the skeleton of *Scoliodon*, *Rana*, *Varanus*, *Gallus* and *Oryctolagus*.
 2. Identification of food stuffs: starch, glucose, proteins and fats in solution.
 3. Demonstration of osmosis and diffusion.
 4. Demonstrate the presence of amylase in saliva, denaturation by pH and temperature.
 5. Determination of coagulation and bleeding time of blood in man/rat/rabbit.
 6. Determination of blood groups of human blood sample.
 7. Recording of blood pressure of man.
 8. Analysis of urine for urea, chloride, glucose and uric acid.
 9. Estimation of haemoglobin content.
 10. Field study: Visit to a fossil Park/Lab/ Science City and submit a report.
 11. Familiarity with the local vertebrate fauna.

Note:- Some changes can be made in the practicals depending on the availability of material.

Guidelines for conduct of Practical Examination:

- | | |
|---|----|
| 1. Identify the given bones, make labeled sketches of their respective-views. | 10 |
| 2. Write down the steps and determine the constituents in the given sample. | 5 |
| 3. Write the procedure and perform the given physiology experiment. | 5 |
| 4. Report on visit to a fossil park/lab/Science City/study of local vertebrate fauna. | 5 |
| 5. Viva-voce & Practical file. | 5 |

SEMESTER-IV**EPC III: DRAMA AND ART IN EDUCATION****Time: 1.30 Hrs.****Total Marks: 50****Internal Marks: 25****External Marks: 25****Course Objectives:** After Completion of Course the Students will be able to:

- Develop imagination and sense of appreciation of art and interest in art.
- Develop aesthetic sense.
- Prepare effective teaching aids.
- Have basic knowledge about color scheme.
- To use drama processes to examine their present and to generate new knowledge, understanding and perceptions of the world and themselves in it.
- Train, enhance some theatre skills that will later help them be creative and enlightened teachers. A process that draws our physical, emotional, intellectual and other faculties together in a moment (eg. life itself) makes for worthwhile, far reaching, holistic learning. Drama is one such experience and should therefore have a central place in school education.

UNIT-I

1. Sketching of different objects related with their respective teaching subjects
2. Preparation of colour chart in file i.e Primary, Secondary, warm, cool, neutral
3. Writing and Sketching practice on the black board with respect to pedagogy subject aesthetically
4. Preparation of chart of alphabets in English, Punjabi and Hindi
5. Preparation of one chart according to pedagogy subject.

UNIT-II

1. Role of drama in pedagogy subjects
2. Use of drama techniques for personality development
3. Preparation of video presentation of pedagogy lessons using drama and art techniques.

Evaluation scheme**a) Internal****Attendance****05 Marks****Assignments on the following**

Report on drama techniques for personality development

Preparation of video presentation of pedagogy lessons.

20 Marks

b) External**25 Marks**

1. Evaluation on the basis of work done in Unit – 1 and II
2. Viva voce will be done by the external.

Note:-

- For internal evaluation a committee of three teachers (concerned teacher, HOD and a senior faculty nominated by the principal) will be constituted at the institution level and coordinated by the principal of the concerned college.
- The committee will assess the performance of the students and evaluate the records. The award list will be forwarded to the university by the principal of the institution.
- The record in the form of files, CD, pen drive be retained for at least three years in the institution.
- In case of any aberration or any complaint the university / external agency is authorized to review the internal awards.

REFERENCES:-

1. Awasthi, S.S. (1964): *A Critique of Hindustan Music and Music Education*. Jalandhar.
2. Bhatkhande, V. M. (1987). *KRAMIKPustakMahikaLaxmi Narayan Garg*, Hathras.
3. Bhatnagar, S. (1988). *Teaching of Music*. Monika Prakashan, Shimla.
4. Kalekar, S. (1968). *SangeetShikshanParichaya*.
5. Khanna, Jyoti (1992): *Teaching of Music*. MadanPannaLal. Teaching of Music. Jalandhar.
6. Shah, S. (1986). *SangeetShikshanPranali*. Pb. KitabGhar Vinod PustakMandir, Agra Vasant. (1986): *SangeetVisharad*. SangeetKarylaya, Hathras

SEMESTER-IV**PAPER-VII (ESL-221): ENVIRONMENTAL STUDIES****Time: 3 Hrs.****Max. Marks: 100****Teaching Methodologies**

The Core Module Syllabus for Environmental Studies includes class room teaching and field work. The syllabus is divided into 8 Units [Unit-1 to Unit-VII] covering 45 lectures + 5 hours for field work [Unit-VIII]. The first 7 Units will cover 45 lectures which are class room based to enhance knowledge skills and attitude to environment. Unit-VIII comprises of 5 hours field work to be submitted by each candidate to the Teacher in-charge for evaluation latest by 15 December, 2019.

Exam Pattern: **End Semester Examination- 75 marks**
 Project Report/Field Study- 25 marks [based on submitted report]
 Total Marks- 100

The structure of the question paper being:

Part-A, Short answer pattern with inbuilt choice – **25 marks**

Attempt any five questions out of seven distributed equally from Unit-1 to Unit-VII.

Each question carries 5 marks. Answer to each question should not exceed 2 pages.

Part-B, Essay type with inbuilt choice – **50 marks**

Attempt any five questions out of eight distributed equally from Unit-1 to Unit-VII. Each question carries 10 marks. Answer to each question should not exceed 5 pages.

Project Report / Internal Assessment:

Part-C, Field work – **25 marks [Field work equal to 5 lecture hours]**

The candidate will submit a hand written field work report showing photographs, sketches, observations, perspective of any topic related to Environment or Ecosystem. The exhaustive list for project report/area of study are given just for reference:

1. Visit to a local area to document environmental assets: River / Forest/ Grassland / Hill / Mountain / Water body / Pond / Lake / Solid Waste Disposal / Water Treatment Plant / Wastewater Treatment Facility etc.
2. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
3. Study of common plants, insects, birds
4. Study of tree in your areas with their botanical names and soil types
5. Study of birds and their nesting habits
6. Study of local pond in terms of wastewater inflow and water quality
7. Study of industrial units in your area. Name of industry, type of industry, Size (Large, Medium or small scale)
8. Study of common disease in the village and basic data from community health centre
9. Adopt any five young plants and photograph its growth

10. Analyze the Total dissolved solids of ground water samples in your area.
11. Study of Particulate Matter (PM_{2.5} or PM₁₀) data from Sameer website. Download from Play store.
12. Perspective on any field on Environmental Studies with secondary data taken from Central Pollution Control Board, State Pollution Control Board, State Science & Technology Council etc.

Unit-I

The multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness

(2 lectures)

Unit-II

Natural Resources: Renewable and non-renewable resources:

Natural resources and associated problems.

- (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- (d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- (e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
- (f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
 - Role of an individual in conservation of natural resources.
 - Equitable use of resources for sustainable lifestyles.

(8 Lectures)

Unit-III

Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

(6 Lectures)

Unit-IV**Biodiversity and its conservation**

- Introduction – Definition: genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

(8 Lectures)**Unit-V****Environmental Pollution :****Definition :**

- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

(8 Lectures)**Unit-VI****Social Issues and the Environment**

- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

(7 Lectures)

Unit-VII**Human Population and the Environment**

- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

(6 Lectures)**Unit-VIII****Field Work**

- Visit to a local area to document environmental assets River / forest / grassland / hill / mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-pond, river, hill slopes, etc

(Field work equal to 5 lecture hours)**References:**

1. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
2. Down to Earth, Centre for Science and Environment, New Delhi.
3. Heywood, V.H. & Waston, R.T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
4. Joseph, K. & Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
5. Kaushik, A. & Kaushik, C.P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
6. Rajagopalan, R. 2011. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
7. Sharma, J. P., Sharma. N.K. & Yadav, N.S. 2005. Comprehensive Environmental Studies, Laxmi Publications, New Delhi.
8. Sharma, P. D. 2009. Ecology and Environment, Rastogi Publications, Meerut.
9. State of India's Environment 2018 by Centre for Sciences and Environment, New Delhi
10. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.

SEMESTER-IV**PAPER-VIII: DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY PAPER)****(Only for those students who have not studied this paper in Semester-II)****DRUG ABUSE: MANAGEMENT AND PREVENTION****Time: 3 Hours****Max. Marks: 50****Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A**Prevention of Drug abuse:**

Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.

SECTION-B

School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

SECTION-C**Controlling Drug Abuse:**

Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program

SECTION-D

Legislation: NDPs act, Statutory warnings, Policing of Borders, Checking Supply/Smuggling of Drugs, Strict enforcement of laws, Time bound trials.

References:-

16. Ahuja, Ram (2003), *Social Problems in India*, Rawat Publication, Jaipur.
17. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
18. Inciardi, J.A. 1981. *The Drug Crime Connection*. Beverly Hills: Sage Publications.
19. Kapoor. T. (1985) *Drug epidemic among Indian Youth*, New Delhi: Mittal Pub.
20. Kessel, Neil and Henry Walton. 1982, *Alcoholism. Harmond Worth*: Penguin Books.
21. Modi, Ishwar and Modi, Shalini (1997) *Drugs: Addiction and Prevention*, Jaipur: Rawat Publication.
22. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
23. Ross Coomber and Others. 2013, *Key Concept in Drugs and Society*. New Delhi: Sage Publications.

24. Sain, Bhim 1991, *Drug Addiction Alcoholism, Smoking obscenity* New Delhi: Mittal Publications.
25. Sandhu, Ranvinder Singh, 2009, *Drug Addiction in Punjab: A Sociological Study*. Amritsar: Guru Nanak Dev University.
26. Singh, Chandra Paul 2000. *Alcohol and Dependence among Industrial Workers*: Delhi: Shipra.
27. Sussman, S and Ames, S.L. (2008). *Drug Abuse: Concepts, Prevention and Cessation*, Cambridge University Press.
28. Verma, P.S. 2017, “*Punjab’s Drug Problem: Contours and Characteristics*”, Economic and Political Weekly, Vol. LII, No. 3, P.P. 40-43.
29. World Drug Report 2016, United Nations office of Drug and Crime.
30. World Drug Report 2017, United Nations office of Drug and Crime.